Public Knowledge, Attitudes and Perceptions towards Genetically Modified Organisms in India

Final Report – June 2010

Gene Campaign

Public Knowledge, Attitudes and Perceptions towards Genetically Modified Organisms in India.

(IDRC Grant Number: - 103926)

Final Report – June 2010

J-235/A, Lane W-15C, Sainik Farms, Khanpur, New Delhi – 110062 (India)
Phone +911129556248; Fax +911129555961
Email – mail@genecampaign.org Web – www.genecampaign.org

Title Page

Title	:	Public Knowledge, Attitudes and Perceptions towards Genetically Modified Organisms in India.
By	:	Dr. Suman Sahai & Prof. E. Haribabu
Report Type	:	Final Technical Report
Date	:	8 June, 2010
IDRC Grant Number	:	103926
IDRC Project Title	:	Public Knowledge, Attitudes and Perceptions towards Genetically Modified Organisms in India.
Country	:	India
Research Institution:		Gene Campaign & University of Hyderabad

Address :

J-235/A, Lane W-15C, Sainik Farms, Khanpur,
New Delhi – 110062 (India) Phone +911129556248;
Fax +911129555961
Email – mail@genecampaign.org
Web – www.genecampaign.org

Department of Sociology
University of Hyderabad, P.O. Central University
Hyderabad – 500 046
Phone –040 3010500 to 512 Extn. 3250 (O),
Fax – 040 3010145 & 853
Email – ehbss@uohyd.ernet.in

Research Team :

Field work for the study was carried out during 2008 and 2009. Primary data collection from quantitative surveys, FGDs and interviews was done by trained researchers. In Jharkhand primary data was collected by a research team led by Prof. Ramesh Sharan, (Dept. of Economics, Ranchi University); in Assam by a research team led by Mr. Bhaskar Jyoti Mahanta heading the North East Centre for Rural Livelihood Research, in Punjab, Andhra Pradesh and Maharashtra by researchers led by Dr. B K D Raja head of the development research agency Samaj Vikas as well as Prof Ajay Dandekar, Ms Geet Lamba and Mr Kuldeep Singh from Punjab University. The overall guidance and supervision was provided by Dr. Suman Sahai, Prof.E. Haribabu and Prof. Amrit Srinivasan.

Abstract :

A three year research was undertaken by Gene Campaign and the University of Hyderabad to study the awareness, attitudes and perceptions to GM technology and GMOs among farmers, consumers and other stakeholders. The study with quantitative and qualitative approaches was conducted in five states, Andhra Pradesh, Maharashtra, Punjab, Jharkhand and Assam.

The general trends seen in the research results were fairly uniform across states. It showed that attitude to food is overwhelmingly guided by cultural –religious factors, irrespective of educational and economic status. This rather than a rational analysis of the benefits of a particular food determines food choice. The sanctity of food is underlined by the clear articulation in the rural communities that any food that had been transformed in the way that GM foods are , would be unacceptable for special ceremonies and religious festivals. People said they would not offer such food to God during religious festivals or serve it on special occasions like a wedding feast. Attitudes to cash crops are more relaxed than to food crops but even there, the notion of ‘tampering’ in some way with the seed, is met with

resistance and farmers have reservations. Gender did not seem to be a big determinant of attitudes to GM foods,

The government must take note that validating GM foods by pure science and promoting these foods on 'science based evidence' of safety is unlikely to be relevant in the back drop of such public perceptions. The presumption that knowledge and awareness about the benefits of GM crops will automatically convince people of their attractiveness cannot be taken for granted.

The level of awareness about GM foods was very low and confused among urban consumers who listed food nutrition and safety as the most desired attributes of food. Consumers by and large felt that not enough was known about GM foods and that more research was needed. They were unclear about what GM foods were and about the status of GM foods in India with respect to availability, labeling or risks and benefits.

According to the study, government is the agency in which the most number of people have the greatest trust across farmers and consumers in all states; they see it as an agency whose information is reliable and that can be relied on to protect their interests (agency that should test for safety and monitor long term impact of GM foods). Across all states studied, the NGO community seemed to enjoy the least amount of trust amongst government agencies, companies, scientists and media. In the case of urban consumers, there was a divergence of views about information on GMOs. Many felt that NGOs provide useful, reliable information; others felt that NGOs doctored their information, like the companies did, to suit their ideology.

Key Words : Key words- GMOs, GM technology, GM foods, Farmer, Consumer, Attitudes, Perceptions , India

Table of Contents

INTRODUCTION

Why Studying Attitudes and Perceptions towards GMOs in India is Important?

There is substantial understanding of the way GM technology is perceived in developed countries where studies have been ongoing on attitudes to GM Foods but there is no comprehensive scientific study as yet to assess the public attitude to GMOs in India although, a couple of reports have appeared recently on willingness to pay and the performance of Bt cotton.

There is a critical need for a study on attitudes and perceptions to GMOs in view of the fact that Bt cotton has been on the market for some years and the anticipated release of Bt brinjal, the first GM food has seen a confrontation between government agencies and civil society groups opposed to the release of GM foods. The reactions to the approval granted to Bt brinjal by the GEAC in October 2009, most recently, has once again shown that there is resistance to GM foods in certain quarters and that there is no dialogue between government and non government actors over this subject. A writ petition in the Supreme Court [Gene Campaign PIL no. 115 (2004)] has been asking for a regulatory system that is technically strong, more transparent and inclusive, and involving the public in decision making. Public resources are being spent on developing a wide range of genetically engineered products in the absence of laws on labeling and liability. Yet the need to "educate" and inform the public about GMO's, or offer consumers a choice, cannot be achieved by labeling alone.

The global debate on GM crops and foods has revealed the need for good governance and participatory policymaking in the field of bio technology. A key component of this is the recognition that the public is not just a stakeholder but a key contributor to the debate. Peoples' opinions, apprehensions and concerns

can no longer be excluded by policymakers, experts and industry alike, as stemming from ignorance and prejudice, even technophobia. The public has shown itself to be open-minded, rational and progressive in adopting what are seen as individually empowering technology products when, *in their perception*, benefits outweigh constraints and risks to use. But in ag-biotechnology the waters become muddied by controversy over exactly such perceptions. Individual consumer benefits in terms of food choice, appearance and taste or health are not easily commensurable with the clear public need for government regulation in the introduction of new agricultural products based on GM technology.

This is especially true for India, where slogans like "*Jai Jawan, Jai Kisan*", testify to the special role agriculture has played in the national economy, equating food security with state sovereignty after independence. A highly concentrated global industry monopoly over GM organisms, for instance in seed, can hardly therefore be expected to go without questioning. In such a context the public's "trust" in government alone is not at issue – historically, it has been presumed and precisely for that very reason needs to be examined afresh, in the light of new and cross-cutting concerns.

With products increasingly intertwined with services and delivery mechanisms to consumers, issues of individual rights, equity in access to resources and the institutional and cultural context to new technology introduction has come to the forefront. Peoples' evaluations of the benefits and risks associated with new technology it is being increasingly realized, are never individual or psychological alone but determined, among other factors, by material, economic interests and the shared experience of technology use and the consequences that flow from that fact. Differences in peoples' professional qualifications, areas of work and organizational mandates, information provided in capacity building and training exercises, media reports and preferences, possibility of personal gain etc. are additional factors that come into play here.

Decision-makers in the public and private sectors clearly need to look for social science research which can be factored into expert issues such as risk analysis and not just relegated to the pragmatics of technology application alone. By focusing on public attitudes and perceptions about biotechnological innovations, this study attempts to both create and fulfill such a need. Its pioneering and representative national character and scope lends it its special character to reveal that food is a significant site for public engagement with science. Today, complex technological innovations have not only transformed production and distribution but severely altered consumption habits and practices. Public policy on science and technology needs to come to terms with broader cultural shifts, especially towards consumer practices.

At present, the GMO governance system in India is inadequate in its representation of consumers, women, the farming community and other stakeholders. Expert Committees and Panels, conferences and discussion forums do not include this diversity of representation nor are there any formal channels to communicate with the public to take aboard their views and remedy this lack. Bringing about transparency in governance in this and other sectors has been the focus of activist struggles for several years.

At the same time, the mode and level of representation by NGO's, of those they work to represent on public and official forums, itself needs a reality check against a study of this kind. To ascertain the manner in which the public can be directly or indirectly involved in technology decisions affecting their life and the complex world situation they are part of, requires new forms of mediation and feedback mechanisms based on the facts provided by this study.

Politically, the need for good governance and participatory policymaking is already being strongly articulated from a number of platforms.

The mismatch between peoples' and expert thinking on issues such as food consumption, quality and security, cannot so easily be put down to the lay

person's "ignorance" or tradition bound world view. Nor can it provide a convenient basis for his/her exclusion from decision making on the latter grounds alone. In the same vein, a greater public dissemination of new technology's special features, risks and methods of use is never adequate by itself. So-called stereotypical and prejudicial thinking about GM products is a function of genuine concern about a wide range of issues and not just the absence or suppression of information. This is particularly so in a society like India, where commonly held beliefs recommend different levels of access to information for different sections of society. Peoples' expectations from and evaluation of the 'legitimate' sources of information regarding the new technologies that they select and whether they are given a genuine choice in the latter, are already conditioned by culture and iniquity and the institutional contexts within which agriculture has operated historically.

With the consumer having emerged as a key constituent in the GM food debate worldwide, gaps in the public knowledge system are particularly noticeable. The potential consumption of GM food is of immense significance as it lies not only at the end of the food chain but is presumed upon the success or failure of the planting of GM crops at the field level.

A study on attitudes and perceptions to GMOs is significant in the present context in India because both the public and private sector in agriculture are starting to commercialize GM products in a variety of conflicting situations.

Public resources are being spent on developing a wide range of products whose suitability and appropriateness is being questioned by many. The results of such a perception study should help to rationalize expenditures from the public and private sectors in agbiotech products. The Government of India is promoting public-private partnerships that also need to be rationalized on the basis of critical needs assessment and incorporating the public's concerns.

Overview of Attitude and Perception Studies on GMOs

Developed Countries

In industrialized countries where biotechnological innovations in food and medicine have been around for some time, psychologists, sociologists and social scientists have been researching public perception and the political dimensions of the biotechnology debate. For example, the Eurobarometer surveys conducted regularly since 1991 by the Directorate General for Research of the European Union (EU), showed from their 2002 survey that Europeans continued to distinguish between different types of applications of GM technology, particularly medical and food applications. A majority of Europeans oppose GM foods because they consider them to be risky for society. A comprehensive study conducted in Europe and published in 2002 found that many policy decisions on GM crops or foods were made based on incorrect assumptions. This is especially significant since many decisions relating to the planting or banning of GM crops quote consumer attitudes as a key factor.

In Australia, Biotechnology Australia, the government agency responsible for coordinating biotechnology issues has been conducting comprehensive surveys since 1999, tracking changing attitudes to GM foods and crops as well as medical biotechnology[i] . A number of surveys showed that GM foods and crops are perceived very differently by the public. For example, consumers and farmers have very differing understanding and expectations of GM technology. The surveys also discovered that the perception of risk was particularly high with respect to GM crops important for Australia, like GM canola, and that attitudes amongst metropolitan dwelling and regional Australians were quite different.

Studying the consumer acceptance of GMOs in Japan, Norway, Taiwan and the USA, Chern and Rickersten[ii] found notable differences in the attitudes and perceptions to GM foods across these countries. For example, Americans were

more willing to consume GM foods than the Norwegians, Japanese and Taiwanese. Also, consumers in these three countries were willing to pay premiums for GM-free food.

There is a reasonable understanding of the attitudes and perceptions in developed countries but few such surveys have examined how agricultural biotechnology is perceived in developing countries where policy formulation involves a wide range of actors, including scientists, government officials, international organizations, local and transnational companies, and farmers' organizations. Policy processes occur at different scales, ranging from local negotiations around agricultural technology priorities to global debates on trade, intellectual property rights, biosafety regulations and biodiversity protection. Given the rapid pace of technological change and the fast-moving international regulatory environment, developing effective national policy processes is a major challenge. Yet relatively little work has been focused on understanding the national and local contexts influencing policy processes in these countries.

Asia

A study conducted in 2007 at the Indian Institute of Management, Ahmedabad found that over 90 % of respondents in the study did not know about GM foods. They were informed by the researchers of the pros and cons of GM foods and tested again. This time over 70 % of the respondents said they were willing to consume GM foods. According to this study, consumers were willing to pay about 20 % price premium for golden rice and about 16 % premium for GM edible oil. (http://www.iimahd.ernet.in/publications/data/2007-06-08Deodhar.pdf)

In 2008, the Asian Food Information Center (AFIC) conducted a survey of consumer trends in major Asian markets. Perceptions of GMOs varied widely across Asia, according to the AFIC survey. According to them, the greatest difference in perceptions was between nations that imported most of their food

and nations that were large exporters. Japan and Korea, which import a large portion of their food supply, were less favorable to GM products. The study said 71 percent of Japanese and 45 percent of Korean shoppers were unaware of the benefits of GMOs.

According to AFIC ,China, India and the Philippines were more favorable to GM crops and consumers in those countries were aware of the benefits. Few of the countries surveyed were concerned about the safety of GMOs and most consumers could identify a few benefits to GM products *(*www.afic.org*).*

Between 1997 and 2001, public attitude studies on perceptions of agricultural biotechnology were carried out in the Philippines and Mexico. Respondents in Mexico and the Philippines considered biotechnology as just a new tool with the potential to solve problems and contribute to future food security. They considered it risky from the point of view of biological diversity but were of the opinion that GM foods posed no health risks. There were however concerns about corporate control of the food chain. In both countries, political actors were suspicious of the research, government officials were concerned about its political impact, scientists in the private and public sectors were not convinced of its utility and anti - GM groups suspected a hidden agenda.

Perception surveys conducted in five countries in Southeast Asia (Thailand, Indonesia, Vietnam, Malaysia and the Philippines) asked what the stakeholders knew or understood about agricultural biotechnology, what they thought about its impact on their lives, where they obtained their information and what kind of information they got, as well as, who they trusted to tell them the truth about the technology.

The ISAAA survey in early 2002 and 2003 showed that the general public was generally in support of agricultural biotechnology but had concerns about its safety to public health. But, these (ISAAA studies) have been contradicted by

other more informal surveys of activist groups like Greenpeace and BioThai. As evidenced from the reactions of the Thai government, first the ban imposed on GM crops and then its subsequent lifting last year, the anti-GM sentiment has had a perceptible influence on the implementation of agricultural biotechnology in some countries. The Asia-Pacific theatre is becoming more and more involved with pro and anti-biotech activism, but without much progress in either enlightened policy making or decision making.

In the Philippines, Philippine Rice Research Institute (Philrice) who are taking the lead in introducing GM rice, specially Golden Rice and the Bangladesh Rice Research Institute (BRAC) and others are involved in the introduction of Golden Rice. Both institutes are part of the International Rice Research Institute (IRRI). There are policy discussions on Golden Rice and policy debates have been coordinated by a well known think tank, the Center for Policy Dialogue, Dhaka, together with BRAC .

In developing countries like India and China, where policy-making process is largely government-led with little opportunity for inputs from the public, the perception of key policy-makers has a very significant influence on policy formulation. Little is known of how the public and key stakeholders perceive GM crops and foods, nor whether there is any understanding of the worldview of key policy people in the political leadership and government departments, with respect to this subject.

A study of popular perceptions acts as a pointer and a reality check on the nature of cultural and ethical taboos, beliefs and customs relating to food and agriculture. It sheds a significant light both on the cultural construction and the structures of power underlying food in India, its production, distribution and consumption. Respondent attitudes show that cultural attitudes and bodily nutrition are inextricably intertwined. Thus even the most practical nutritional and economic issues relating to food, such as efficiency of production and distribution cannot be dealt adequately in isolation from the cultural conceptions and

attitudes toward food prevalent among the people. The layers of consumer/ public attitudes to food or nutritional supplements are however different and will be highlighted in the study in order to inform policy-makers prior to an engagement with regulations relating to risk, biosafety and related parameters. Equally, consumer attitudes and perceptions are often quite different from those of experts such as economists, scientists and technologists, even when relating to the same data. A study on attitudes and perceptions is needed highlight these differences and in turn inform policy-makers that consumers themselves are a stratified group ranging, for instance, from the poor farmer to the rich, leisure class, from young girls and boys to feeding mothers. The results of a study on perceptions of agriculture and GMOs will help policy makers and regulators to incorporate public concerns into policy making and improvement of regulation.

Synthesis of the Project

The proposed study of public perceptions and awareness of GMOs is being undertaken to understand the situation with respect to this technology in India.

As public controversy grows around GM crops, countries have made attempts to study the underpinnings of this controversy and the underlying reasons for the acceptance or rejection of this technology by the public. There is a reasonable understanding of the attitudes and perceptions in developed countries, most notably in Europe, Australia and United States, where detailed studies have been conducted on GM foods, and to a lesser extent on biopharmaceutical products. In contrast, relatively few such surveys have examined how agricultural and medical biotechnologies are perceived in developing countries where there is limited public involvement in policy formulation.

Limited surveys have been conducted in some countries of South and Southeast Asia. For example, a limited study on attitudes to GM foods carried out in India and China focused largely on how to improve consumer acceptance of the foods, rather than on understanding attitudes and perception per se, which remain largely unexplored. No systematic survey of public opinions and attitudes has been carried out ever since modern biotechnology made its foray into India. It is extremely important that the public's attitudes to this technology, particularly to GM crops and foods, be assessed systematically so that larger societal interests and concerns can be included in the national biotechnology development program.

The range of stakeholders targeted in the study include policy planners, administrators and decision makers in the government, academics, the scientific community, the industry, farmers, farmer organizations, NGOs and civil society groups on the one hand, and the general public and consumers on the other. A

matrix analysis of the results will help to develop a better understanding of the nuances of the responses in the diverse target groups, including any gender based differences. It is hoped that the study outcome will contribute towards improved dialogue, and promote rational decision making around GM crops. Additionally, the study findings are expected to help the biotechnology policy development process in the country by taking into account the societal contexts of technology adoption.

Basic Rationale of the Project:

As the public controversy surrounding GMOs grows in intensity, decision-makers in the public and private sectors are looking for social science research on public attitudes and perceptions about biotechnological innovations

Such research of course could be used by vested interests to circumvent or suppress public opposition, and this is usually the case. But it would be far more worthwhile if such data could be used by policy-makers to determine whether GM technology meets the needs of the society in which it is being introduced. Some scholars believe that any study involving sensitive technologies should focus on those who have some knowledge of the subject and are engaged with it. Others are of the opinion that studies of attitudes and perceptions which include both, the key stakeholders and the public, can contribute to a better understanding of the technology.

There is not a single authentic, scientific study assessing the public's attitude to agricultural biotechnology in India. It is uncertain to what extent the concerns articulated by activists and the promotions launched by promoters of GM technology in government and outside, are shared by the public or reflect their views, since no systematic public perception study has been done.

A study of public perceptions and awareness of GMO's will act as a powerful empirical index of this lacuna, which is already being talked about in public forums, the media, national and international civil society and human rights organizations. Prominent examples are certain key publications and Gene Campaign's national conference on the "Relevance of GM Technology to Indian Agriculture and Food Security which brought on board a wide range of stakeholders and included participants with very diverse views, from industry, civil society, government, scientific establishments, consumers, students etc As the global debate on GM crops and foods reveals, the need for good governance and participatory policymaking is being strongly articulated from a number of platforms. This study will reveal the source and type of stereotypical thinking and prejudicial understanding which surfaces along with genuine concerns, in the absence or suppression of information.

Individual perceptions of the benefits and risks associated with the new technology will be determined among other factors, by the sources of information that people select, their belief and value systems, their interests, biases and their individual experiences. Additional factors that come into play are professional qualifications, areas of work and mandates of the organizations they work for, information provided in capacity building and training exercises, media reports, cultural conditioning and preferences, possibility of personal gain etc. Hence, it becomes essential to analyze the factors that shape the perceptions with respect to the benefits and risks of GM technology. Gaps between the perception and awareness of the stakeholders will lead to confusion and mixed reactions about the technology and this will be reflected in policy.

The GMO governance systems in India are also inadequate in their representation of consumers, women, the farming community and other representatives. Expert Committees and Panels, conferences and discussion forums do not include this representation nor are there any formal channels to communicate with them to take their views. The lack of transparency in

governance in this and other sectors has been a focus of activist struggles for several years.

A study of popular perceptions will act as a pointer and a reality check on the nature of cultural and ethical taboos, beliefs and customs relating to food. The layers of consumer/ public attitudes to food or nutritional supplements are different and will be highlighted in the study in order to inform policy-makers prior to an engagement with regulations relating to risk, biosafety and related parameters. Equally, consumer attitudes and perceptions are often quite different from those of experts such as economists, scientists and technologists, even when relating to the same data. The study will highlight these and in turn inform policy-makers that consumers themselves are a stratified group ranging, for instance, from the poor farmer to the rich, leisure class, from young girls and boys to feeding mothers. The study will help to understand how policy and regulation should be sensitive to these differences.

The proposed study is urgent because both the public and private sector in agriculture are starting to commercialize GM products in a variety of conflicting situations. India's biotechnology program has been going on for almost two decades without a proper public policy instrument. The process of formulating a policy has begun as a response to civil society demands and is ongoing.

Public resources are being spent on developing a wide range of products whose suitability and appropriateness is being questioned by many. The results of this study should help to rationalize expenditures from the public and private sectors in these products. The Government of India is promoting public-private partnerships that also need to be rationalized on the basis of critical needs assessment and incorporating the public's concerns. If attitudes and perceptions are not taken into account, public apprehension is bound to increase and the resulting rejection of GMOs may lead to a waste of investments and perhaps seal off any future opportunities that may arise from applications of the technology.

The Research Problem

The overall goal of the proposed study is to contribute towards formulation of a meaningful and transparent public policy around biotechnological innovations in India, which takes into account public perceptions and attitudes.

The objectives of the current study were to:

1. Assess the level of awareness about the use of biotechnology in the agriculture sector among farmers, consumers and their attitudes and perceptions to GMOs.
2. Assess the attitudes and perceptions to GM technology among key stakeholders.
3. Analyse the reportage on the subject of biotechnology in some key newspapers.
4. Analyse the content of the debate on biotechnology in the upper and lower houses of Parliament.
5. Develop research capacity and train young researchers in social science research on agbiotechnology.
6. Discuss research data with a cross section of stakeholders
7. Derive policy conclusions from the study

This study should be seen as the first effort in an ongoing process of longer term monitoring of attitudes to agricultural biotechnology, tracking changes in such perceptions and attitudes over time and assessing public acceptance/ rejection of new biotechnology products. Future studies could examine specific components of attitudes and perceptions regarding the risk factors, and ethical issues related to GM crops .

II. METHODOLOGY

Framing the methodology began with discussions with a range of scholars, experts and diverse stakeholders. Academics and social science research scholars not associated with the study were invited to comment, critique and vet the methodology as it evolved.

Our discussions emphasized the need to make sure that the methodology and the research process is not only sound but also completely transparent. All research partners are agreed that our approach is not based on *a priori* concepts and attribution of meanings to GM food. Our research methodology would be such as to privilege individuals as active agents capable of reflecting on events and objects and document their perceptions that are mediated by their socio-economic status and their systems of meanings, values and attitudes.

A draft methodology was shared with a round of commentators and reworked after getting feedback from scholars from both inside and outside India, particularly from those who have had experience of conducting similar studies in the US and Europe.

In addition to the advisory group associated with the research project, we have benefited from discussions with Prof Brian Wynne of Lancaster University and the principal author of the study of the Commission of European Communities on Public Perceptions of Agricultural Biotechnologies in Europe (the PABE study), Prof Ian Scoones at the Institute of Development Studies (IDS),UK, and Prof Sheila Jasanoff from Harvard University, USA.

A methodology to understand perceptions about GM crops and foods should keep in mind the context in which the study is proposed and issues related to agriculture. The context is that the Indian population is highly differentiated in terms of economic, cultural and political endowments and stratified along the lines of class, caste and gender. There exists a significant proportion of

marginalized communities who could have different perceptions about technology as well as differential access to technology. There are irrigated regions and rain-fed regions in the country. In most irrigated regions, farmers have the experience of using green revolution technologies. In rain-fed areas there is uneven use of green revolution technologies. Farmers also vary in the amount of land they possess. Most farmers have small land holdings, below 5 acres.

Consumers, another category studied here, are a stratified group also ranging, for instance, from the poor farmer to the rich, leisure class, from young girls and boys to homemakers and professionals. The study will help to understand how policy and regulation should be sensitive to these differences.

The study was conducted in two phases. Phase I attempted to understand the perceptions and attitudes to current agriculture and its associated problems in India and to embed the understanding of risk and modified foods within this. This would give a more comprehensive picture of the perceptions about new agriculture technology which includes perceptions about the seed, pesticides and fertilizers. Questions elicited awareness about new technologies like hybrids, High Yielding Varieties(HYV) and new generation seeds with radical new properties.

The study asked what stakeholders think of food - its cultural and religious dimensions. It also asked questions to assess what risks people will take with agriculture (soil health, impact on biodiversity) and food , including its potential impact on health. Questions were framed about agricultural inputs, soil health and credit as well as about farming and its future. Will the next generation continue farming?

Attitudes to food and cash crops were assessed and attitudes to food that was natural and food was grown from radically different seed formed part of the investigation. The research study also explored the perception about the need to regulate new seeds and technologies and the preferred agencies that should do

this. An important set of questions dealt with the perceptions about trust. Which agencies do stakeholders trust as sources of information and whose advice do they prefer.

Phase I of the study explored basic attitudes and perceptions of agriculture and its components like seed, fertilizers and pesticides. Perceptions about what is a good seed, source of procuring seed, crops cultivated, amount of land leased out and land leased in by farmers. Questions relating to what according to farmers is needed for good agriculture -- land, good seed, water, access to technology -- whether or not the needed inputs are available in quantity and quality. Whether farmers consider it worthwhile to pursue agriculture? The study with consumers included perceptions of safe food and willingness to take risk with foods. The first phase of the study employed survey method, which used a questionnaire, and a qualitative method that employed FGD and interview techniques. The insights gained from the phase I of the study helped us design the second phase of the study.

Phase II of the study examined the perceptions of and attitudes to risk , for instance with respect to altered/ modified crops and food , new concepts of agriculture and new agriculture technologies including new agrochemicals with advantages and risks in the highly differentiated farming context. In most parts of the country farmers have the experience of using chemical fertilizers, pesticides, and high yielding varieties introduced as a part of the green revolution. The green revolution brought farmers into the matrix of relations involving the state, and input producers and dealers.

Consumers are a stratified group in terms of rural and urban consumers. Rural consumers consist of farmers, who produce food and also consume the food they produce. In areas where farmers largely cultivate cash crops they depend on the market for food. Landless labor and those involved in non-farm occupations constitute a significant section of rural consumers. In relative terms

urban consumers tend to have more disposable income compared to rural consumers.

As this study is the first comprehensive study in India, our aim was to capture perceptions and attitudes towards food of a broad and somewhat representative section of the farmers and consumers in rural and urban areas given the diversity in agriculture, and social and cultural structures. For this purpose we adopted the survey method to achieve a broad, representative coverage. Similarly we adopted the survey method to capture the perceptions and attitudes of urban consumers on modified food. Perceptions and attitudes relate to what meanings people attach to food and what features in food are considered desirable for maintaining and promoting health, whether modified food would have such qualities and what kind of risks could be associated with such modified foods.

A combination of quantitative-statistical surveys and qualitative methods like Focus Group Discussions (FGD) and interviews were used to understand the experiences regarding existing agricultural technologies and perceptions of risks associated with new technologies and modified crops and foods.

The Risk Approach

Essentially, the approach of this study was to understand the attitude to risk and how risk is perceived by diverse stakeholders, with respect to the production and consumption of food and their view on the regulation of risk.

Theories of risk have historically neglected food issues but in the wake of 'food scares' since the eighties, public confidence in the food industry and government regulatory bodies has been seriously undermined, giving rise to serious thinking on the issue. At the same time, since risk is an important determinant of food choice, risk has become increasingly attached to consumer attitudes and perceptions in general. The mathematical approach to risk analysis, failed to embody the social and cultural context of decision-making with the result that the approach has proved to be of little utility for the prediction of behavior in matters relating to food risk. Today, issues of control and trust have entered the discourse on food risk. For instance, potential risk from food biotechnology are

characterized by low perceptions of control, while life-style and dietary health risks are associated with greater perceptions of control.

Similarly, some approaches have been favored politically, because of their potential to explain the apparent irrationality of lay risk perceptions, and the implication that the public can be educated to overcome perceptual bias and to accept more rational assessments of risk. In the face of all these approaches, qualitative approaches are gaining favor as more able to provide the neutral context for understanding public perceptions and attitudes to food and agriculture issues. In the western world particularly Britain and Europe, consumer concern over food safety has steadily increased since the 1970's, yet in India risk perceptions have not been explored at all in relation to food. Some emerging attention on the part of industry only reflects the growing realization that the success of new food and agriculture technologies like GMOs will largely depend upon public acceptance.

This study presumes risk is influenced by a wide range of qualitative factors rather than statistical rationales and probabilities. Social meanings surrounding risk perceptions render the mere quantitative assessment of risk impossible. Also, in the qualitative approach, the polarization of lay and expert risk assessments can be exposed as data to be examined rather than to be overcome. The public 's approach to authority such as government, science and industry which backs technological innovation in food and agriculture, becomes a factor relative to social and cultural pasts, and hence cannot be neglected. That is why the perceptions of the educated and the S&T elite need to be put under the scanner as well. The role and perceptions of regulating and policy bodies, the scientific community and the media also consequently form part of this study.

Mainstream risk research has concentrated almost exclusively upon the so-called 'irrational' views of the general public. The sociological, cultural approach attempts to overcome these biases by studying risk within the wider social and ideological context and by refusing to judge lay perceptions as somehow "inferior".

And finally, food holds tremendous symbolic significance. In particular, vegetarianism and religious taboos hold a great degree of significance in Indian culture and yet cannot be said to determine the entire population's attitudes. Food choices and food risk perceptions are culturally and identity driven. Food related risk is therefore construed in India in a way that is unique and may vary by food type. This study has attempted a cross-regional analysis not only for enhancing the representative value of its findings but to try and capture this important yet elusive dimension of public attitudes and perceptions to risk in food and agriculture practices.

Operationalising Concepts

We operationalized the key concepts employed in the study by developing empirical indicators of the concepts. Indirect questions like whether farmers would use chemicals that were effective herbicides and would control weeds, but would also destroy surrounding vegetation were posed, to approximate (herbicide tolerant) GM seeds.

As an empirical indicator to assess if people would like to eat GM foods, we asked whether they would eat food that was cultivated from new types of seeds in the development of which parts of animals or insects had been used . In order to see whether farmers would make a distinction between cash crops and food crops, we asked whether they would use the kind of seed described above, to grow cash crops and food crops.

The concept of GM crops and foods was presented as those crops and foods that were different to conventional crops and food because they had been changed in some fundamental way. 'GM" seeds were presented as new varieties produced by a process which involved introducing parts of plants, animals or insects to provide some useful attribute such as improved ability to fight pests. Bt

cotton was presented as a seed in which a modification was made by introducing parts of insects to minimize the use of pesticides.

Instruments of data collection:

Standardized questionnaires were used for the quantitative study of farmers and urban consumers. For FGDs, thematic questions were used to promote and guide the discussion in the group.

- Quantitative data was collected through household interviews using questionnaires from two types of key stakeholders; rural farmers and urban consumers
- Qualitative data was collected through Focus Group Discussions (FGDs) from key stakeholders like farmers, consumers, scientists and seed dealers.
- Senior people who would not be amenable to an FGD setting were interviewed independently.
- An analysis was done to evaluate the nature of concerns expressed by the political leadership by examining the record of parliament debates.
- Media reportage from leading newspapers was studied to examine the perceptions in the media and the way they presented the issues around Agbiotechnology. Three papers were selected. The Tribune published from Punjab has a wide readership in North India and is respected as a paper covering agriculture issues. The Hindu, a largely southern newspaper known for unbiased reporting and the Daily News & Analysis (DNA) read mostly in western India.

Selection of states:

- The study on farmers and consumers was conducted in five states:
    - Andhra Pradesh
    - Maharashtra
    - Punjab

- Jharkhand
- Assam

These states are geographically distributed to represent North, South, East and West India. Assam was included from the northeast of India, a region which is considered somewhat isolated from the mainstream. Andhra Pradesh and Maharshtra have been cultivating Bt cotton since 2002-2003. Jharkhand and Assam do not cultivate cotton and hence have no exposure to Bt cotton. Punjab is considered the cradle of the green revolution in India, known to practice intensive agriculture, it has regions which grow cotton and others that do not. Punjab is considered the quintessential “agriculture state” of the country. Known for its early adoption of the green revolution and intensive agriculture practices, has both cotton and non cotton growing regions. Maharashtra and Andhra Pradesh have pockets of intensive agriculture as well as conventional agriculture. Jharkhand and Assam have largely conventional agriculture.

Sampling for Farmers Survey

Two districts were chosen in each state. The sampling was purposive. In each district, two villages were selected randomly using the census list. In each village 200 farmer households were selected randomly for survey. This brought the total sample per district to 400 farmer households and the total sample size per state to approximately 800 farmer households.

The following districts were selected: Andhra Pradesh- Mahboobnagar and Guntur; Maharashtra - Amravati and Yavatmal; Punjab - Bhatinda and Patiala; Jharkhand - Ranchi and Dumka; Assam - Golaghat and Jorhat.

Sampling for Urban Consumers

In each state one city was chosen for this survey. Hyderabad in Andhra Pradesh, Nagpur in Maharashtra, Chandigardh in Punjab, Ranchi in Jharkhand and Jorhat in Assam. The sampling was purposive. A stratified random sample of about 500

urban consumer households was surveyed in each city. This sample consisted of the following five different consumer groups, of approximately 100 each, selected randomly:

- Professionals (lawyers, chartered accountants, doctors, scientists etc.),
- Students
- Government employees
- Housewives
- Academicians

a) The professionals surveyed were identified through professional associations, lawyers from the Bar Association, list of doctors from leading hospitals, etc.
b) The list of academics surveyed were identified from universities and from teachers associations.
c) The government employees surveyed were identified through major government offices in the city.
d) The housewives surveyed were identified on random basis drawn from the voters list.
e) The students surveyed were identified from hostels and colleges.

Methodology for FGDs

Three FGDs were held in each district in each state. Two FGDs were held with two different farmer groups in villages belonging to different mandals (blocks). One FGD in each district was held with shop owners who deal in seeds, fertilizer and pesticide.

Each farmer FGD had about 15 members. About ten shop owners/dealers constituted the other FGD. FGDs with urban consumers were organised in groups of 15-18.

Table No.1 Distribution of farmers in the sample across the five states:

State	Sample size	
	Frequency	Percent
Andhra Pradesh	812	20.0
Maharashtra	836	20.6
Assam	804	19.8
Jarkhand	800	19.7
Punjab	800	19.7
Total	4052	100

Table No. 2. Distribution of farmers in the sample across districts

District wise Sample Size in each state							
	Andhra Pradesh	Maharashtra	Assam	Jharkhand	Punjab	Total	
District	%	%	%	%	%	%	Freq
Guntur	50.2	-	-	-	-	10.1	408
Mahabubnagar	49.8	-	-	-	-	10.0	404
Yavatmal	-	50.4	-	-	-	10.4	421
Amaravathi	-	49.6	-	-	-	10.2	415
Golaghat	-	-	38.1	-	-	7.6	306
Jorhat	-	-	61.9	-	-	12.3	498
Ranchi	-	-	-	50.1	-	9.9	401
Dumka	-	-	-	49.9	-	9.8	399
Bhatinda	-	-	-	-	50	9.9	400
Patiala	-	-	-	-	50	9.9	400
Total	100	100	100	100	100	100	4052

Analysis of Data

As an initial step in the analysis, frequency tables were generated on the basis of the data collected through the sample survey from farmers' households from urban consumers. Contingency analysis was carried out to examine association, between demographic variables (independent variables) and the variables that are empirical indicators of experiences, perceptions, attitudes towards risks associated with agriculture and food.

While the survey results provide statistics regarding the association between the dependent and independent variables measured on nominal, ordinal and interval/ ratio scales, the results that we obtained from the FGDs and interview were used to understand the meanings that people attach to agriculture and food in different contexts. Meanings cannot be measured; they can only be interpreted and understood. We employed a combination of methods to explore the diversity of experiences and diversity of perceptions and the factors that account for the variations in perceptions. Thus, this study is an attempt to use more than one source of data to produce a narrative that captures the perceptions of farmers, consumers input dealers, who represent the interests of industry, scientists and professionals, policy makers, media and political leaders and attempts to explicate the anxieties and tensions that new technologies generate.

Field work for the study was carried out during 2008 and 2009. Primary data collection from quantitative surveys, FGDs and interviews was done by trained researchers. In Jharkhand primary data was collected by a research team led by Prof. Ramesh Sharan, (Dept. of Economics, Ranchi University); in Assam by a research team led by Mr. Bhaskar Jyoti Mahanta heading the North East Centre for Rural Livelihood Research, in Punjab, Andhra Pradesh and Maharashtra by researchers led by Dr. B K D Raja head of the development research agency Samaj Vikas as well as Prof Ajay Dandekar, Ms Geet Lamba and Mr Kuldeep Singh from Punjab University. The overall guidance and supervision was provided by Dr. Suman Sahai, Prof.E. Haribabu and Prof. Amrit Srinivasan.

III CAPACITY BUILDING

Training and Capacity Building Workshop on Studying Attitudes and Perceptions towards GMOs in India; Dept of Social Sciences, Central University, Hyderabad

Gene Campaign, in association with the School of Social Sciences, University of Hyderabad had organized a training workshop on studying attitudes and perceptions towards GMOs (Genetically Modified Organisms), on August 19, 2008 at the School of Social Sciences, University of Hyderabad.

The aim of the workshop was to develop research capacity and interest among post- graduate students, Ph.D. researcher scholars, faculty members and others about the importance of such studies and to build capacity in methodology and data analysis for such research.

The methodological issues in social science research on application of genetic engineering in agriculture were discussed. GC highlighted the factors which influence the adoption of a new technology, namely, economic factors like affordability, potential productivity, social factors such as degree of access to technology, cultural factors such as meanings and values, health related factors such as nutrition, long-term and short term risks as well as environmental factors including risks. While studying the perceptions of the farmers, the researcher has to centre his questions around affordability and access, productivity, sustainability, degree of independence and choice in cultivation, and risks related to investment and soil. Perceptions of consumers could be best studied by focusing on the issues of affordability, access, nutrition and risks to health. Thus, an empirical study to understand farmers' and consumers' perceptions has to be based on their conceptions of risk safety, affordability and sustainability and values and meanings. Questions have to be carefully framed to bring these out . The methodological tools to be pursued in obtaining such kind of data include statistical surveys, which will provide summary descriptions regarding the socio-economic and demographic backgrounds, experiences, and opinions. The

measurements are to be at two levels: nominal (qualitative) ordinal and interval ratio scales. The other tool to be used is micro level interview/ FGD to understand the processes, systems of values, meanings that farmers and consumers attach to food crops and food. Practical examples were discussed from other studies like on ITC.

The workshop further elaborated on the methodology adopted by Gene Campaign in conducting the study. The need for such kind of research which stems from the fact that the birth and development of agricultural biotechnology, particularly GM crops have courted considerable public controversy was highlighted. It is extremely important that public's attitude to the technology is assessed systematically, to include larger societal interests and concerns in national biotechnology development program. Such studies could be expected to contribute to improved dialogue and rational decision-making.

One section of the workshop centred on a comparative analysis of the methodologies followed by the PABE and the Eurobarometer studies and their key findings, which constitute some of the seminal works in this field. Gene Campaign's methodology has taken tips from both PABE and Eurobarometer studies, but has customized its approach to the Indian situation. It has adopted a mixed research approach- combination of qualitative and quantitative methods. While farmer and consumer surveys would be useful as general indicators of the contours of public attitudes and perceptions, the finer details and nuances would be provided by focus group discussions and in-depth interviews.

The participants discussed details about each of the qualitative and quantitative methods to be followed in conducting such a study namely, the focus group discussion, in-depth interview, participant observation and sample survey using a structured questionnaire. The participants discussed about the loopholes and disadvantages in each method and how to overcome these, in order to get the best and unbiased data.

This was followed by an interactive session with the participants, which helped flag out the problems in adapting social science methodology to such kind of research and how these could be overcome.

Participants wished to know whether the GC study would focus on Bt Cotton, the only GM crop being commercially grown in India at present and assess public attitudes and perceptions towards this crop. SS clarified that it is not a study about the performance of a particular crop, but a study on understanding perceptions towards GM technology in general. A Ph.D. research scholar of the Department of Sociology, AP pointed out that in India, in all probability, farmers' perceptions would be totally influenced by their experience with Bt Cotton, and it would be difficult to get an objective perception of GM technology *per se*. SS replied that in order to avoid this, the study would cover both Bt and non-Bt states and regions (with an additional set of variables for the latter). Also, the questionnaire has been designed in a manner that it is able to yield information on general perceptions, rather than experience with one particular crop.

Another research scholar of the same department DP wished to know whether the results of the study would go to policy makers, insisting that it should be widely disseminated to create awareness and inform policy. AKM from the Department of Sociology highlighted the difficulties which will be faced by a researcher in the field, trying to ask questions about GM technology to an illiterate farmer in rural India, who may be hearing about such a technology for the very first time. A faculty member of the Department, Dr. VS pointed out that it would be difficult for social scientists to understand the science of GM technology; thus, such studies could be best conducted through an inter-disciplinary approach with a team composed of both scientists and social scientists.

One participant JB of the Department of Political Science put forward her opinion that such an attitudes and perceptions study might run the risk of overemphasizing and overestimating the role of cultural values and meanings. In her view, such a study should take into consideration the fact that culture is an adaptive tool, which helps people adapt to new situations never faced before, with very good results. Prof. HB pointed out that this kind of study, by being unbiased and scientific, would help bring out these kinds of subtle nuances in public attitudes and perceptions.

Participants also pointed out that while trying to assess the attitudes and perceptions of farmers towards GM crops, the study should not presume that farmers are passive recipients of a new technology, but that they have the good sense to adopt what is most profitable for them, in the long run. MD made the very valid point that such a study should be designed in a manner that it is able to bring out the gender differentials in attitudes and perceptions. A another faculty member PB stressed that a questionnaire for farmers should contain questions on how the farmer feels about his freedom of choice in cultivation and also his trust in different agencies like the government, agriculture department, media, NGOs etc.

The workshop concluded with a discussion about the present day relevance of social science research in understanding public attitudes and perceptions, in the backdrop of which a new technology is being adopted. Referring to Gene Campaign's study on understanding public knowledge, attitudes and perceptions towards GMOs in India, SS expressed the hope that this training workshop would stimulate further such studies, with more social scientists engaging themselves in this new field of inter-disciplinary research. It is very important that more scholars engage in such areas of contemporary research. As the public controversy surrounding GMOs grows in intensity, decision-makers in the public and private sectors are looking for social science research on public attitudes and perceptions around biotechnological innovations. Such research would help

policy-makers to reflect on whether GM technology meets the needs of the society in which it is being applied. However, while engaging in such studies, the scholars would do well to remember that modern technologies like GM technologies may not always be motivated by the public good, as earlier agricultural technologies. Due to the privately owned and patented nature of GM technology, it is even more pertinent for objective, scientific research to take place, in understanding public attitudes and perceptions.

IV. RESEARCH FINDINGS

Research Findings - Phase I

The Indian population is highly stratified not only in terms of economic and social endowments but also in terms of cultural endowments - levels of education, and the degree of access to information. The size of land holdings among the farmers in rural areas is differentiated in terms of: marginal, small, medium and large holdings. This differentiation creates conditions for unequal access to critical inputs needed for agriculture. In this context, it is important to understand the perceptions of different categories of farmers regarding crops and foods that were modified or altered in some way, approximating genetic engineering. Farmers' perception about the changing agricultural scenario in India will provide some insights into the way they perceive new technologies and new seeds with radically different properties to conventional seed.

The objectives of the Phase I study were to explore the conditions under which agriculture is carried out, by eliciting the experiences of a cross section of farmers regarding access to farm inputs- seed, fertilizers, pesticides irrigation and credit. An important aspect was understanding the farmer's perception of a "good" seed. Apart from the quality of seed, an attempt was made to assess the level of understanding about agricultural technology. The study sought information on the profitability of agriculture and its desirability as an occupation in the future.

II. Methodology:

For the Phase I study, three states – Andhra Pradesh, Maharashtra and Gujarat were selected. In all three states Bt cotton has been adopted since the crop season 2002-03

Two districts were selected per state. From Andhra Pradesh Guntur and Warangal, from Maharashtra Amravati and Yavatmal, and from Gujarat Ahmedabad and Gandhinagar.

Data collection:

A structured questionnaire was used to collect information. Data was collected from over 700 farmers on size of land holdings, crops cultivated, sources of agricultural inputs, credit, yield and awareness about agriculture technology.

III. Socio-economic profile of the farmers

Andhra Pradesh:	354
Maharashtra:	146
Gujarat:	217

The socioeconomic background in terms of caste, class and education could influence access to information about seed and other inputs and also determine access to these inputs as well as access to credit from institutional sources. Socio economic background also could influence the attitude towards new technology and associated practices that the farmers have to learn and implement. These background variables could play an important role in the awareness about new seeds like GM seed.

Socioeconomic background of farmers in the three states

Caste:

Caste has been categorized in terms of the popularly used categories by the government OC (Other castes generally understood as higher castes), BC (Backward castes which are intermediary cultivating castes), SC (Scheduled Caste) and ST (Scheduled Tribe). In terms of religious categories, in addition to Hindus who are categorized into caste groups, Muslims also practice agriculture but to a lesser extent. Class background is ascertained indirectly by variables

such as the size of land holdings and extent of irrigated and un-irrigated land. Educational achievement was measured in terms of levels of education – illiterate, primary school, high school and undergraduate level etc.

Table No. 1 Caste composition of the farmers in the three states:

	Andhra Pradesh	Maharashtra
Caste	%	%
OC	44.63	26.03
BC	46.33	32.19
SC	3.67	29.45
ST	2.82	4.79(GEN)
Muslim	2.54	7.53(NT)
Total	100	100

Table No. 1 indicates that the majority of the farmers belong to the OC and BC categories. In the case of Maharashtra nearly 30 per cent of the framers are from SC background. In both states, few farmers belong to the ST category. The pattern indicates that the upper castes and intermediary caste groups are predominantly involved in agriculture. These groups by deploying their economic and educational resources that give them power, will play a significant role in the evaluation of new technologies and the decision to adopt, reject or remain ambivalent to new agricultural technologies such as GM technologies.

Table No. 2 Educational qualification farmers

	Andhra Pradesh	Maharashtra	Gujarat
Education	%	%	%
Illiterate	42.37	35.62	11.1
Upto V Class	20.62	18.49	32.7
Class VI - X	27.40	30.82	44.7
Intermediate	5.65	7.53	9.7
UG Degree and above	3.95	7.53	1.8
Total	100	100	100.0

Table No. 2 indicates the levels of educational achievement of the farmers. The majority of the farmers have educational achievement ranging from primary

school to high school or 10th standard. Education enables individuals to access information and use the information to take decisions with regard to new technologies and the associated practices. In the case of Andhra Pradesh, 42.37 per cent of the farmers were illiterate. It is likely they would follow the example of farmers who are better educated and better off.

Table No.3 Highest education level attained in the household:

	Andhra Pradesh	Maharashtra	Gujarat
Individual	%	%	%
Self	29.38	23.97	55.3
Spouse	2.82	3.42	08.3
Others	67.80	72.60	36.4
Total	100	100	100.0

Table No. 3 indicates who attained the highest level of education in the household. Only in Gujarat the majority of farmers themselves had achieved the highest level of education, whereas in Andhra Pradesh and Maharashtra the proportion was less than 30 per cent. In such households, the children were better educated or family members who held jobs outside. Educated family members can play a significant role in accessing information and processing the accessed information for decision making. Educated individuals in a household will help farmers in matters relating to filling out application forms for various purposes such as getting credit and for obtaining authentication of land documents.

Table No. 4 Distribution of Farmers in terms of the category of land landholding

	Andhra Pradesh	Maharashtra	Gujarat
Landholdings	%	%	%
Land Owner	93.79	96.58	93.5
Share Cropper	3.95	1.37	2.8
Land owner and share cropper	2.26	2.05	3.7
Landless Agri Labour	2.26	----	----
Total	100	100	100.0

Most farmers were owners of the land, very few share croppers and landless labour in samples studied.

Table No. 5 Area of irrigated land owned by farmers

	Andhra Pradesh	Maharashtra	Gujarat
Irrigated land	%	%	%
Upto 5 Acres	32.75	57.78	34.1
5 - 10 Acres	31.88	20.00	51.2
11 - 15 Acres	19.59	6.67	14.7
16 - 20 Acres	7.89	6.67	---
20 Acres & above	7.89	2.22	---
Total	100	100	100.0

Table No. 6 Area of un-irrigated land owned by farmers

	Andhra Pradesh	Maharashtra
Unirrigated land	%	%
Upto 5 Acres	77.78	56.78
6 - 10 Acres	22.22	31.35
11- and above acres/bhigas		10.17
Total	100.0	100.0

Table No.7 Area of leased out land by farmers

	Andhra Pradesh	Maharashtra
Leased out land	%	%
Upto 5 Acres	50.00	16.67
7 – 10 Acres	42.86	16.67
10 – 15 Acres	7.14	16.67
No response	--	50.00
Total	100.0	100

Table No. 7 shows that the proportion of farmers who leased out land is very small. Table No. 8 below indicates, that the leasing-in of land is more frequent.

Table No 8 Area of leased-in land cultivated by farmers

	Andhra Pradesh	Maharashtra
Leased in land	%	%
Upto 5 Acres	34.91	58.06
5 - 7 Acres	12.07	12.90
7 - 10 Acres	18.53	3.23
10 – 15 Acres	19.40	3.23
15 – 20 Acres	9.05	6.45
20 Acres & above	6.03	3.23
Total	---	3.23
		9.68
Total	100.0	100.00

Table No. 8 indicates that in Andhra Pradesh of those who have leased in land, nearly 35 per cent are marginal and small farmers owning below 5 acres. A similar trend is seen in Maharashtra, of those who leased in land 58 per cent were small and marginal farmers. Other farmers leased in land also for various reasons. The leased land may be blocking entry to their land or the leased land may have better access to water for irrigation.

Input Sources - Seed

Table No 9 . Sources from which farmers procure seeds

	Andhra Pradesh	Maharashtra	Gujarat
Procure seeds from	%	%	%
Govt. agency	1.41	5.48	64.1
Private dealer	92.09	88.36	26.3
Both govt and private dealer	0.28	4.79	17.1
Fellow farmer and other sources	0.28	1.37	2.3
No response	5.93	--	--
Total	100	100	100.0

Table NO. 9 shows that the majority of farmers in Andhra Pradesh and Maharashtra depend on private seed dealers for their seed (88-92 %). In Gujarat however, 64 per cent of the farmers procure seed from government agencies,

while only 26.3 per cent depend on private seed dealers. A smaller percentage sources seeds from other farmers.

Criteria for selecting seed

Table No. 10. Andhra Pradesh

Reasons	%
High yield	94.35
Pest resistant	0.56
Subsidy seed	0.85
Demand in market	1.98
Others	0.56
No response	1.69
Total	100

In Andhra Pradesh, high yield is the most dominant reason for selecting a particular seed, followed by other factors. Almost 95 % of farmers chose seed for high yield. The same trend is reflected in Maharashtra.

Table No. 10.A Maharashtra:

Reasons for choosing seeds	
	%
Increased production	56.16
Pest resistant	0.68
Other farmer advised it	19.18
Demand in market	0.68
Suits to land	2.05
Told by the shopkeeper	2.05
Average production is good & more profit	4.79
Ordinary seed do not give good yield	4.11
It is new seed & krishi kendra person advised to go for it	0.68
It is new seed in market & is used by others	1.37
These seeds do not need pesticides & insecticides	1.37
It requires less water	0.68
We are now familiar with it	0.68
Farm last year experience	1.37
No Response	4.11
Total	100

In Maharashtra, whereas yield was favored, it was not so overwhelming as in Andhra Pradesh. Farmers were influenced by the advice of other farmers and their experiences of crop survival and yield.

Table No 11 Perception of the farmers regarding good quality of seeds:

	Andhra Pradesh	Maharashtra
	%	%
High yield	67.51	78.46
Based on last year yield	4.24	----
Pest resistant	0.28	0.68
Demand in market	20.34	4.74
Size of the grain	0.28	----
No response	7.34	22.60
Total	100	100.0

Table No.11 shows that for the majority of farmers good quality seed is one that gives high yield. Farmers in Andhra Pradesh give importance to seed that has a high demand; farmers in Maharashtra do too, but to a lesser extent. *Surprisingly, pest resistance does not feature as an important criterion for selecting seed.*

Farmers also look for certification of the seed by government agencies such as Agmark (Table 12), but most farmers (68 % and 38 %) in Andhra Pradesh and Maharashtra are not conversant with branding and certification of seed.

Table No. 12 Farmer's method of recognizing good quality of seeds:

	Andhra Pradesh	Maharashtra
	%	%
Ag mark	22.03	6.85
BSI	1.13	5.48
Can't recognize	0.56	6.85
Relatives and fellow farmers	----	5.48
Shop keeper and the seed company	----	4.10
From experience	--	17.81

Krishi Kendra	--	2.74
Don't Know	68.36	37.67
No response	7.63	4.11
Total	100	100.0

Table No. 13 Percentage of farmers who saved hybrid seeds for next season:

	Andhra Pradesh	Maharashtra	Gujarat
	%	%	%
Yes	1.98	4.11	26.3
No	91.24	95.21	73.7
No response	6.78	0.68	--
Total	100	100	100.0

Table No. 13 shows that the majority of the farmers do not save hybrid seed for the next season. This trick question was to assess the extent to which an agricultural technology with a catch, is adopted correctly. Farmers in Andhra Pradesh and Maharashtra seemed much more conversant with hybrid technology, understanding that you cannot save seed for the next season. Surprisingly, in Gujarat (with more literate farmers) farmers were more likely to use seed of hybrids for the next season. Hybrids do not yield fertile seed so seed cannot be saved for the next season. This question is an indicator of the farmer's ability to comprehend the hybrid technology.

Fertilizers:

Majority of the farmers in the three states use chemical fertilizers. They reported that they use chemical fertilizers for increasing yield and ensuring the good growth of crops. Some farmers, especially in Maharashtra mentioned that enough quantity of organic fertilizers is not available.

Farmers depend on various sources for procuring fertilizers. The predominant source is the private dealer: Ninety five percent of farmers in Maharashtra and 96.0 per cent of farmers in A.P. mentioned that they procure fertilizers from

private dealers whereas in Gujarat 76.5 per cent mentioned that they obtain fertilizers from government agency while 18 per cent reported that they got the fertilizers from private dealers. The remaining farmers in Gujarat mentioned that they got fertilizers from fellow farmers, farmers' associations or government outlets. About 59 per cent of farmers in Andhra Pradesh and 52 per cent of farmers in Maharashtra and 63 per cent of the farmers in Gujarat reported that fertilizers are expensive and they cannot afford to buy as much fertilizer as they need.

Over 90 per cent of the farmers in Maharashtra and Gujarat buy fertilizers by paying cash out right. However, in Andhra Pradesh about 64 per cent buy fertilizers by paying in cash. The rest procure fertilizers on credit. Private seed dealers and fellow farmers are the most frequently consulted for advice on selecting seed and fertilizer, although many farmers also rely on their own experience. This indicates the complete breakdown of the agriculture extension system through which scientists interacted with farmers to help them make choices and to solve their problems. Farmers rarely mentioned that the public extension system played any role in advising them. Although upto 50 % of farmers reported that chemical fertilizers increase yield, they also feel that the continued use of chemical fertilizers will decrease soil fertility

Pesticides:

A similar trend to fertilizers was noticed in the procurement of chemical pesticides in the three states. 98 per cent and 96 per cent of farmers in Andhra Pradesh and Maharashtra respectively reported that they buy pesticides from private shops and retailers but in Gujarat the majority (about 70 %) buy pesticides from government agencies, and the rest procure pesticides from private pesticide dealers.

Irrigation:

Sources of water supply:

In India at present only about 30 per cent of the cultivated land gets assured water for irrigation. Bulk of the pulses and coarse grains are cultivated in rain fed areas. In this context irrigation assumes significance. In some parts of India like Punjab, Haryana and Western Uttar Pradesh, the irrigation system is based on big dams and canals. In the present study the sources of irrigation water are presented in Table No. 14.

Table No. 14 Sources of irrigation water

Source	Andhra Pradesh	Maharashtra	Gujarat
	%	%	%
Canal	20.06	19. 18	52.5
Tube well	19.77	14.47	52.1
Both canal and tube well	4.52	1.37	5.1
Tank	7.63	0.68	--
Rain-fed	42.66	15.75	---
Lift irrigation	4.24	---	---
No response	1.13	10.96	0.5
Total	100.0	100.0	100.0*

Table No. 14 shows that the farmers in the three states depend on multiple sources of water for irrigation. Over 50 per cent of farmers in Gujarat mentioned that they depend on canal irrigation while in Andhra Pradesh and Maharashtra about 20 per cent reported that they depend on canal irrigation. In Andhra Pradesh a significant proportion of farmers (42.66 per cent) depend on rains for cultivation. In A.P. one sees a variety of irrigation systems in use. Regarding the adequacy of water supply for irrigation, a large proportion of farmers (82.19 per cent in Maharashtra) mentioned that they did not have adequate water supply for irrigation. The percentage of farmers who reported inadequacy of irrigation water are 35.88 per cent in A.P. and 19.8 per cent in Gujarat. The majority of farmers in A.P. (77.12 per cent) and Maharashtra (94.52 per cent) reported that the

quantity of water available for agriculture has decreased over the years while in Gujarat (78.8 per cent) reported that there has been no decrease. Irrigation facilities are closely related to the supply of electricity, especially in states where farmers depend on ground water (tube wells, open wells with pumping sets powered by electricity or diesel) for irrigation. In Andhra Pradesh in regions where farmers depend on ground water the state government has introduced subsidy on electricity. The price of diesel is always kept lower than the price of petrol keeping in view the needs of farmers. In spite of these measures energy is not always readily available for irrigation.

Sources of credit:

With the Green Revolution package requiring the use of inputs such as chemical fertilizers, pesticides and irrigation, the cost of cultivation has been continuously rising. This has led to farmers taking recourse to credit to augment their financial resources to procure the necessary inputs. The sources of credit include institutional credit from nationalized banks and other government agencies. The institutional credit is made available to farmers subject to farmers fulfilling certain conditions and complying with formal procedures. The compliance procedure often causes delays in accessing the institutional credit in time for the agricultural season. When this happens, farmers tend to approach private money lenders for credit at high interest rates. In several states the private dealers who supply fertilizer, pesticide and seed, also provide credit. Taking loans from private moneylenders and seed dealers does not involve the complicated compliance and guarantee procedures and even though interest charged is high, farmers prefer these sources since the credit is available in time. In this study, the majority of farmers in Maharashtra (85.62 per cent) and Andhra Pradesh (94.63 per cent) have taken loans, whereas in Gujarat the only 12.4 percent farmers have taken loans. In all three states the majority of the farmers said they raised loans for meeting expenditure relating to agriculture, 66.40 in Andhra Pradesh and 87. 16 per cent in Maharashtra. 96.3 per cent of the 27 farmers in Gujarat

who took loans, also used it for agriculture. Farmers depend on multiple sources of credit such as commercial banks, district cooperative banks and moneylenders.

Awareness about GM seed

Table No. 15 Awareness among farmers about Bt cotton

Response	Andhra Pradesh	Maharashtra	Gujarat
	%	%	%
Yes	9.6	4.7	27.2
No	86.72.	95.21	72.8
No response	3.67	--	--
Total	100.0	100.0	100.0

The majority of farmers were not aware what Bt seeds are or how they are made, even though they had been cultivating it for 5-6 years. Farmers use the term Bt seed as just another name. There is no awareness that these seeds are different from other cotton hybrids. Even among educated farmers and some members of the rural middle class, the term Bt is used as an acronym for Biotechnology. In other words the Bt seed is described as 'Biotechnology' seed in a generic sense. Most of the farmers are not aware that the Bt seed is a privately owned seed.

Table No. 16 Whether farmers want to continue farming

	Andhra Pradesh	Maharashtra	Gujarat
	%	%	%
Yes	92.94	23.29	91.2
No	3.67	22.60	6.9
No other option	---	54.11	---
No response	3.39	--	---
Undecided		---	1.8
Total		100.0	100.0

A crucial set of questions regarding the attractiveness of farming as an occupation for the future, showed bleak results. Whereas farmers in Andhra Pradesh and Gujarat wanted to continue farming, those in Maharashtra did not. 54 percent of the farmers said they continued farming because they had no option and 26 percent said they did not wish to practice farming. This reflects the crisis of farming in Maharashtra, reflected most tragically in the spate of suicides.

Table No. 17 Whether farmers want their children to do farming

	Andhra Pradesh	Maharashtra	Gujarat
	%	%	%
Yes	33.62	26.71	52.5
No	59.89	54.69	24.4
No alternative	---	10.88	-
Depends on their choice	---	4.11	--
No response	6.50	--	--
Undecided	---	3.40	6.9
Total			

Farmers in both Andhra Pradesh and Maharashtra do not see farming as an attractive choice for their children and over half did not want their children to farm. The picture was more supportive of farming in Gujarat but the overwhelming endorsement for agriculture is missing everywhere. When asked what they wanted in order to continue with agriculture, farmers across the board said they wanted good quality seed and timely availability of credit as well as fertilizer at low cost.

RESEARCH FINDINGS - PHASE II

Quantitative Study – Farmers

In this chapter we present the attitudes and perceptions of farmers with respect to seed that has been modified in some fundamental way, and new pesticides and chemicals. In addition we present their willingness (or not) to consume modified food, sources of information they trust and their perceptions regarding regulation of new agriculture technology. We analyse the responses by relating them to their demographic, social and economic background. The data collected from Andhra Pradesh, Maharashtra, Assam, Jharkhand and Punjab, are presented at all India level in aggregate and in individual states in the study. The socio-economic and demographic background and experiences with the existing technology constitutes a set of variables that would tend to influence the perception/ awareness and attitudes towards a radically different, new generation of seeds and agriculture inputs.

Seed that has been "modified"

Modified seed was presented as seed in the development of which parts of plants, animals or insects had been incorporated. An approximation of Bt seed was presented as seed in which a poison had been put to control pests so that the use of external pesticides could be reduced.

Correlation with Age

Figure No. – 1 Would you cultivate cash crops from seed having insect poison in it to control pest

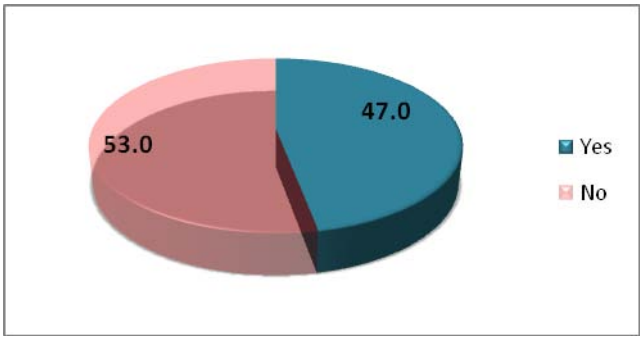


Figure No. 2 Would you cultivate food crops from seed having insect poison in it to control pest

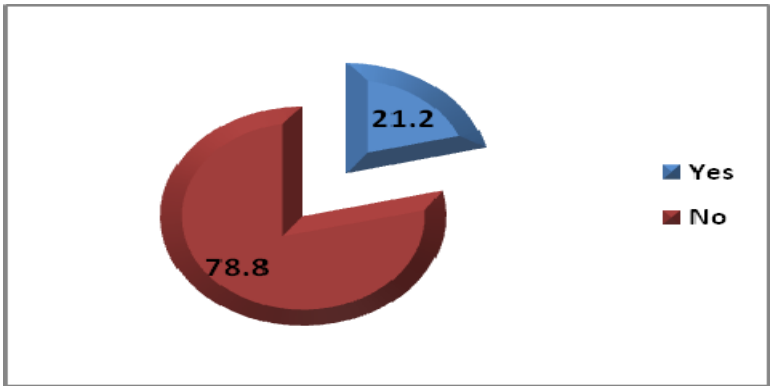


Table 1 shows that just over 50 per cent of the farmers across all age groups do not seem to accept the idea of cultivating a cash crop from seed that had in built pesticide, but the proportion of farmers who do accept the idea is also high across all age groups. In the case of food crops we find that the majority of farmers would not cultivate food crops from seeds containing a poison to control pests. The older farmers (over 50 years) were more inclined to reject food crops that were grown with inbuilt pesticides.

Table 1 Using modified seed containing poison as in built pesticide: Cash crops/ food crops

	Cultivate **cash** crop from seed having insect poison in it to control pest			Cultivate **food** crop from seed having insect poison in it to control pest		
Age	Yes	No		Yes	No	
	%	%	Freq	%	%	Freq
Below 30 yrs	45.7	54.3	709	23.1	76.9	709
30 - 50 yrs	47.3	52.7	2202	22.1	77.9	2202
51 yrs and above	47.2	52.8	1141	18.5	81.5	1141
Total	47.0	53.0	4052	21.2	78.8	4052

Correlation with Education

We explored whether there is an association between the level of education and the perceptions of farmers. Responses presented in Table 2 show that as the level of education increases, there seems to be greater rejection of growing modified cash crops and food crops. However in the case of illiterate farmers a greater proportion (59.9 per cent) appeared to approve of the idea of cultivating modified cash crops compared to those with higher levels of education. In the case of food crops farmers with higher education do not approve of the idea, but one third of the illiterate farmers were open to the cultivation of food crops that had been modified. Given the adverse economics of small farmers, (small holding farmers are more likely to be illiterate), this finding reflects the willingness of small farmers to take higher risks to improve their farm productivity, even if the seed was “tampered” or “modified”.

Table 2 Education level and cultivation of modified cash and food crops

	Cultivate cash crop from seed having insect poison in it to control pest			Cultivate food crop from seed having insect poison in it to control pest		
Education	Yes	No		Yes	No	
	%	%	Freq	%	%	Freq
Illiterate	59.4	40.6	1060	33.8	66.2	1060
Primary Education	46.7	53.3	838	18.0	82.0	838
Secondary	39.1	60.9	1562	16.6	83.4	1562
Above Secondary	45.9	54.1	592	15.7	84.3	592
Total	47.0	53.0	4052	21.2	78.8	4052

Association with size of land holdings:

Agriculture in India is practiced in irrigated and unirrigated areas or rain-fed areas. Farmers in the irrigated areas tend to be more enterprising as they are better off, have an assured source of irrigation and have relatively easier access to credit and agriculture inputs. They also have better access to information from various sources as compared to farmers in rain-fed areas. If we look at the perceptions and attitude of the farmers with different size of land holdings, we see that two third of farmers who have less than 5 acres do not seem to be interested in cultivating cash crops that are modified whereas equally two-third among whose have above 5 to ten acres seem to be more open to the idea of cultivating cash crops with modified seed. In the case of food crops grown with modified seed we notice that the majority of farmers (ranging from 70 per cent to 79.1 per cent) across all sizes of land holdings do not approve of the idea of cultivating such food crops. If we take the size of land holding as one of the indicators of social class, it is clear that the farmers belonging to different classes in the study do not seem to endorse the idea of cultivating food crops from seed that has inbuilt pesticide even if it had an advantage. Those who approve of the

idea of cultivating modified food crops range between 20 to 30 per cent across all sizes of land holders.

Table 3 Cultivation of cash crops and food crops from modified seed- by size of land holding (irrigated areas)

	Cultivate cash crop from seed having insect poison in it to control pest			Cultivate food crop from seed having insect poison in it to control pest		
Area in acres	Yes	No		Yes	No	
	%	%	Freq	%	%	Freq
Less than 5 Acres	38.5	61.5	1695	20.9	79.1	1695
5 - 10 Acres	63.9	36.1	559	29.7	70.3	559
10 Acres and above	63.7	36.3	273	27.8	72.2	273
Total	46.9	53.1	2527	23.6	76.4	2527

Land holding - Un-irrigated land

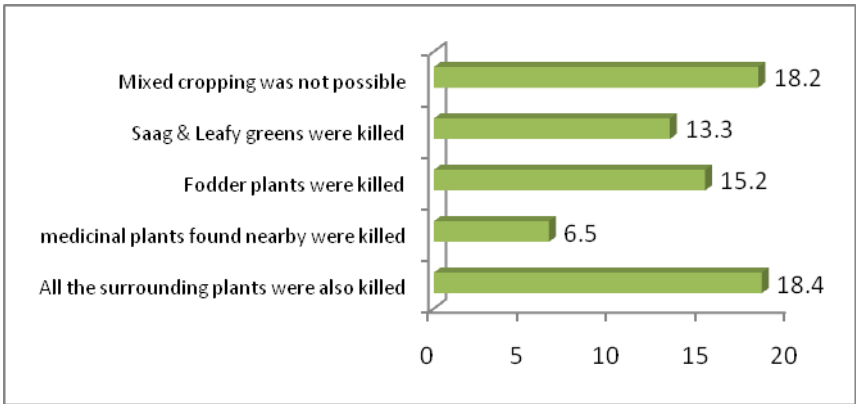
The majority of smaller farmers (70 %) do not seem to be positively disposed to cultivating from modified seed cash crops. In the case of food crops, we find that above 80 per cent of the farmers among all categories do not have a favourable disposition to cultivate such food crops. A greater proportion of farmers with rainfed farms do not approve of cultivating crops with modified seed compared to those who have irrigated land. Food crops that are grown from tampered/modified seeds are by and large not acceptable to farmers across farm size and irrigation facilities.

Table 4. Cultivation of cash and food crops from modified seed - by size of land holdings (unirrigated areas)

	Cultivate cash crop from seed having insect poison in it to control pest			Cultivate food crop from seed having insect poison in it to control pest		
Area in acres	Yes	No		Yes	No	
	%	%	Freq	%	%	Freq
Less than 5 Acres	29.3	70.7	1616	13.2	86.8	1616
5 - 10 Acres	58.7	41.3	407	19.9	80.1	407
10 Acres and above	48.2	51.8	168	13.1	86.9	168
Total	36.2	63.8	2191	14.5	85.5	2191

New kind of pesticides and chemicals:

Figure No. 3 Will you use chemicals that would kill all weeds but also kill



Age is an important variable in shaping the perceptions and attitudes of people as different age groups differ in terms of exposure to ideas and practices. Today the younger population is exposed to a variety of media which tend to shape their perceptions and attitudes. In agriculture based on chemical pesticides and fertilizers the experience of farmers shows that chemical fertilizers have affected soil fertility and chemical pesticides have been affecting harmless organisms and getting deposited in soil and food grains as residues. In the study we

explored the perception of the respondents regarding the degree of risk they would take in using agricultural inputs that have implications for soil and biodiversity. Table 5 shows the attitude of people towards chemical pesticides in terms of the potential effects of pesticides on health and soil fertility. The majority of farmers would not use pesticides that can control pests well but at the same time have harmful effects on human health. Similarly the majority across all age groups would not use pesticides if it was going to affect soil fertility in the long run. There seems to be a clear trade-off. They want pesticides, even if they control pests only partially but that would not affect the soil fertility. However, younger farmers (below 30 years) seemed somewhat more willing than older farmers to try pesticides that control pests fully even if they had implications for human health and soil.

Table 5 Response to new kind of pesticides

	Control pests well but be risky for health			Control well but reduce soil fertility in long run			Only partly control pests but will not affect soil fertility		
Age	Yes	No		Yes	No		Yes	No	Total
	%	%	Freq	%	%	Freq	%	%	Freq
Below 30 yrs	26.4	73.6	273	26.4	73.6	273	50.5	49.5	273
30 - 50 yrs	15.2	84.8	836	20.8	79.2	836	70.5	29.5	836
51 yrs and above	11.0	89.0	518	17.0	83.0	518	76.6	23.4	518
Total	15.7	84.3	1627	20.5	79.5	1627	69.1	30.9	1627

Rural and farming communities in India use biodiversity in a number of ways. “Weeds” are not useless plants. They constitute either leafy green vegetables for the family or green fodder for the livestock that the family keeps. Surrounding flora also yields the valuable medicinal plants on which the community depends for health and veterinary care. We tested responses to new age chemicals that would confer advantages like weed control but had other disadvantages, to see the nature of risks farmers were willing to take.

Table 6 Will you use chemicals that would all kill weeds but also kill

	Surrounding plants			Medicinal plants			Fodder plants			Saag and leafy greens			Make mixed cropping impossible		
Age	Yes	No		Yes	No		Yes	No		Yes	No		Yes	No	
	%	%	Freq	%	%	Freq	%	%	Freq	%	%	Freq	%	%	Freq
Below 30 yrs	23.4	76.6	709	10.3	89.7	709	22.7	77.3	709	22.6	77.4	709	24.4	75.6	709
30 - 50 yrs	17.8	82.2	2202	5.7	94.3	2202	13.8	86.2	2202	12.1	87.9	2202	17.1	82.9	2202
51 yrs and above	16.6	83.4	1141	5.5	94.5	1141	13.4	86.6	1141	9.7	90.3	1141	16.5	83.5	1141
Total	18.4	81.6	4052	6.5	93.5	4052	15.2	84.8	4052	13.3	86.7	4052	18.2	81.8	4052

We find that the majority of farmers across all age groups would not use effective herbicides that would damage surrounding plants, medicinal plants or edible leafy greens. Slightly over 20 per cent of younger farmers (below 30 years) indicated that they would be willing to use herbicides that were effective, even if they were harmful to useful plants. Farmers generally seem to attach great value to the useful and edible plant species in around the farms as they contribute to their food and health security.

The importance of mixed cropping (as an output maximizing strategy) in the Indian farming system is judged from the finding that the majority of farmers (76-84 %) across all age groups would not use herbicides that were effective but made mixed cropping impossible.

Table 7 Response to new kind of pesticides that will

	Control pests well but be risky for health			Control well but reduce soil fertility in long run			Only partly control pests but will not affect soil fertility		
Education	Yes	No		Yes	No		Yes	No	Total
	%	%	Freq	%	%	Freq	%	%	Freq
Illiterate	22.2	77.8	261	29.9	70.1	261	49.0	51.0	261
Primary Education	14.8	85.2	384	24.5	75.5	384	68.5	31.5	384
Secondary	15.1	84.9	676	16.0	84.0	676	74.0	26.0	676
Above Secondary	12.7	87.3	306	17.6	82.4	306	76.1	23.9	306
Total	15.7	84.3	1627	20.5	79.5	1627	69.1	30.9	1627

The majority of farmers across all levels of education including those who are illiterate, are not positively disposed to use pesticides which are effective and kill all pests but are harmful to health. We also find a similar response to the question whether or not farmers would use pesticides that kill pests but reduce soil fertility. A high premium is placed on soil fertility by most farmers. Farmers want pesticides that protect crops against pests but do not damage soil fertility even if the pesticides protect crops only partially. As with other parameters, we see that small (more illiterate) farmers are more willing to take risk in a sense, they are willing to try more risky options to improve their current status, which is very poor.

Farmers in Irrigated areas

Most farmers with access to irrigation facilities would not like to use pesticides that would kill all pests but would be harmful to human health, but about a fourth of the respondents across all size categories were open to using pesticides that would kill all pests even if they turn out to be harmful to health. Pesticides/chemicals that damage soil fertility are not acceptable to the majority. However, one third of small farmers, 43 per cent of medium size farmers (those who have 5-10 acres) and 50 per cent of those who have 10 acres and above do not seem to interested in using pesticide that only partially control pests. Soil health is important, the majority of farmers would not use pesticides and chemicals that negatively affects fertility of soil. Risk to health is also not acceptable.

Table 8 : Irrigated land by new kind of pesticides

	Control pests well but be risky for health			Control well but reduce soil fertility in long run			Only partly control pests but will not affect soil fertility		
Area in acres	Yes	No		Yes	No		Yes	No	Total
	%	%	Freq	%	%	Freq	%	%	Freq
Less than 5 Acres	22.1	77.9	526	25.7	74.3	526	61.8	38.2	526
5 - 10 Acres	29.6	70.4	179	20.1	79.9	179	56.4	43.6	179
10 Acres and above	28.4	71.6	95	14.7	85.3	95	49.5	50.5	95
Total	24.5	75.5	800	23.1	76.9	800	59.1	40.9	800

In the case of unirrigated land (see Table No 9) we find that the majority (94.5 per cent) of farmers across all categories of land holdings would not use pesticides that are effective and kill all pests but also cause harm to human health. Within the categories we see a similar trend. Farmers who have unirrigated land are more concerned about soil fertility compared to farmers who have irrigated land. This reflects the fact that farmers who have irrigated land generally use high yielding varieties along with chemical fertilizers. They feel they can “manage” the fertility of their soils. Farmers with unirrigated farms are generally resource poor, cannot afford investments in chemical fertilizers and are therefore more careful about nurturing soil fertility.

Table 9 Un-Irrigated land by new kind of pesticides

	Control pests but risky for health			Control pests but reduce soil fertility in long run			Only partly control pests but not affect soil fertility		
Area in acres	Yes	No		Yes	No		Yes	No	Total
	%	%	Freq	%	%	Freq	%	%	Freq
Less than 5 Acres	3.7	96.3	784	15.2	84.8	784	85.8	14.2	784
5 - 10 Acres	13.6	86.4	169	23.7	76.3	169	72.2	27.8	169
10 Acres and above	5.4	94.6	56	33.9	66.1	56	66.1	33.9	56
Total	5.5	94.5	1009	17.6	82.4	1009	82.5	17.5	1009

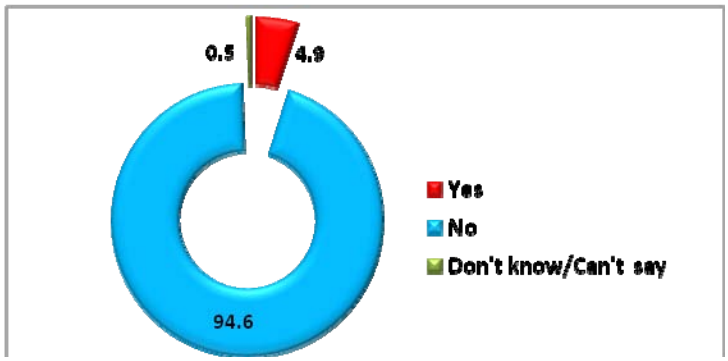
From Table 10 we see that the overwhelming majority of farmers (over ninety per cent) do not want to control weeds by using to chemicals that would kill surrounding plants (95 per cent), medicinal plants (97 per cent), fodder plants (97 per cent) and leafy greens (97 per cent). This response is to be seen as a response to herbicide tolerant crops that claim to “reduce drudgery” and are being promoted as a boon for rural women particularly. The loss of biodiversity as in surrounding flora, seen as weeds by those practicing industrial agriculture is not acceptable to the farming community;. This flora brings many kinds of benefits to farm families which they are not willing to sacrifice for the advantage of effective weed control on their farms. Farmers having unirrigated land responded similarly.

Table 10 Unirrigated land by using chemicals that would kill all weeds

	Surrounding plants			Medicinal plants			Fodder plants			Saag and leafy greens			Make mixed cropping impossible		
Area in acres	Yes	No		Yes	No		Yes	No		Yes	No		Yes	No	Total
	%	%	Freq	%	%	Freq	%	%	Freq	%	%	Freq	%	%	Freq
Less than 5 Acres	4.1	95.9	1616	2.6	97.4	1616	2.0	98.0	1616	2.2	97.8	1616	7.4	92.6	1616
5 - 10 Acres	5.9	94.1	407	4.4	95.6	407	3.2	96.8	407	2.2	97.8	407	2.2	97.8	407
10 Acres and above	7.7	92.3	168	3.6	96.4	168	3.0	97.0	168	5.4	94.6	168	3.6	96.4	168
Total	4.7	95.3	2191	3.0	97.0	2191	2.3	97.7	2191	2.5	97.5	2191	6.2	93.8	2191

Consumption:

Figure : - 4 Would you eat new foods that were highly nutritious but were grown from seed containing animal or insects parts



In the study we explored whether farmers approve of consuming food cultivated from seed modified with parts of plants, insects and animals. It is clear from Table 11 that the majority of farmers across all age categories do not approve of consuming food grown with seed that is modified with parts of insects (82.1 per cent), and animals (81.9 per cent). Not surprisingly there is greater tolerance to "tampering" with other plant parts. Only half (55.2 %) did not approve of consuming such food. A small group (10 per cent of the farmers) expressed the view that they do not know or cannot say.

The perception that food grown from seed that is modified with animal or insect parts is different to food grown from other, normal seed, is seen across all age groups and educational status. This kind of food is viewed as "tampered", not natural and not desirable. The arguments of scientists and proponents of GM technology who argue that DNA is the same everywhere and for instance, insect DNA is no different to other DNA, will have to acknowledge the perception that it perhaps is! Policy makers must be sensitive to the findings that food grown from seed that is viewed as "modified" in some fundamental way is not largely acceptable to rural communities. Going only by the "science based evidence"

approach clearly does not take on peoples' concern especially in an agrarian society like India with deep seated cultural and religious connotations about food.

Table 11 Would you eat food that was highly nutritious, that was grown form seed containing animal and insects parts.

Age	Yes	No	Don't know/Can't say	Total
	%	%	%	Freq
Below 30 yrs	5.1	94.9	0.0	709
30 - 50 yrs	5.0	94.2	0.7	2202
51 yrs and above	4.5	95.0	0.5	1141
Total	4.9	94.6	0.5	4052

Education

We explored if there was an association, between education and perception and attitude towards consuming modified food. Table no. 11 indicates the responses to the questions. The majority (82.1 per cent) indicated that they would not consume food that was grown from seed that had been modified with insect parts. However, over 10 per cent among those will primary education and above said 'they cannot say'. Comprehending such a novel food appeared to confuse some people. Whether they would consume food that was grown from seed modified with plant parts, there was less reluctance. Over 30 per cent among those who have primary education and above said they would consume such food. Overall 55.2 per cent said they would not consume such food. Fifteen per cent said that they "cannot say". The rejection of food cultivated from seed modified with animal parts was much higher. 81.9 per cent of the respondents said they would not consume such food. Clearly, the number of people who accept food grown from seed modified with plants is higher than those where parts of insects or animals are involved. The involvement of insect and animal parts even in the seed used to cultivate food is not accepted by rural communities.

Table 12 Would you eat food that was highly nutritious, that was grown form seed containing animal and insects parts.

Education	Yes	No	Don't know/Can't say	Total
	%	%	%	Freq
Illiterate	5.2	94.3	0.5	1060
Primary Education	4.2	95.2	0.6	838
Secondary	4.7	94.8	0.5	1562
Above Secondary	5.7	93.6	0.7	592
Total	4.9	94.6	0.5	4052

Size of landholdings:

Analysis of disposition towards eating food that was grown from seed containing material from insects/ plants and animals. We found that 85.8 per cent of farmers across all categories say they would not eat food grown from seeds that contained parts of insect. Sixty one per cent of the farmers across all size categories do not approve of consuming food from seed that contained plant material. Eighty five per cent across all size categories do not have a positive disposition towards consuming food grown from seed containing material from animals. There was also significant uncertainty. Over 20 per cent of the farmers mentioned that they could not say what there reaction would be.

Table 13 Would you eat food that was highly nutritious, that was grown form seed containing animal and insects parts.

Area in acres	Yes	No	Don't know/Can't say	Total
	%	%	%	Freq
Less than 5 Acres	4.2	95.4	0.4	1695
5 - 10 Acres	4.7	93.9	1.4	559
10 Acres and above	4.8	93.8	1.5	273
Total	4.4	94.9	0.7	2527

To examine if the perceptions differ among the farmers who have un-irrigated land we cross-tabulated the response to the question on disposition to consume

food grown that contained from seed material from insects/ plants and animals (see Table No.14). The pattern of responses is similar to responses of farmers who have irrigated land. However, the proportion of those who are not favorably disposed to consume food that contained material from insects/plants and animals is less compared to those who have irrigated land. Similarly farmers who have information deficit are also comparable to those who have irrigated land. One thing that comes out clearly from the analysis is that there seems to be a greater degree of positive disposition to consume food if it contained genetic material from plant sources rather than from insect and animal sources.

Table No. 14 Un-irrigated by disposition towards eating food that contained parts of insects/ plants/ animals

	Material from insects				Material from plants				Material from animals			
Area in acres	Yes	No	Don't know/ Can't say		Yes	No	Don't know/Can't say		Yes	No	Don't know/ Can't say	Total
	%	%	%	N	%	%	%	N	%	%	%	N
Less than 5 Acres	2.9	86.1	11.0	1616	43.6	45.4	11.0	1616	2.7	86.1	11.2	1616
5 - 10 Acres	5.9	67.1	27.0	407	11.8	60.9	27.3	407	5.9	65.1	29.0	407
10 Acres and above	5.4	73.2	21.4	168	8.3	70.2	21.4	168	6.0	72.0	22.0	168
Total	3.7	81.6	14.7	2191	35.0	50.2	14.8	2191	3.6	81.1	15.3	2191

Trust:

Analysis of who farmers consider reliable trustworthy sources of information

The responses of farmers in different age groups are tabulated in Table No. 15 & 16. We find that the majority of farmers (87.3 per cent) across all age groups place a high level of trust in the government compared to any other institution. Seed dealers come next and scientists come third. Seventy one percent of the farmers across all age groups place little trust in the NGOs and the media as reliable sources of information. The government agencies played a crucial role in

disseminating information about new technology during the green revolution. In the perception of farmers the state agencies continue to be the most trust worthy institution. The state is not only seen as a structure but also as an agency and is expected to play a pro-active role in providing necessary information, timely and adequate credit, adequate irrigation, quantity and quality of power, subsidies, and remunerative price for the produce after harvest. The significance of seed dealers lies in the fact that they have become the major source of credit and information at the village level. Because national banks are not efficient providers of credit, farmers have learnt to rely on the local shop from where they can access credit along with seed, fertilizer and pesticide. The input dealer is also the most readily available source of information and problem solving (trouble shooting) since the agriculture extension service has broken down and scientists are not available to farmers for information and advice. Because farmers are so dependent on the seed dealer for credit, they are more or less forced to take his advice on seed since the dealer ties up the credit to his recommendation on seed and agro chemicals. The seed dealer has in this way because a powerful instrument for influencing the seed choice of farmers and seed companies have used this fact to their advantage.

Table No. 15 Who do you trust as a reliable source of information?

Age Group	Government Agencies		Seed Dealer		NGOs		Scientists		Media		Total Freq
	Low	High	Low	High	Low	High	Low	High	Low	High	
	%	%	%	%	%	%	%	%	%	%	
Below 30 yrs	11	89	14.4	85.6	78.1	21.8	70	30	44	56	709
30 - 50 yrs	13.1	86.9	18.9	81.1	69.9	30	62.3	37.8	52.3	47.7	2202
51 yrs and above	13.1	86.9	21.4	78.6	68.6	31.3	54.6	45.4	56.4	43.6	1141
Total	12.8	87.3	18.8	81.1	71	29	61.5	38.6	52	48	4052

Table No. 16 Who influence your choice of input

	Government Agencies			Seed Dealer			NGOs			Scientists		
Age	Yes	No		Yes	No		Yes	No		Yes	No	Total
	%	%	Freq	%	%	Freq	%	%	Freq	%	%	Freq
Below 30 yrs	72.1	27.9	709	78.3	21.7	709	14.7	85.3	709	15.1	84.9	709
30 - 50 yrs	62.1	37.9	2202	68.5	31.5	2202	16.3	83.7	2202	15.2	84.7	2202
51 yrs and above	58.8	41.2	1141	61.9	38.1	1141	17.2	82.8	1141	17.3	82.7	1141
Total	62.9	37.1	4052	68.3	31.7	4052	16.3	83.7	4052	15.8	84.2	4052

Despite the overt influence which farmers even admit, the majority of farmers across all age groups (94.9 per cent) seem to feel that they are free to make choices on seed !

Table No. 17 Farmers' perception of freedom in making choices.

Age	Yes	No	
	%	%	Freq
Below 30 yrs	95.5	4.5	709
30 - 50 yrs	94.9	5.1	2202
51 yrs and above	94.5	5.5	1141
Total	94.9	5.1	4052

The high trust in government is found across all age groups and levels of education.

Equally the distrust of NGOs is also seen across age groups and levels of education. Scientist have lost trust of farmers. There is no extension system and scientists from agricultural universities in the region seldom go to the field. For the farmer, the scientist has lost the pre eminent position he enjoyed during the days of the green revolution.

Table No. 18 Who do you trust as a reliable source of information?

Education	Government Agencies		Seed Dealer		NGOs		Scientists		Media		Total Freq
	Low	High	Low	High	Low	High	Low	High	Low	High	
	%	%	%	%	%	%	%	%	%	%	
Illiterate	13.2	86.8	12.2	87.9	64.9	35.1	72.6	27.3	54	46.1	1060
Primary Education	10.9	89.1	24.3	75.6	71.4	28.6	53.3	46.7	51.7	48.3	838
Secondary	14.2	85.8	19.3	80.7	74.1	25.8	59.9	40.1	52.8	47.2	1562
Above Secondary	10.8	89.2	21.6	78.4	73.1	26.8	57.1	42.9	47.1	52.9	592
Total	12.8	87.3	18.8	81.1	71	29	61.5	38.6	52	48	4052

As a corollary of trust the farmers place in government agencies farmers reported that their decisions regarding choice of inputs is most influenced by the government. The government has been playing an important role both directly and indirectly in agriculture. We find that as the level of education increases the influence of various agencies declines. A greater proportion of illiterate farmers mentioned that their actions are influenced by the government agencies and seed dealers compared to farmers with higher levels of education. The better educated farmers.

Table No. 19 Whose views are you influenced by

	Government Agencies			Seed Dealer			NGOs			Scientists		
Education	Yes	No		Yes	No		Yes	No		Yes	No	Total
	%	%	Freq	%	%	Freq	%	%	Freq	%	%	Freq
Illiterate	72.9	27.1	1060	78.3	21.7	1060	12.4	87.6	1060	12.4	87.6	1060
Primary Education	57.9	42.1	838	63.2	36.8	838	20.0	80.0	838	19.7	80.3	838
Secondary	58.7	41.3	1562	66.8	33.2	1562	17.2	82.8	1562	15.0	85.0	1562
Above Secondary	63.2	36.8	592	61.7	38.3	592	15.5	84.5	592	18.4	81.6	592
Total	62.9	37.1	4052	68.3	31.7	4052	16.3	83.7	4052	15.8	84.2	4052

Regarding the association between size of land holdings and the sources of trust worthy information (Table No. 20) we found that the majority of farmers across all sizes of land holdings in both irrigated and unirrigated conditions, place high level of trust in government agencies (86.8 %) followed by seed dealers (82.1 %), scientists or academia (30.6 %). Again we see that the NGOs are not highly trusted as a source of information.

Table 20 Who do you trust as a reliable source of information?

Area in acres	Government Agencies		Seed Dealer		NGOs		Scientists		Media		Total Freq
	Low	High	Low	High	Low	High	Low	High	Low	High	
	%	%	%	%	%	%	%	%	%	%	
Less than 5 Acres	15.3	84.6	23.1	77.0	73.9	26.2	65	35	49.6	50.4	1695
5 - 10 Acres	9.7	90.3	8.6	91.4	84.6	15.4	76.2	23.8	34.9	65.2	559
10 Acres and above	7.3	92.7	5.1	94.9	90.1	9.9	82.4	17.6	33.3	66.7	273
Total	13.2	86.8	17.9	82.1	78	22	69.4	30.6	44.6	55.4	2527

Table No. 21 Whose views are you influenced by

	Government Agencies			Seed Dealer			NGOs			Scientists		
Area in acres	Yes	No		Yes	No		Yes	No		Yes	No	Total
	%	%	Freq	%	%	Freq	%	%	Freq	%	%	Freq
Less than 5 Acres	61.5	38.5	1695	72.2	27.8	1695	17.8	82.2	1695	14.3	85.7	1695
5 - 10 Acres	74.2	25.8	559	85.9	14.1	559	7.0	93.0	559	8.2	91.8	559
10 Acres and above	76.2	23.8	273	88.3	11.7	273	10.3	89.7	273	9.2	90.8	273
Total	65.9	34.1	2527	76.9	23.1	2527	14.6	85.4	2527	12.4	87.6	2527

Table 22 Do you feel free to choose your seed

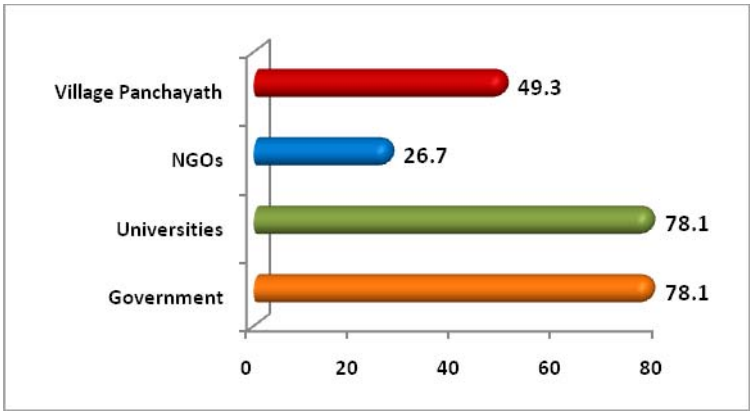
Area in acres	Yes	No	Total
	%	%	Freq
Less than 5 Acres	97.6	2.4	1616
5 - 10 Acres	96.8	3.2	407
10 Acres and above	97.0	3.0	168
Total	97.4	2.6	2191

Table No. 23 Un-irrigated land by sources of influence

	Government Agencies			Seed Dealer			NGOs			Scientists		
Area in acres	Yes	No		Yes	No		Yes	No		Yes	No	Total
	%	%	Freq	%	%	Freq	%	%	Freq	%	%	Freq
Less than 5 Acres	49.5	50.5	1616	47.1	52.9	1616	24.8	75.2	1616	18.7	81.3	1616
5 - 10 Acres	60.0	40.0	407	75.9	24.1	407	21.1	78.9	407	16.7	83.3	407
10 Acres and above	64.3	35.7	168	79.2	20.8	168	29.2	70.8	168	17.9	82.1	168
Total	52.6	47.4	2191	54.9	45.1	2191	24.4	75.6	2191	18.3	81.7	2191

Regulation:

Figure – 5: If new seeds are created that have benefits but also risks, who should regulate/monitor these seeds



In the survey farmers were asked who, according to them should regulate new technology, new seed. Hence again the majority of farmers reported that public institutions must be involved in regulation – Government agencies (78.7 per cent), universities (59.9 %) and local governments (43. 2 %). Farmers did not seem to favor the involvement of NGOs in regulation. Only 26. 7 per cent mentioned that NGOS should be involved in regulation. There is no significant variation in responses in different age groups. A similar response was seen across all age groups and educational levels.

Table 24 Who should regulate/monitor new seeds

	Government Agencies			Universities			NGOs			Village Panchayat		
Age	Yes	No		Yes	No		Yes	No		Yes	No	Total
	%	%	Freq	%	%	Freq	%	%	Freq	%	%	Freq
Below 30 yrs	83.6	16.4	709	50.6	49.4	709	22.0	78.0	709	52.8	47.2	709
30 - 50 yrs	76.1	23.9	2202	51.1	48.9	2202	27.2	72.8	2202	51.3	48.7	2202
51 yrs and above	78.7	21.3	1141	59.9	40.1	1141	28.7	71.3	1141	43.2	56.8	1141
Total	78.1	21.9	4052	53.5	46.5	4052	26.7	73.3	4052	49.3	50.7	4052

Seventy eight per cent of the farmers across all levels of education felt that the government should regulate the new technology. With in the groups with different levels of education (80 %) of the farmers with primary education and (82.2 %) of those with above secondary level felt that the government should take the responsibility. This is followed by academia (53.6 per cent) and local governments (49.3 per cent). The majority of the farmers (73.3 per cent) seem to think that NGOs do not have any role in regulation. The respondents seem to assign the primary role to the government.

Table No. 25: Who should regulate/monitor new seeds

	Government Agencies			Universities			NGOs			Village Panchayat		
Education	Yes	No		Yes	No		Yes	No		Yes	No	Total
	%	%	Freq	%	%	Freq	%	%	Freq	%	%	Freq
Illiterate	76.7	23.3	1060	35.5	64.5	1060	19.3	80.7	1060	58.7	41.3	1060
Primary Education	80.3	19.7	838	60.4	39.6	838	29.4	70.6	838	46.7	53.3	838
Secondary	76.2	23.8	1562	55.6	44.4	1562	29.8	70.2	1562	45.9	54.1	1562
Above Secondary	82.6	17.4	592	70.4	29.6	592	28.2	71.8	592	44.9	55.1	592
Total	78.1	21.9	4052	53.5	46.5	4052	26.7	73.3	4052	49.3	50.7	4052

Quantitative Study – Consumers

One of the objectives of the study was to understand the perception and attitudes of urban consumers towards genetically modified

Culture of food in India:

India is known for the diversity of its cuisine and diverse food habits across regions, and communities which have developed and differentiated. Food has a strong cultural significance and its use, in social and religious rituals, is complex and differentiated. For example, different kinds of cooked and uncooked food are offered to deities as part of religious worship and rituals and then consumed as food blessed by the Gods. Different types of food are cooked for different occasions – ceremonies associated with marriages, ancestral worship and festivals. In terms of food habits there are strict vegetarians and those, who shun even the use of onions and garlic in food, and others are meat eaters. Even among meat eaters there are differences in terms of the animal meat that is permitted for consumption. Meat eaters, belonging to some caste groups among the Hindus do not consume meat on religious occasions because meat cannot be offered to deities as a sacred offering. Other religious groups will abjure this or the other kind of meat. Food is one of the markers of cultural identity of communities and groups. In other words, food is an integral part of a system of cultural symbols. Food that has been modified in some fundamental may , as in the case of genetically modified food, is likely to have implications for social and cultural beliefs, values and practices in the society.

In this background, quantitative surveys were conducted in five cities of the five states where farmers were also studied. 500 consumers each from Hyderabad, Nagpur, Ranchi, Jorhat, and Chandigarh were included in the survey. The sample was drawn from homemakers, scientists and professionals and students. To gain insights into micro-level processes were organized FGDs.to understand

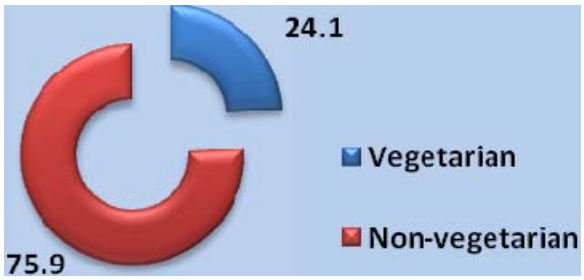
the perception and attitudes of urban consumers towards genetically modified food .

Food preferences:

Pertinent to the study are food preferences and habits. In the survey out of 2550 households drawn from five cities 75.9 per cent mentioned that they are not strict vegetarians and consume non-vegetarian food at least some times (see Table 1).

Table No. 1 Food preferences

Food preferences	Freq	%
Vegetarian	614	24.1
Non-vegetarian	1,936	75.9
Total	2,550	100.0



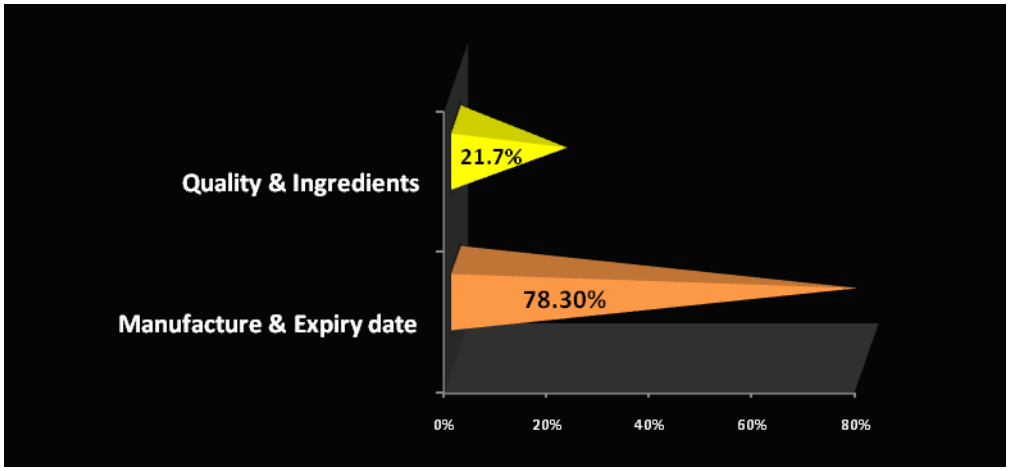
About 87 per cent of the urban consumers bought packaged food. When we asked this question, it was intended to get a sense of what percentage of consumers buy canned foods, snacks, processed foods etc. However the survey revealed that the high percentage of consumers buying packaged food largely reflects the fact that ordinary staples like rice, wheat flour, oil, legumes, spices are being sold in pre weighed packages even in government run subsidized food stores, Fewer people buy their food from old style grocery stores where food was individually weighed and delivered to the consumer. This trend makes a shift in favour of the industrialization of food as also the standardization of food. Studies done by consumer groups however have revealed that such packaged food may suffer two drawbacks; both from poor quality and under-weight. Part of the finding also reflects the situation of the urban middle class household where since both partners are working, semi processed foods, ready to eat foods and

home delivered foods are becoming more prevalent. The emergence of super markets in the bigger cities since the mid 1990s, coinciding with the beginning of the economic boom and the appearance of credit cards has also encouraged buying of packaged food.

Consumers have become more discerning buyers and look for information on the labels of packed food. Seventy eight percent of the respondents in the study said that they look for manufacture and expiry date of the product. Only 21.7 per cent said that they look for quality and ingredients.

Table No. 2 Information sought on labels

Expiry & Manufacture date	1,735	78.3%
Quality & Ingredients	481	21.7%
Total	2216	100%

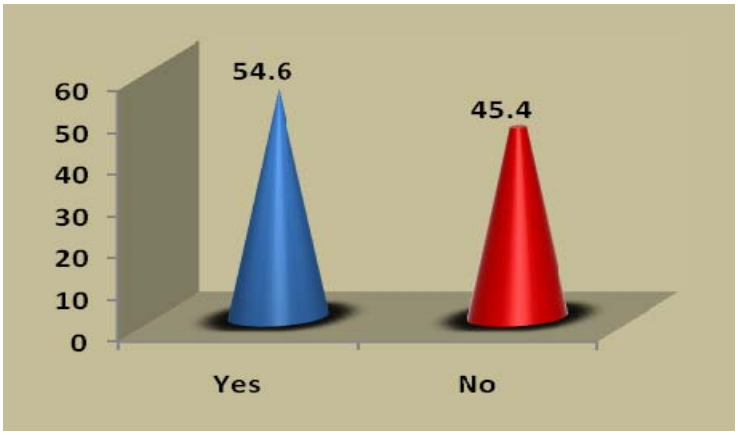


Urban consumers in our study also mentioned buying imported food. With the increasing number of super markets which have become retail outlets for food products produced by foreign companies and more disposable income in the urban middle class, this trend is likely to increase. It is not uncommon to see

semi-processed food like pasta, cereals, sauces, canned fruit and vegetables displayed in these stores. Nearly 55 per cent mentioned that they buy imported food. (Table 3)

Table No: 3 Buying imported food

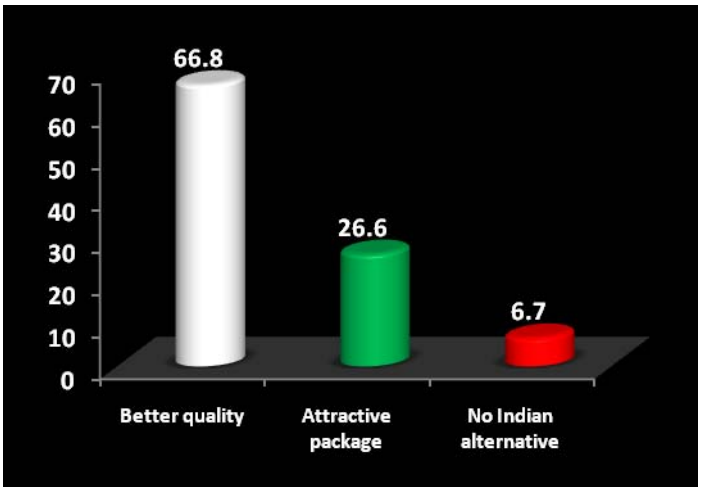
Imported Food	Freq	%
Yes	1,375	54.6
No	1,144	45.4
Total	2,519	100.0



In the perception of the urban consumer, imported foods are of better quality and they cite that as the main reason for buying imported food (66.8 %). This is followed by attractive packaging (26. 6 per cent) and lack of an alternative (6.7 Percent).

Table No. 4 Reasons for buying imported food

Why Imported Food	Freq	%
Better quality	1,532	66.8
Attractive package	610	26.6
No Indian alternative	153	6.7
Total	2,295	100.0

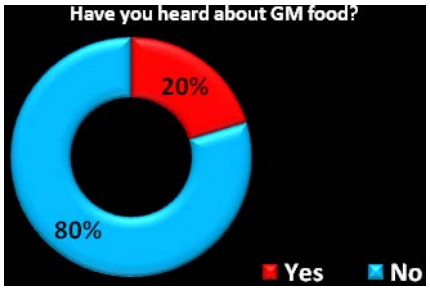


In the present study we explored if consumers have ever heard of GM foods. It is quite revealing that even among the middle class population which is educated and exposed to the media, about 80 per cent of the respondents had not heard of GM food. This means that the majority of the population, including educated sections are not aware of what GM food means, and how it is produced.

This observation has serious implications for policy. Attempts to introduce GM foods into a market where the majority of the population is not aware of the nature of GM foods or how they are produced, nor of their benefits and risks is not a very democratic or sensitive way of dealing with the subject.

Table No 5 Have you heard of GM food

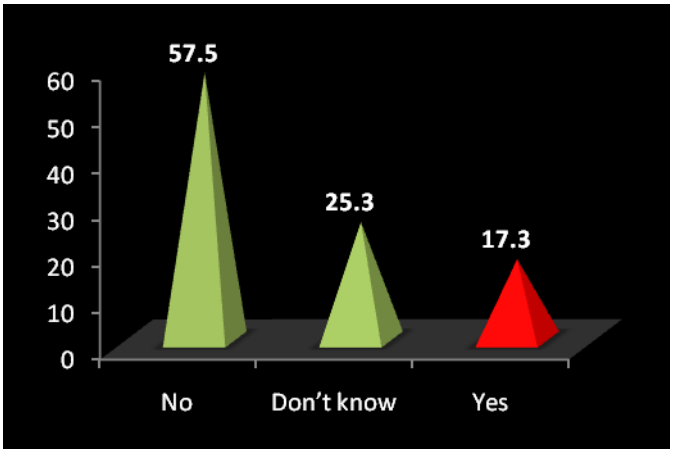
	Freq	%
Yes	517	20.3
No	2,033	79.7
Total	2,550	100.0



We enquired whether the respondents think GM food is already in the market. The majority of the respondents do not think that GM food is available in the market but about 17 percent of the respondents think that they are already in the market (Table No. 6). Some people feel that the semi-processed corn sold in the market may be GM corn.

Table No 6 Knowledge about GM food availability in the market.

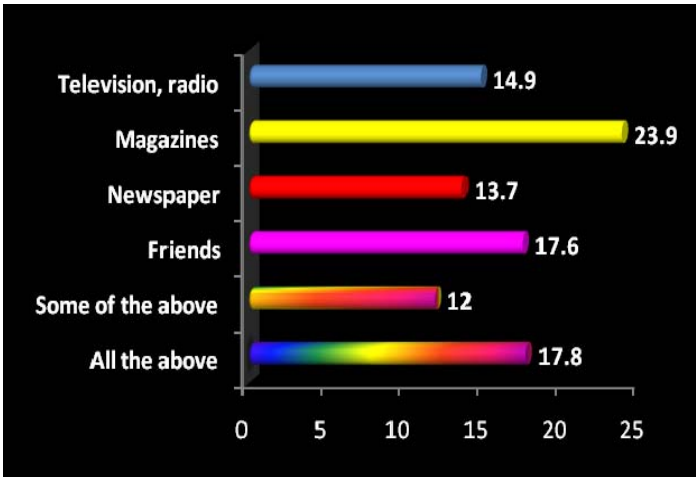
	Freq	%
Yes	440	17.3
No	1,466	57.5
Don't know	644	25.3
Total	2,550	100.0



The study also asked what sources the consumers depend on for information on GM food. Responses are tabulated in Table No 7. Only 415 responded to the question . This group is a subset of those who said that they had heard of GM food. Nearly 56 per cent got their information from the print and electronic media, the other source was friends. About 18 pe cent mentioned that they got information from more than one source.

Table No 7 Sources of information about Modified food

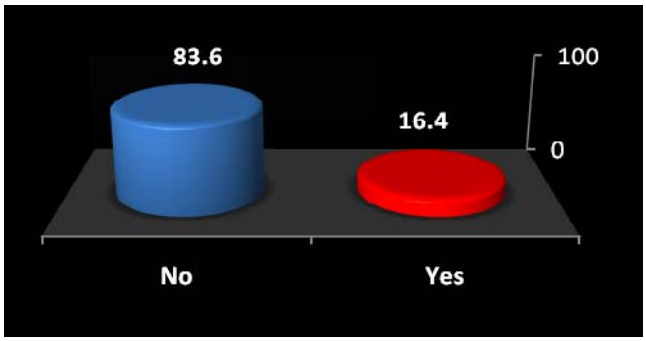
	Freq	%
Friends	73	17.6
Newspaper	57	13.7
Magazines	99	23.9
Television, radio	62	14.9
Some of the above	50	12.0
All the above	74	17.8
Total	415	100.0



The lack of awareness that here is such a thing as genetically modified food is seen in responses set out in Table 8 & table 9. Nearly 84 per cent of the respondents had not heard about any benefits of GM food and only 16.4 per cent said they had.

Table No 8 Have you heard about the benefits of GM food

	Freq	%
Yes	418	16.4
No	2,132	83.6
Total	2,550	100.0



When asked what kind of benefits they had heard, of the 388 (out of 2550) who responded positively, nearly 70 per cent mentioned that the benefit that they heard of was that GM food is nutritious followed by 23.5 per cent who said something similar, that it is healthy.

To the question whether they had heard of any risks associated with GM food, 96 per cent of the respondents mentioned that they had not. This finding reveals a very high level of ignorance among urban consumers about GM foods. This ignorance has to be seen in the context of a high percentage of the consumers buying packaged and processed foods.

Table No 9. Have you heard about risks of GM food

	Freq	%
Yes	102	4.0
No	2,448	96.0
Total	2,550	100.0

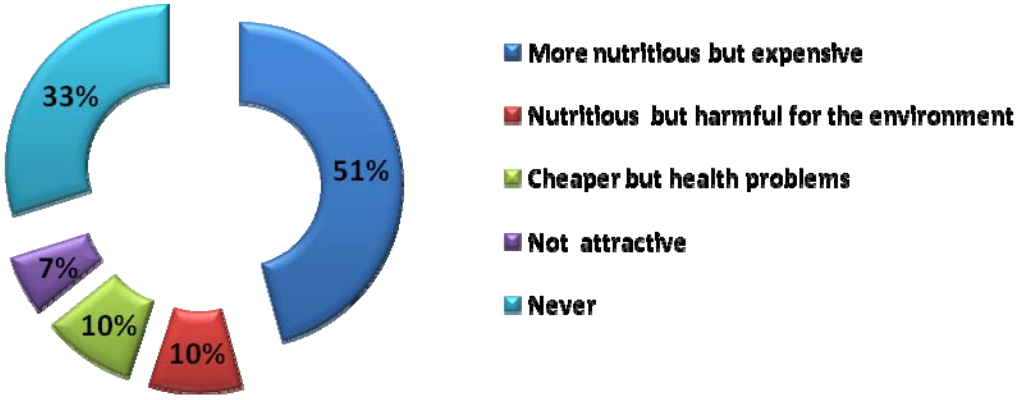
A consumer body like this cannot exercise any choice in the matter of GM food. Introducing GM foods into the market in the near complete lack of awareness, would not be ethical, specially since we know that food is culturally embedded (see data from FGDs)

Table No 10. Would you eat food that is

Would you eat food that is	Freq	%
More nutritious but expensive	1,301	51.0%
Nutritious but harmful for the environment	262	10.3%
Cheaper but health risks	262	10.3%
Not attractive	168	6.6%
Never	849	33.3%
Total	2,550	

When asked to indicate how they evaluate food and the relative importance of factors that they think are significant in the choice of food, 51 per cent mentioned that they would choose food if it is more nutritious even if it is expensive. Only ten per cent said that they would choose food that is nutritious even if it causes harm to the environment, reflecting a larger awareness generated from the environmental movement. Another ten per cent mentioned that they would choose food if it is cheaper even it could cause health problems (Table No 10).

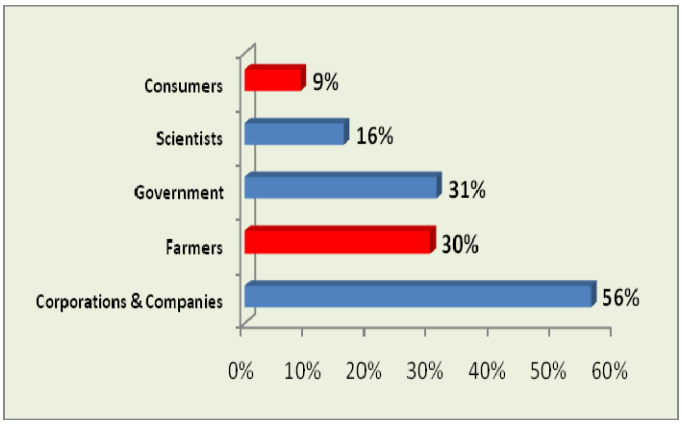
The classical association of food with nourishment is seen here, overlaid perhaps by the growing emphasis on “nutrition” as the property promoted by purveyors of packaged foods.



The majority of the consumers were clear that GM foods largely benefit the corporations and companies that are involved in the production and distribution of such food (Table 11). Farmers and the government. were also cited as beneficiaries. Only 9 per cent of the consumers mentioned that they would benefit from GM food. It is clear that in their perception they themselves are the last ones to benefit.

Table No 11 Who benefits most from GM foods

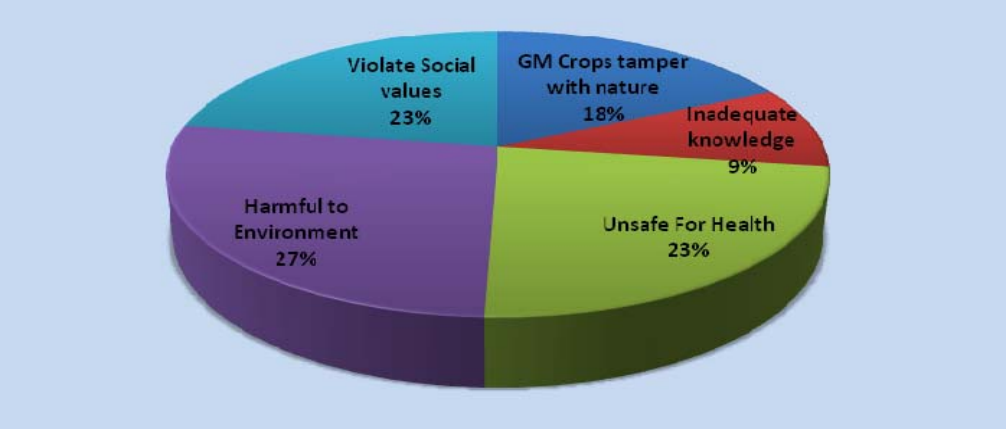
Beneficiary	Freq	%
Corporations & Companies	1,423	56%
Farmers	761	30%
Government	791	31%
Scientists	416	16%
Consumers	237	9%
Base Total	2,550	



We attempted to understand the perceptions of consumers regarding the properties of GM food. They were asked to respond to some categorical statements in the questionnaire. The responses are shown in Table No 12. The lack of engagement is seen in the majority response which is “can’t say”. Barring a high level of consensus (64 %) that there is not enough knowledge about GM foods and more research is needed, consumer perception was fairly confused about these new foods. In the sample 28.5 per cent mentiond that the modified food crops tamper with nature. 64 per cent said that more knowledge based on reserch is needed. The majority mentioned that they could not say any thing regarding the safety and its effect on the environement, but a little less than a fourth of the respondents were concerned that GM foods violate social values associated with food.

Table No 12 Perception about properties of GM food

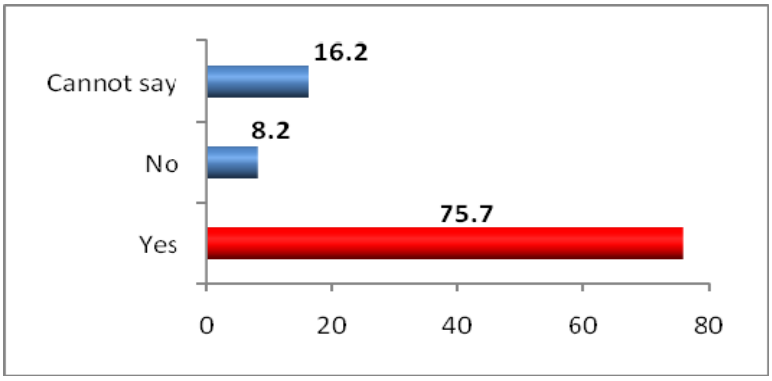
Awareness	Agree %	Can’t Say %	Disagree %
Modified crops tamper with nature	28.5	60.1	11.4
More research needed, Inadequate knowledge	64	30.2	5.9
Unsafe for health	19.5	65.6	14.8
Harmful to environment	16.5	66.4	17.1
Violate social values	18.1	67.6	14.3



Consumers were very conscious of their right to know about the ingredients in food. Nearly 76 per cent mentioned that the consumers had this right. 16 % were not clear and about 8 per cent did not know that they have such rights (Table 13)

Table No 13 Do consumers have the right to know about the ingredients of food

	Freq	%
Yes	1,930	75.7
No	208	8.2
Cannot say	412	16.2
Total	2,550	100.0



We have seen that some of the respondents in the survey believed that GM food is already available in the market. To the question whether they thought that GM food is labeled in India, the majority mentioned said they could not say whether it was or not. About 23 per cent of the respondents thought GM foods were labeled. The consumers lack of awareness about what is happening with GM foods is quite divorced from the reality.

Table No 14 Do you think GM food is labeled in India

	Freq	%
Yes	577	22.6
No	566	22.2
Can't say	1,407	55.2
Total	2,550	100.0

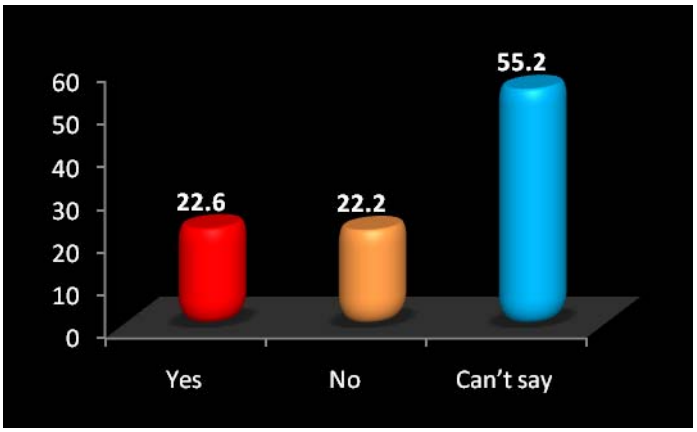
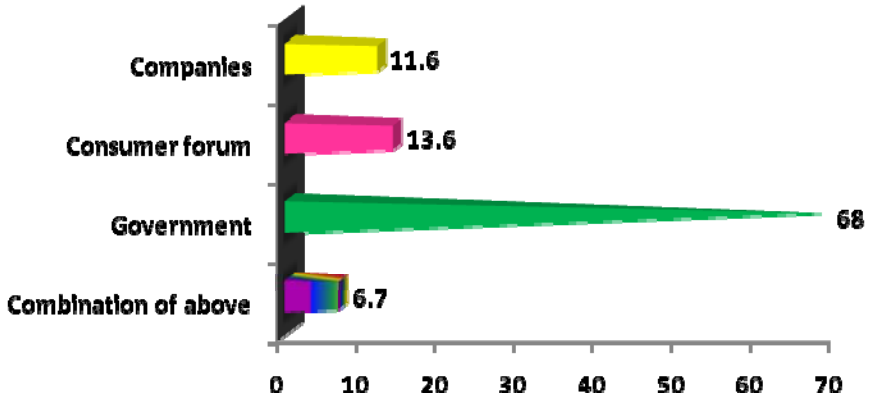


Table No 15 shows that out of 1796 respondents who answered the question the majority wants the government to take responsibility for the labeling of food; their next choice, being consumer forums. About 7 per cent mentioned that a combination of agencies must be involved in labeling.

Table No 15 Who should do the labeling

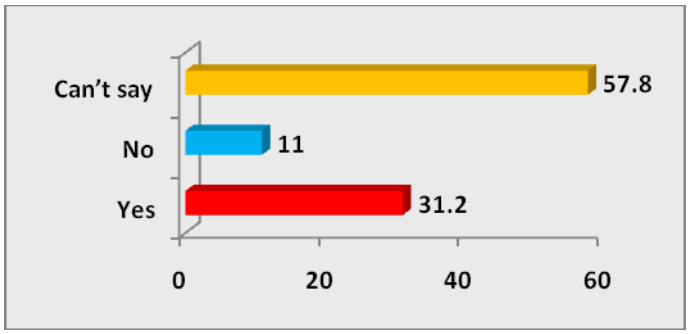
Labeling agency	Freq	%
Government	1222	68.0
Consumer forum	244	13.6
Companies	209	11.6
Combination of above	121	6.7
Total	1796	100.0



The study also attempted to find the perceptions of consumers regarding adequacy of testing GM foods. Thirty one per cent said that GM foods were being tested adequately, 11 per cent said they were not. However, the majority could not say if testing was adequate. (Table No 16)

Table No 16 Do you think GM foods/ crops are being tested adequately

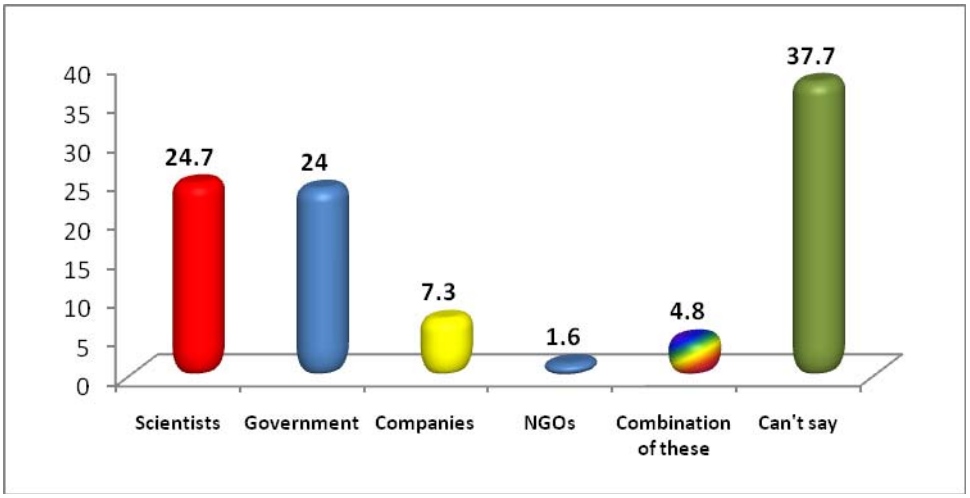
	Freq	%
Yes	796	31.2
No	280	11.0
Can't say	1,474	57.8
Total	2,550	100.0



About half the respondents thought that scientists and government were doing the testing. Some thought that the companies were doing the testing. (Table 17)

Table No 17 Who do you think is doing the testing

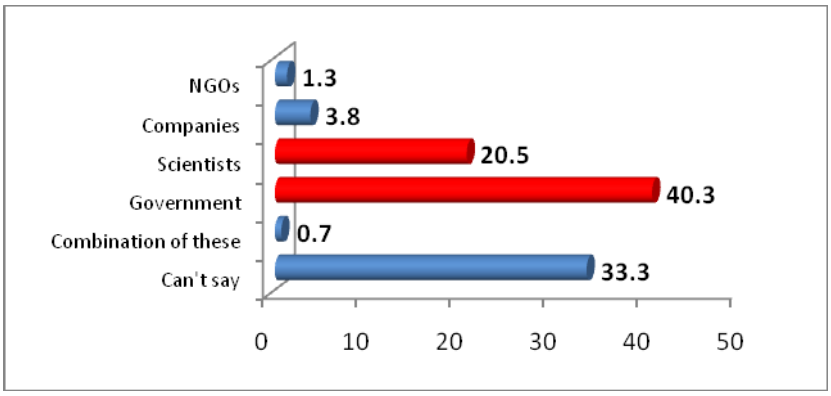
	Freq	%
Government	612	24.0
Scientists	630	24.7
Companies	185	7.3
NGOs	40	1.6
Combination of these	122	4.8
Can't say	961	37.7
Total	2,550	100.0



To the question which agency or organization the respondents would trust to do the testing for safety, we find that 40 per cent mentioned that government is trustworthy followed by scientists. Less than 5 per cent mentioned that companies are trustworthy and only 1.3 per cent mentioned that NGOs may be trusted (Table No. 18)

Table No 18 Whose testing would you trust most?

Agency	Freq	%
Government	1026	40.3
Scientists	523	20.5
Companies	98	3.8
NGOs	33	1.3
Combination of these	19	0.7
Can't say	848	33.3
Total	2547	100.0



Respondents were asked to indicate whether long term monitoring of GM food was required and if so, who should be entrusted with monitoring. The majority (77. 3 %) expressed the view that long term monitoring was required and that the government should do the monitoring along with scientists. Less than 5 % believed that companiers and NGOs should do the monitoring.

Table No 19 Is long term monitoring of GM food needed?

	Freq	%
Yes	1,971	77.3
No	579	22.7
Total	2,550	100.0

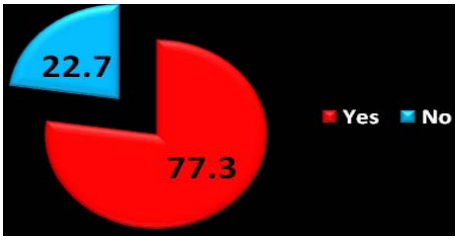
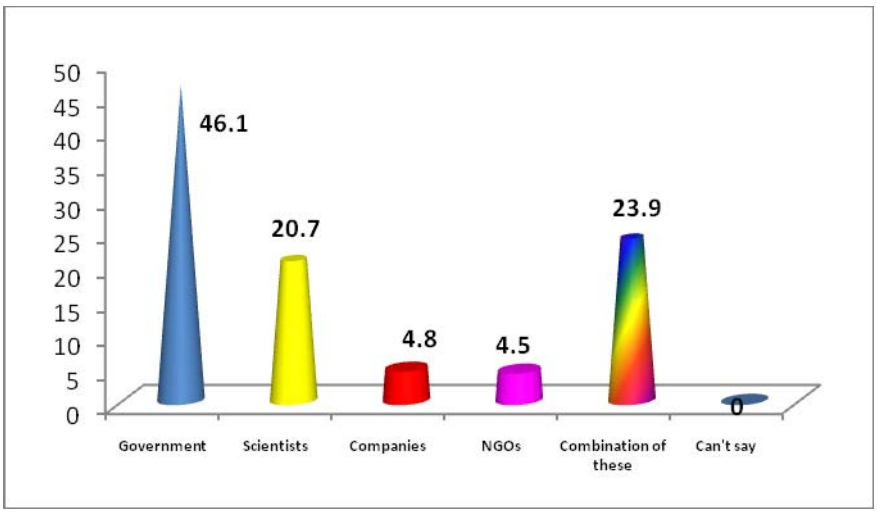


Table No 20 Which agency should monitor GM food?

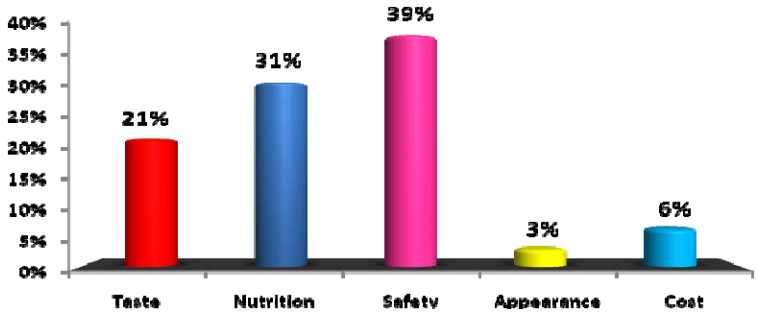
Agency	Freq	%
Government	1004	46.1
Scientists	450	20.7
Companies	104	4.8
NGOs	97	4.5
Combination of these	521	23.9
Can't say	1	0.0
Total	2177	100.0



On questions on what constitute the most important properties of food, safety was rated highest, followed by nutrition and taste.

Table No 21 the most important features of food

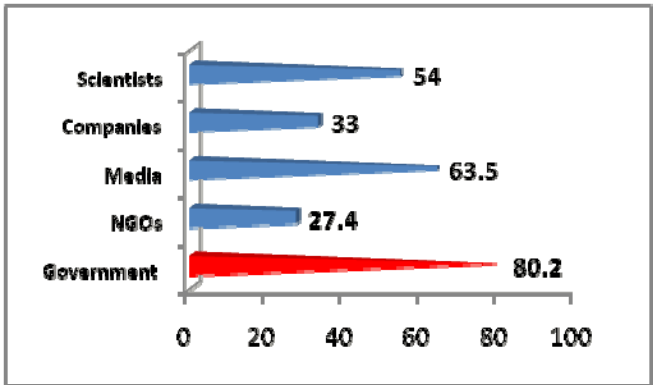
Feature of food	Freq	%
Taste	543	21.3%
Nutrition	786	30.8%
Safety	988	38.7%
Appearance	73	2.9%
Cost	160	6.3%
Total	2,550	100.0



The respondents (80 %) felt that the most reliable information on GM foods was provided by the government, followed by the media, then scientists. Companies were not thought to provide reliable information and the information provided by NGOs was thought to be the least reliable.

Table No 22 Who provides the most reliable information on the GM foods?

Agency	Freq	%
Government	2046	80.2
NGOs	699	27.4
Media	1618	63.5
Companies	841	33
Scientists	1376	54



Qualitative Study
Findings of Focus Group Discussions (FGDs)

FGDs - Farmers

Key Findings

The focus Group Discussions with farmers, showed great similarity across the region and the views. The discussion points were clustered in five thematic areas.

Farmers do not believe that technology always leads to improvement in life. Its impact depends on many factors like the socio-economic status of farmers, the levels of literacy and their exposure to external agencies and information. For instance, literacy will influence the ability to understand complicated instructions given on seed packets or pamphlets that are distributed by seed companies explaining the technology adoption process. This happens in the case of Bt cotton where instructions about the pesticide sprays and management of insect refuges were given to farmers on pamphlets and leaflet. Illiterate farmers will not be able to follow such instructions which affects their ability to understand or adopt the technology.

Big farmers were better positioned to understand and adopt new technology as compared to small farmers. All farmers agreed that food like rice and vegetables do not have the same taste as in the past. They also agreed that this high level of chemicals used in agriculture has spoiled the taste of food.

Nobody in the group had heard of GM seeds. When the discussions progressed and GM foods were explained as those in the development of which parts of animals or insects or plants could be used, farmers responded that if such crops were more nutritious and also cheap, they would consider eating it. This has to

be seen in the context of poverty and deprivation of food. Faced with food shortage, the farmers in this area responded with a partial willingness to consume food that had been “tampered” with, provided it was cheap. The farmers also felt that unless they saw such “altered” foods themselves and heard about their impact on health, they would not be able to say anything definite. Farmers did not have a view on whether cultivation of such food would be harmful or not.

All farmers in this region eat millets every day because it is their traditional food. If they are not able to cultivate it, they would buy it. They felt that millets give strength for manual labour, which they cannot get from rice or wheat. In the hot summers of Andhra Pradesh, farmers value watery gruel of millets which keep them cool during hot summers. Most farmers regretted the fact that millet cultivation is going down and that their children do not value it as much as they do.

Most in the group had heard about high yielding varieties but none had heard about GM seeds and could not give any examples of these. This was the response from farmers from the region where Bt cotton has been cultivated for the last seven years.

Few members of the group said they read the labels on seed packets, they depend largely on the seed dealer and some times other farmers for information. This was the case whether farmers were literate or illiterate. Farmers are not aware that Bt cotton is substantially different to the normal cotton that they have used in cultivation. According to them it is just a new seed.

Asked where Government should focus its attention in agriculture, the farmers said they wanted investment to go to developing high yielding seeds. This is their top priority.

With the growing cost in agricultural inputs without any significant increase in the price of agricultural produce, increasing yield of crops has become the top priority of farmers in all the regions, where the study was conducted. The earlier preference among the farming community for other traits like disease-resistant, drought-salinity tolerance has been relegated to the background.

Farmers were keen to explore new kinds of pesticides but would prefer such pesticides not to kill natural insects which eat pest larvae.
The group said, they tried to avoid food harmful to health but this is not always possible because when food is in short supply, they eat the food they get even it has partly spoiled and they know that it could be harmful to health.

Responses from all farmers showed the strong cultural context of food. Crops and foods developed by using animal parts may be considered nutritious but they are considered impure. Farmers uniformly responded that they could not consider offering such food to God or use it in festivals and marriage ceremonies.

Agricultural Inputs:

Regarding the problems faced with existing agricultural technologies, farmers said by and large that seeds are not available on time, the quality is poor and the cost is high. Fertilizers from Government outlets are almost never available on time and farmers have to run around four to five days to get fertilizers, which was almost never available in adequate quantity. However, they said the quality in government outlets was satisfactory and the price was not high, but since they have to run around to access the fertilizers and waste money, ultimately the fertilizers from Government shops turned out to be more expensive than what is available in the private shops. They said pesticides are available easily but the quality is very uneven. Some companies produced sub-standard and spurious pesticides. They said credit from public institutions like banks is difficult to access, the process is complicated and they have to pay commissions to get a

loan. For these reasons, they are forced to go to private money-lenders but more often to the seed dealers and get credit on high rates of interest, but they get it on time and for all requirements.

Majority of the farmers grow cotton under rain-fed conditions. Although electricity is provided free to pump water from bore-wells, the supply of electricity is erratic and irrigation can not be done easily. The farmers said that Government procurement of cotton was problematic. They have to go to designated areas, wait for four to five days to deliver the cotton and they would get the payment only after forty days. As compared to this the traders procure the farmers' cotton at their doorstep and farmers prefer this even though they get a lower price. The farmers say they feel free to choose the seed they want. They also say at the same time that they follow the advice of the seed dealers about the seed they want. The dependence of the farmers on the seed dealer is very high since he is the source of credit and agriculture credit and inputs; he is also the only source of information and advice to solve problems. After the break-down of the Government's agricultural extension service, the influence of the seed dealer has become substantial and farmers follow his recommendation in all matters related to agriculture. This gives private seed companies direct access through the seed dealer to influence the choices that farmers make. Companies can influence through commissions or profit margins that they offer, which seed the seed dealer will stock. In this way, they are able to get a large market share. The farmer, on the other hand is in a relationship of dependence with the seed dealer, follows his advice and still feels that he is free to choose his seed.

Awareness of Bt Cotton:

Farmers had no idea about genetic modification but they do say that Bt means cotton which gives high yield but without high expense on pesticides. Farmers said Bt cotton means putting poison in the cotton seeds so that the cotton will not be affected by the pests. They did not know how Bt cotton is produced.

They said that Bt cotton has bigger pods, which are not affected by the pests and the seeds are different from conventional hybrid seeds which require a lot of pesticides. With conventional seed, even with heavy use of pesticides, control of pests is not guaranteed whereas in Bt cotton the pests can be controlled with 3 to 4 sprays of pesticides. None of the farmers knew whether Bt cotton was tested by anybody before it was released. The farmers did not think that new kinds of seeds could solve the problem of hunger. They spoke about hunger being a complex problem resulting from many causes, caste and land was cited as determinants of poverty and hunger.

The farmers felt that if they got agricultural inputs in time and a good price for their agricultural produce, they will be able to feed their families. Today, the biggest problem is that they cannot make a profit from agriculture because the cost of producing a crop is very high and the Government has placed restrictions on the price at which their produce can be sold. The farmers felt that given the right conditions(good seed, enough water, timely and good quality inputs) they could banish hunger from their villages. Farmers responded that if anyone could save new seeds from fertilizers or pesticides this should be the Government.

Farmers do not believe Bt cotton was tested properly. Farmers do not think that they are any mechanism in place to monitor the safety or the quality of seeds. They do not think anyone is doing any studies to see the impact of Bt cotton on soil health or friendly insects. The group did not know if anybody was consulted before Bt cotton was introduced. They did not think farmers was asked for their experience of cultivating Bt cotton. They said that the seed of Bt cotton is produced by the seed industry. They said that the role of Government departments and agricultural universities was less and less visible now. Farmers felt that even if Government set up strong safety testing ways for seeds and agro-chemicals, this would not be implemented rigorously because of corruption in the system.

It was mentioned that both goat and sheep are dying after eating tender leaves of Bt cotton. Farmers said Bt cotton contains poison to kill the pests and this poison is spread throughout the flower and leaves. Hence leaves are poisonous and harmful to animals. They also affect soil fertility when leaves and flowers fall into the fields. They said that people ate the meat of goats and sheep that became sick after eating Bt cotton leaves, so Bt cotton poison has also entered their bodies.

The group tell that Bt cotton will not solve their problems and that Bt cotton is not essential to improve productivity of cotton or food crops because hybrids are doing the job quite well.

Compared to non-Bt cotton, Bt cotton seeds are more expensive and they require more water. The productivity of Bt cotton is going down year after year due to loss of soil fertility because of the poison coming into the soil from the Bt cotton plant. Bt cotton is more prone to other pests than non Bt cotton and the crop yield goes down very much where rainfall is not adequate.

FGD - Seed Dealers

The group of seed dealers felt that technology does not always improve life. They agreed that food like wheat, rice, vegetable etc. does not taste the same like in the past due to high use of chemicals, like fertilizers and pesticides. Some people in the group had heard of Bt cotton and Bt vegetables.

They were not very clear about how Bt cotton is made but they all said that Bt cotton had poison. On being asked, whether they would be willing to eat food which was produced from seed containing parts of animals or insects, the group uniformly said “No”. This largely vegetarian group said that the thought of eating food with animal or insect ingredients was nauseating and it would be against their religion.

The group knew about high yielding hybrid seeds and genetically modified seeds. They said that apart from Bt cotton, GM foods were also being developed. Their source of information was Television and newspapers. The group felt that GM food could be harmful to health and to the environment because such foods are not natural. The seed dealers felt that investments in public and private sector should focus on high yielding crops.

On the subject of safe/unsafe food, the group felt that any manipulation of food is risky. Addition of chemical ingredients like coloring and preservatives makes food unsafe. Genetically manipulating crops produces unsafe food.

Seed dealers generally had higher levels of education than the majority of farmers and have access to sources of information like books, magazines, Television. Like farmers, they are also is conservative about the cultural context of food. This group also said they would not make offerings of GM food to God nor would they serve such food during religious festivals or marriages.

Seed dealers said that both the public and private sectors must ensure that the seed they develop is beneficial to farmers. Seed should primarily be high yielding and reduce the requirements of inputs like fertilizers and pesticides. All GM seeds must be tested carefully since they contain poison. Carelessness in this regard will be harmful to farmers and consumers. They felt the company producing the GM seed should do all safety testing under Government supervision. Instead of printing illegible information in small print, in many languages, on the label, information about seed should be printed clearly in the main language used in the state. If manufacturers can print their brand name in the local language, there is no reason they cannot do the same thing with the information on the label.

FGD- Urban Consumers and Homemakers

In Ludhiana, a focus group discussion was held with ten women discussants (including the translator). The discussants were all homemakers. Most of them are well- educated and two of them are working as lecturers in local colleges. It is expected that their attitudes and perceptions towards GMOs would be reflective of the views of the urban, middle-class home maker.

A similar exercise was also conducted in Nagpur city of Maharashtra, among residents of an upper middle class residential complex. The only difference is that while the group in Ludhiana was comprised only of women, in Nagpur, the women had brought along their spouses to the discussion. The group in Nagpur was a little varied in the sense that it also included, apart from the women and their spouses, three female students residing in the colony as well as a woman who works as a cook in the households of the complex. They were included in the discussion owing to their eagerness to participate in the discussion and also because it was expected that their inputs would add variety to the discussion.

The urban homemaker in both Ludhiana and Nagpur, were in agreement that food, including grains and vegetables, no longer taste the same as they used to a few years back. More than the young homemakers, it is the older generation of women who have strong opinions about this. According to a grandmother in Ludhiana, Basmati rice has improved in terms of looks; longer- grained and good to look at but that 'heavenly' smell is no more. In her words, "Earlier, if one family cooks basmati, the smell would waft to the whole neighbourhood, but no longer". A 65 year old woman from Ludhiana also claims that same is the case of wheat. According to her, "the wheat we used to get earlier; the taste of those *rotis* (Indian bread made of wheat)… so divine. And so soft too! Now, no matter how well you knead the dough, *rotis* do not turn out so soft". Similar opinions have been voiced in Nagpur too; according to one homemaker," earlier one could get

that smell in the uncooked rice itself… Now, no longer!" The women in Nagpur also complain about the loss of taste in some traditional varieties of rice. According to Nalanda, a woman from a rural background who cooks for the families of the complex, "the *chinoor* rice, a local variety grown in Maharashtra, is very tasty. Even that does not taste the same now! It is quite expensive compared to other rice available in the market. But despite the high price, it is not as good! It is not the real *chinnor*." A 45 year old Lecturer and mother of two, recounts that when she was a child, her father used to cultivate a local variety of rice called *karikammod,* (in Bhandara district) which was very tasty and nutritious. According to her, its seeds are no longer available and that variety is lost forever.

All the discussants, both in Ludhiana and Maharashtra are in agreement that vegetables and fruits no longer taste the same and they give different reasons for it. According to all the discussants in Ludhiana, this is due in large part to the overdose of pesticides. Ms.M.S. says that if vegetables are organically grown, they will be tastier. But she complains, "Where do you get organic produce in Ludhiana?" A young home-maker Mrs.H.S. said that if organic vegetables are available, she will definitely buy them and will not mind paying extra for them. According to P.B., "In Punjab, especially in Ludhiana, we have no dearth of money. We are willing to pay extra, but where are the natural/organic foods?

In Maharashtra too, people feel that the loss in the taste of the vegetables is due to the application of chemical fertilizers and pesticides. According to Ms.N, "in the villages, farmers apply little chemical fertilizers, more natural fertilizers like cow-dung. In Nagpur city and its outskirts, lots of chemicals etc. are applied to make the vegetables grow faster." She further says that the vegetables produced organically are smaller in size but good in quality. In her words, "you get small tomatoes in the villages but they are tastier. One is enough to make gravy. In our village, cauliflower is so good in taste, the ones available in Nagpur have absolutely no taste"

Respondents also feel that the loss of taste in fruits may be due to the process of artificial ripening practiced today. A discussant from Ludhiana, Ms.R.M. said that “fruits need to ripen slowly. Then only they get the taste. Nowadays, fruits are artificially ripened and taste and nutrition are compromised.” Mr.B.N of Nagpur says that the papaya nowadays is artificially ripened making it tasteless. Ms.M.K.A. in Ludhiana too complained about the loss of taste in the papaya.

Very interesting observations were recorded in response to the question as to what is genetic engineering and what the respondents know about it. In Ludhiana, four respondents said that they have heard about it. Ms.S.P.K., a young lecturer and Dr. D. who also teaches at a local college says that it is “related to” Biotechnology and they gave the example of Bt cotton. Ms.P.B. said that she has heard about it but does not have any idea what it is. She asked the moderator to enlighten her about the technology. On the other hand, Ms.M.K. is of the opinion that it has something to do with “puting something artificial in vegetables like the pumpkin to make them grow big. They do the same with melons”. Mrs.M.S. also says that she has heard that melons are injected through GM technology to give them their colour and sweetness. Her reaction to such fruits is that they are “unnatural” and she expresses the concern “I feel so sad that my grandchildren have to eat such food, where will they get their strength from?”

In Nagpur, most of the respondents said that they were aware about this technology and some of them said (falsely) that the tomatoes available in Nagpur city are genetically modified. According to Mr.B.N, “earlier, we used to get small tomatoes, but now we get GM tomatoes, which are much bigger in size and look good, but do not taste as good.” M.R. also says that “the local variety of tomatoes called ‘gaurani’ tomatoes is very good! The GM tomatoes are very nice looking, but no taste at all”.

Confusion about GMOs in the market GM tomatoes are not sold/ available in India.

In both Ludhiana and Nagpur, the moderator explained to the discussants the basic principles of GM technology, with examples and then sought their views on this kind of technology. In response to the question whether they will consume GM food if they have a gene from another organism, respondents gave different answers. In Ludhiana, some respondents said that natural food is the best and they were worried that such GM foods would have negative side- effects. However, two respondents said that they would be willing to consume such foods, provided all tests for safety have been conducted. In the opinion of Dr. D. " in the region of Bhatinda (in Punjab) , due to overuse of pesticides, there are lots of cases of blood cancer. If GM could give me freedom from pesticides, I will eat it". In Nagpur, Mr.B.N. expresses worry about the toxicity on human beings. According to R. "we wear cotton (referring to Bt cotton) , but what about fruits, vegetables and rice etc. That we eat! Would such products be safe for us?" However, despite this concern, Mrs.R says that she will consume GM food if it is cheap. In her words, "the urban middle class, people like us, who work so hard to make ends meet, look only at the cost. Nobody bothers about any long-term effects. If GM vegetables are produced in large numbers, cost will come down. Prices of vegetables are going sky-high. *Gaurani* tomato is so costly! Who can afford it?"

Respondents who are vegetarians are opposed to eating GM foods that have a gene from organisms like insects and animals. According to Ms.K. from Nagpur who is studying to be a doctor, "I will absolutely not take any GM food which has non- veg genes in it (from insects and animals). My mother is very strict about it; she will not allow such food into our kitchen, as it will make our kitchen impure." Ms. R. also says that "I will cook such food for my husband who is fond of non-vegetarian food, but will not eat it myself if I know it has non- veg genes in it". In Ludhiana, Ms.M. K. says that "If I eat such a food, maybe I will get nightmares

imagining insects running inside my stomach". Most of the respondents are not that averse to GM food with genes from other plants.

Non-vegetarians are also opposed to consuming GM food which might have a gene drawn from animals like cows and pigs. They feel that their religion will not permit them to do so. But Dr. D. apprehends that more than religion, politics will not allow such foods to come into the market, with political leaders using the opportunity to create communal tension. Ms.S.P., however, feels that for the poor, it is not religion but his hunger which will play the most important role. If such foods are sold cheap, she feels that the poor in India will not have any hesitation to consume it.

Regarding the risks of GM foods to human health, environment etc., most of the discussants feel that there might be risks in the long-term. One lady in Ludhiana expressed the fear that genetic engineering could lead to genetic disorders. Ms.M.K points out that "When the Green Revolution began, did we think that it would come at such a heavy price? Same can happen with this technology. You will come to know only after the effects are visible. No use saying sorry then" . Mrs.M.S. says that she and her family will not each such food. But she is worried about the illiterate farmer and consumer, whose family might consume it. In her words, "If his children have side- effects from eating it, who would bear the medical expenses?" Ms.R.M also says "As regards long term effects, who knows? Life is very insecure these days. Such rise in cases of cancer! Who knows what unknown evils this new technology will bring?"

In Nagpur, Mr.B.N. says that any technology for India must have minimal risk but should be affordable as well. He also feels that specialized knowledge is required and tests need to be conducted to rule out risks from GM foods. Still, he expresses the concern that there might be long-term effects, but that it does not deter one from using any technology, giving the example of mobile phones, which has health hazards, but people use them still.

Almost all respondents feel that any new technology comes with its own hazards and hence, caution should be the main watch word in adopting any technology. Ms.H.S. in Ludhiana feels that technology has both positive and negative effects. In her words, “ Bottom-line is we should not tamper too much with nature.” Ms.M. K. is of the opinion that “ technology cannot envisage problems ahead. You keep on hearing one disaster and then another due to failure of technology. Technology is a man-made thing; how can it be ever superior to the processes of nature, which are slow but sure”. In Nagpur too, the group feels that every technology has good and bad effects and that it should be carefully used. They feel that the same should apply in case of GM technology.

FGD – Students

A focus group discussion with 18 post- graduate students of the Punjab Agricultural University reveals a variety of attitudes and perceptions towards GMOs. All the students respond in the affirmative that they know what GM technology is. But surprisingly, on being questioned about its basic principles, quite a few could not describe any details or how genetic engineering is done . One female student said that “it has something to do with using bacteria and viruses as vectors”. Another student says that “Actually, we studied it as part of our graduate course. I don’t remember much of it now!” A few other students also voice a similar opinion. One student replied that “it involves taking gene from a resistant species and incorporating into the desired variety.” Mr.A. said that “When I hear about GM, the first thing it brings to my mind is disease resistance. We also get more production. Regarding taste, I am not so sure”.

Ms.S, Ms.D & Ms.K say that they have heard about genetic engineering but are not forthcoming about what they think it to be. Ms. K, studying to be a doctor gives the reply “I am not very sure, as I am only studying and have not gone in-depth into the issue.”

Students from PAU have strong opinions about hybrid seeds, This is expected considering that they all studied agricultural sciences. According to Mr..R., studying in PAU, the main difference between local varieties of seeds and hybrids is that in case of hybrids, farmers cannot save the seed for the next season. His classmate Ms. K. points out that productivity is more in hybrids, but it comes with the constraint that the farmer cannot save the seeds. This is the reason why companies are coming out with more and more varieties of hybrids; they earn huge profits from them. Mr.A. defends hybrids as being “the need of the hour! We need more food to feed more people, while land is finite. The only way we can do so is by increasing productivity through hybrids”. M.G. says “I

don’t think that hybrid tastes good; it only increases the yield. Local varieties definitely taste better”.

Youth also feel that food, including grains and vegetables, do not taste the same as earlier. Many feel that food in the villages is better in quality than that available in the cities. Ms.D. says that “the coriander leaves one gets in the villages smell so good. That is missing in what we buy here Her sister Ms.K. also says that “the food one used to get in the villages, was much better in taste and flavour than what we get in the urban areas”. Ms. H. says that “food in the villages is definitely fresher; it is freshly plucked and eaten. Whereas, we residing in the city, do not get to eat such fresh food.” Ms.A. observes that “the food I eat at my grandmother’s home in the village is tastier than what we get to eat in the hostel”.

With respect to GM technology, students at PAU express a variety of opinions. According to Ms.K., “If we think in terms of Bt cotton, it is a good technology in that it has reduced the farmers’ expenditure on insecticides.” Ms.A. cautions that at the same time, the technology will have to be very fast to cope with new problems which might come up. Science has to anticipate future problems and develop accordingly. In her view, when one pest is suppressed, other pests are going to come. Technology has to be ready for it. She gives the example of cotton, “where we have Bt cotton to deal with bollworm but now, mealy bug has become an even worse problem.” She poses the question “Does GM technology have the solution for that?” Mr.D. believes that “When we introduce a new technology in India, we have to look into India’s environmental and other conditions. Is the new technology suited to it? We have different agronomic conditions in India; technology has to be developed accordingly. We have different climate, different economic condition, and different culture. The technology must be able to deal with all this”.

For the youth in PAU, the curriculum is their main source of information about GM technology. But quite a few of the youths say that newspapers constitute an important source of information as well. Mr.S. says that he has recently come across a news item in the *Hindu*, which reported cattle deaths in Andhra Pradesh due to eating Bt cotton plants. Ms.S. says that the media carries two kinds of articles: pro and anti GM technology.

When asked whether they would consume GM food with genes from other plants, animals, insects etc., varied responses were obtained. Ms.K. emphatically said that she will not consume such food containing genes from insects and animals as she is a strict- vegetarian but she does not have objections to GM food with "vegetarian genes". Ms.K. says that she has no objections if "it will be a better crop. I have no taboos. Educated people do not have taboos like this". Her classmate Mr.S. points out that Ms.K. is speaking only for herself and educated people like her. In his opinion, "If GM food has genes from a cow or pig for instance, definitely people in India will not eat it. The cow is sacred and eating it would be outside the acceptable behaviour of the society". Ms.S. also apprehends that the larger population might have a problem; and that it could infact lead to riots and communal tension. M.R. also cautions that "all consumers have to be thought about: not just youths like us, who have graduate and post-graduate degrees". Mr.D. however, feels that in India, till now, few are concerned about quality of food as in the West. "Common man is still occupied with meeting his basic needs- food, clothing and shelter. If GM food is cheap, he will eat it".

A question was asked about the risks which GM food/ crops could pose to human health, health of animals, environment etc. Most of the discussants feel that any new technology comes with its share of problems. There could be risks which scientists might discover later. Ms.S. drew attention to the newspaper reports about cattle deaths, while Ms.K. said that from her medical studies, she feels that it could cause allergies. Mr.S. says that "there are many contradictory studies. We do not know whom to believe or not to believe". All are of the opinion

that before launching such products, there should be proper tests. Ms. S. , however, says that “ We are eating food with high pesticide residue. If we can live eating such kind of food, then we can survive GM too with all its harmful effects. We live in Punjab; we consume pesticides everyday; we can consume GM too”.

Interviews - Scientists

Key Findings

In **Punjab**, three in depth interviews were conducted with senior scientists:
(i) Dr. S.S.G, Head of the School of Agricultural Biotechnology, Punjab Agricultural University (PAU)
(ii) Dr. J.S.S., Assistant Biotechnologist in the School of Agricultural Biotechnology, Punjab Agricultural University (PAU)
(iii) Dr. K. S., Retired Scientist of PAU and Member of the Punjab Farmers' Commission.

In **Maharashtra,** in depth interviews were conducted with the following four scientists:
(i) Dr. M.S. K., Former Director, Central Institute for Cotton Research, Nagpur
(ii) Dr. R.T. G., Chairman, Arag Biotech Pvt. Ltd., Ex. Tech. Advisor, FAO
(iii) Dr. R.B. T., Chairman and M.D., Agro-Ind and Eng. Sev. (Pvt.) Ltd., Technical Advisor to World Bank, USAID, IARI (India) etc.
(iv) Dr. R.D. G., Agro-Ind and Eng. Sev. (Pvt.) Ltd.

The scientists interviewed expressed varied opinions, attitudes and perceptions about GMOs. A standard set of questions were asked; with different responses from each.

Punjab

The scientists were asked about their individual responses to the question whether Bt cotton was properly tested for safety before being released in India, with varying results. Dr. S.S.G., PAU said that there was no need for this in India. In his view, "the Americans have been using Bt technology for the last ten years and they must have done so only after thorough evaluation. So I don't think our

scientists needed to perform additional tests". Dr. J.S.S. was emphatic that he had knowledge that Bt cotton was tested for safety before release. According to him, "the general principles for testing were developed when Bt maize was tested in the U.S. A similar process has been followed for Bt cotton in India; where it has been tested for safety for human beings, livestock etc".

Maharashtra

Dr. M.S.K., former Director of the Central Institute of Cotton Research said that all experiments as well as regulatory requirements were fulfilled and the MNCs were asked to complete all requirements-tests for human safety, animal health, residue effect, effects on other species through cross- pollination etc. The Department of Biotechnology (DBT) ensured that all these requirements were fulfilled and presented this in a meeting, after which approval was given.

Dr. R.B.T., disagreed with Dr. M.S.K. saying that the of seed required for testing, both for effect on milk, soil etc., were not made available. According to him, the government department gave the approval, despite the fact that the required samples were not available for testing.

Dr. M.S.K. then changed his view and agreed with Dr. RBT and admitted that only the formal requirements on paper were complied with. In his words, "'Formalities' were completed, but whether the formalities were performed in the manner they should have been done, is a matter of question. Procedure has been followed, but not the spirit of it." Dr. R.B.T. was of the view that in all probability, there was pressure from the companies, to expedite the process. He said that there have been instances in other countries where MNCs bribe the government to approve their products. The scientists hinted that such a thing could also have happened in India.

Though most of the scientists believe that the government has set up a standard system to ensure post- release monitoring and surveillance *(this actually does*

not exist), almost all of them are in agreement that in India, this is very difficult to achieve.

The scientists expressed concern that there are chances that in India , the Bt gene might have entered the human food chain. According to Dr. M.S.K., it has started entering the food chain through cotton oil and seed cake. The oil is consumed by human beings and the cake used as animal fodder. In his view, there is strong likelihood that it is entering the human food chain through milk, meat etc.

Punjab

Dr. S.S.G. said that Bt cotton must have entered the human food chain, but he does not see any harm in it. According to him, "the Bt gene is not toxic to human beings and the acidic PH in our bodies will stop the toxin from working" *(there is no proof of anything like this)*. His colleague Dr. J S.S. also expressed a similar view that Bt cotton would express toxicity only in alkaline guts, while the human gut is acidic. He, however, admitted that it could cause allergic reactions.

Dr. J.S.S., a molecular biologist working on GM crops, pointed out that the claim that GM crops can increase food productivity and be a solution to the world's hunger is a tall claim. According to him, GM technology helps improve the quality but does not increase yield. He strongly feels that hunger is more the result of inequities in society and not availability of food. Dr. K. S. feels GM crops target only a specific issue; for example, pest resistance. Beyond that, they might also have a detrimental effect.

Maharashtra

The scientists from Maharshtra feel that Bt cotton or any other GM crop will be beneficial to only the big farmers, particularly in Maharashtra, who can afford all the inputs. Dr. M.S.K. points out that 90% of farmers in Maharashtra grow cotton on rain- fed land; they will not be benefited by this technology. The scientists

from Punjab, however, have a different take on the issue. According to Dr. K.S, “in a state like Punjab, it is possible even for a small farmer to reap the benefits of new technology. Agriculture in Punjab is totally mechanized, despite the fact that not all farmers own tractors. In Punjab, there is one tractor for two and a half farmers; those who do not own one, hire one”. Dr. J.S.S., however, pointed out that for marginal farmers to be benefited there must be some mechanism to ensure control over the pricing mechanism.

All scientists are in agreement that GM seeds are very expensive, which they believe to be the result of private monopoly. Dr. S.S.G., of the School of Agricultural Biotechnology/PAU feels that the day this technology is owned by universities, it will be affordable to all. Also, companies are using the Bt gene only on hybrids, to ensure that the farmers have to buy seed every year. In his words, “If this gene comes to the University, we will try to put it into varieties and not hybrids, thus saving the farmer the expense of buying seed every year”.

Maharashtra

However, according to Dr. R.B.T., and Dr. M.S.K., GM technology would always remain an expensive technology as along with the high cost of seeds (hybrids made by companies), it also requires much more inputs than normal seeds.

Dr. S.S.G. maintains that there is no difference in water consumption in case of GM crops, but Dr. J.S.S., from the same department feels that the Bt cotton plant is more bushy and takes more nutrients from the soil and also requires more water.

Maharashtra

Dr. M.S.K., is also of the opinion that Bt cotton requires more water; since Bt cotton plants have a very shallow root system. According to him, it is very sensitive to water stress (drought). High dosage of fertilizers, and assured irrigation are required to get the full benefit of Bt cotton.

Most of the scientists do not have a clear idea about India's policy on agricultural biotechnology. According to Dr. M.S.K. "so far as our information goes, the government policy has not been spelled out in clear terms." Most of them also feel that no stakeholders have been consulted in the process. Dr. M.S.K. also narrated his own experiences as Director of CICR when BT cotton was being approved. According to him, at that time, stakeholders were not consulted, particularly farmers as the government was in a hurry to push the technology.

Punjab

Dr. S.S.G, was the only one who thought that stakeholders were consulted in the process, however, expressed a note of pessimism when he said that "in India, we have good laws and policies for everything, but implementation and enforcement is very poor".

All scientists are in agreement that GM technology all over the world is promoted by the industry as it is a proprietary technology with patents over it. Many feel that the public sector in India, especially the Indian Council of Agricultural Research has lagged behind in this technology by many, many years, helping Monsanto- Mahyco gain in the process. According to Dr. R.B.T., the MNCS are about 25 years ahead of ICAR in terms of technology due to their vast capital resources. In his view, Indian scientists who were involved in the process of Bt Cotton adoption have not gone to the farmers' fields to see for themselves Bt's performance in the field, as there were no government funds for travel & monitoring.

Maharashtra

The scientists felt that there might be risks associated with GM crops and hence, effect on the plant itself, soil health, water, residue effect, impact on animal health, impact on other species, food chain, environment as well as impact on secondary pests- all these parameters must be taken into account before

approving GM crops. Dr. M.S.K. claimed that the incidence of other pests and diseases have increased after Bt Cotton has been introduced. He predicts, “You will see the real effect of Bt in the days to come. There will be more pests and diseases in times to come!”

Punjab

Dr. J.S.S. and Dr. S.S.G., believe that GM food/ crops carry no immediate risks. However, Dr. S.S.G. did not give a direct reply to the question about long-term effects. He chose to respond that “As far as long-term effects are concerned, who knows? I think X-Rays carry more risk than GM technology, but aren’t we using it?”

All scientists are of the opinion that if stringent measures are put in place to assess risk and safety before permitting release of GM crops, the introduction of GM crops will not be possible! According to Dr. S.S.G., India is good at making laws, with a miserable track record of implementing them. Dr. R.T.G. and Dr. R.D.G. feel that the government does not have the infrastructure for such monitoring. Dr. M.S.K. responded with an example. According to him, as a cotton scientist, he knows that except for a few companies, the Bt seeds of most companies is sub standard, and gene expression is not complete or stable. Despite this, the seed of these companies is being sold in the market. Along with this a large amount of spurious and fake seed is being sold to farmers. This is a reflection of the government’s monitoring and surveillance capacity.

On being asked whether they would consume GM foods themselves, Dr. S.S.G. and Dr. J.S.S. gave an emphatic yes; Dr. S.S.G., saying that it would be a better option than consuming vegetables with lots of pesticide residue, as is the case in Punjab. Dr. K.S. was hesitant saying he did not wish to be a guinea pig for strange foods. Dr.M.S.K. and Dr. R.T.G. said that they would have to be convinced with scientific data that the GM food is absolutely safe. Dr. R.B.T. said that he would not eat such food.

Interview – Government Officials (Agriculture)

Key Findings

AKG is the Assistant Director of Agriculture. He has an M.Sc. in Agronomy and has 17 years of professional experience. His primary professional responsibilities are supervising about 100 villages and monitoring the implementation of the Government's agricultural schemes, monitoring the quality of seeds and pesticides through inspection of seed storages and providing advisory services to farmers in his area.

AKG feels Bt cotton was not tested properly before release because it was introduced by private companies. They took short-cuts to make more profits in a short period. The government machinery was not involved in any way in the release of Bt cotton to farmers. The companies did not provide any demonstrations of Bt cotton to the farmers before releasing the seed into the market. AKG does not think that mechanisms have been put in place to monitor the impact of this seed on the health of humans and animals or on the soil or environment or friendly insects. He has not heard any such monitoring mechanism in his area. AKG said that the Bt poison had already entered in the human beings through the meat of goat and sheep which became sick after eating Bt cotton leaves. Sick animals were slaughtered and the meat sold at cheap rates. This meat (meat is usually very expensive) was eaten by a number of local people and AKG feels that the Bt poison had entered the food system in this way.

He does not think that GM crops could solve the problem of hunger and he does not believe that genetic engineering is handed to improve the productivity of food crops. According to him, the risks posed by GM food are high and there are no mechanism to evaluate this risk or to monitor them after GM food crops have been released in to the market. According to AKG GM crops could only benefit big land-lords who can invest in irrigation with adequate chemical inputs. Bt

cotton needs more water than non-Bt cotton which is a critical water resource to get good yield. He pointed out that the productivity of Bt cotton is going down every year in the rain-fed areas of his district.

AKG regretted that India does not have a policy on agriculture or on agbio-technology. He stated that there is no policy, so there is no question of assessing the need of Indian agriculture or farmers. He thinks that no stake-holders were consulted on the issue of Bt cotton, he is not aware of any consultation with the farmers in Andhra Pradesh or anywhere-else. According to him, GM technology is promoted by the industry in India and in the world. Public institutions like the Indian Council for Agricultural Research (ICAR) and agricultural universities have no role in the development of GM crops in India. According to the Agricultural Director, the risks associated with GM foods are primarily related to the health of human beings and animals. The impact of Bt cotton leaves on big animals like cows and buffaloes is slow, but small animals like goat and sheep get sick within days of eating Bt cotton leaves. They then slow down and die quickly.

If there were to be negative impacts from the cultivation or consumption of GM crops, there is no agency where one could register a complaint and none of the personnel in the existing Government structure are either educated about what to do in such circumstances nor are they empowered to take any action. Nobody knows where a complaint of this type should be registered.

The Agricultural Director felt that Indian mutton exports could be seriously impacted if goat and sheep die from eating Bt cotton leaves and valuable foreign exchange would be lost.

According to AKG, certain factors must be taken into account before approving GM crops.

- The special property of the crop variety and its impact on the environment must be researched more systematically before releasing the seed into the market.
- The safety of the crop for human and animal health must be ensured before marketing.
- Training programme should be conducted for farmers and companies must pay for this training. Demonstrations which should be conducted by unbiased, autonomous agencies like universities and some good NGOs.
- An autonomous cell should be established with arbitration powers to monitor the impact of GM crops to animal and human health. The cell should be free from political interference and the members of the cell must be people with the highest integrity and commitment to the public.

AKG said that stringent measures most be put in place for evaluating GM crops though they will not be implemented rigorously through the existing mechanisms because the multinational companies are determined to promote their seeds at any cost; they can buy anyone in the system. An autonomous cell/structure like the Election Commission is the only way to implement measures stringently.

AKG would not eat GM food because of the risks involved and he would never advise his family to eat such food.

Note: AKG is a Member of the shepherd community, which keeps goats and sheep Therefore, he is specially sensitive to issues concerning goats and sheep. He said that he has not paid much attention to the reports of cattle dying due to eating Bt cotton leaves.

Interviews - Senior Media Persons

Key Findings

An analysis of the views expressed by journalists and media persons in Maharashtra and Punjab reveal that GM technology is an issue fiercely debated and covered in the Maharashtra media. On the other hand, Mr.S.S.B., Chief Reporter of the Ludhiana edition of *the Tribune* admits that the issue does not get much editorial space as the debate on GM technology has not caught up in Punjab.

Mr. J.H., a Nagpur-based journalist who has reported extensively on the agrarian crisis in Vidarbha, expresses the following view on the adoption of GM technology in India; “In the government promoting GM technology, I see murder of all democratic values as GM is being pushed by eliminating all other choices by taking off from the markets hybrids, local varieties etc. which are affordable. As a journalist trying to chronicle this whole process, I find this absurd and suspicious. I suspect this is because; there is a huge margin in case of Bt seeds.” In his view, “our country is passing through a multi-faceted and very complex agricultural crisis- the crisis of the entire rural economy. The promotion of GM technology by these companies actually coincides with this crisis. This crisis is being used as a ground to promote GM, a ‘magic wand’ which can solve the problems overnight”.

Mr.J.H. says that he does not know whether GM is a good or bad technology, but he is worried by the fact that “GM seeds guzzle water; it is not a sustainable practice. It makes farmers more dependant than ever before”. According to him, the adoption and promotion of GM technology in India is part of a system which seeks to make our country dependant on foreign imports and reflects the myopic vision of our planners.

Mr.C. W. the former editor of the Marathi daily *Sakaal*, also says that he doesn’t know about the merits and demerits of GM technology *per se*. But he has, in his

writings, opposed the manner in which it came to India, the way in which it was promoted by our political leaders, the way the entire state and machinery helped in this promotion, which he finds very suspicious.

In Punjab, particularly in Ludhiana, Ms.S.B. of the *Tribune* says that there have been seminars and news conferences from time to time on GM technology and Bt cotton. She feels that it is a very controversial technology. However, apart from these isolated meeting and seminars, there is hardly any awareness on this issue in Ludhiana, atleast among the general public. Mr.S.S.B. also voices the same opinion, further adding that though farmers in Punjab cultivate Bt cotton, they do not have much awareness about it. However, farmers have great faith in the Punjab Agricultural University (PAU) and whatever advice it gives. If PAU asks farmers to cultivate Bt, he feels that they will do so.

With respect to the regulatory mechanism. Mr.J.H. says that it is a reflection of the sad state of affairs that while the public sector is not able to get clearance for their indigenously grown Bt seeds, on the other hand, Monsanto gets about 75 varieties of Bt Cotton cleared in a single meeting. He believes that such dynamics would be understood even by a small child and that there must be huge exchange of kickbacks for such approvals.

Mr.J.H. dismisses the claims that GM technology is needed to increase food productivity as absurd . He points out that" in 2004, there were huge surpluses of food. Why did then India witness the largest number of starvation deaths during this period, when India had 90 million tones of food surplus. Even today, we have food surplus. It's the purchasing power which is the crux."

Almost all the journalists are in agreement that GM technology does not hold the solution to the ills afflicting Indian agriculture, despite the acceptance of Bt cotton by the farmers. According to Ms. S.B., despite paying heavy price for seeds, Punjab is in the throes of an agricultural crisis as productivity of the land has gone down drastically. It is very sad that majority of the farmers want to leave

agriculture in Punjab. Mr.S.S.B. claims that in Punjab, all problems in agriculture are the result of the Green Revolution with its over-emphasis on chemical fertilizers and pesticides. Pesticides have contaminated the soil and the water. He says “I don’t know how good GM technology will be? Would it eliminate the need for pesticides altogether? As far as I know, Bt is effective against only one pest, but what about other pests?” According to him, in Punjab, the need of the hour is for a sustainable form of agriculture which does not destroy the land and the water, and that India requires “home- grown, sustainable technologies to suit our needs rather than blindly borrowing technology from the West”.

According to Mr. J.H., the shift from cotton to soyabean in Vidarbha is reflective of the farmers’ rejection of cotton as a monoculture and also rejection of Bt or GM technology, which was forced onto them.

Talking about the present agrarian crisis in Vidarbha, Mr.W. said that Bt technology cannot be held solely responsible for the crisis. In his words, “ there was a crisis even before Bt was introduced. But now the crisis situation has reached its peak, accumulating over the years and Bt has not alleviated the crisis. In my native village, Meti Kheda, till six months back, there were no suicides. It was a progressive village, where the farmers’ movement started there. But now no more. Recently, there have been two suicides (this was corroborated by villagers when we visited the village; village which grows Bt cotton), which has demoralized the other villagers”.

In Ludhiana, Mr.S.S.B. and Ms.S.B. feel that GM technology will not be readily accepted by urban consumers. People are not willing to experiment with another new technology and repeat their experience with pesticides. They have realized the value of organics. S.B. says that in Ludhiana, many affluent people are now trying to grow their own vegetables naturally in their kitchen gardens and farmhouses.

On the other hand, in Maharashtra, Mr.J.H. feels that the urban population will have no hesitation in eating GM foods. According to him, the urban consumer does not know or is bothered about how food production takes place, whether it is produced by GM technology or something else. In his words, “an urban child will not even know if carrot grown on or under the ground. This knowledge and empathy will be lacking even by those studying agriculture as a science”. Mr.W. says that affluent people like to buy organic grains. But how many people can actually afford them? Also, their availability is also not ensured! If given a choice and the price is also affordable, he will go for organically grown or local varieties. Everybody knows that local varieties have a much superior taste to hybrids, but it must be affordable as well as available. Mr. W. laments the fact that the urban consumer goes to no extent in spending money on shopping in malls, eating out in restaurants but he is unwilling to pay a few extra rupees to the poor farmer for organic vegetables and grains.

With regard to the role of the media in the GM debate, Mr.J.H. and Mr.W. feel that the media in Maharashtra have played an active role in promoting GM technology. According to Mr.W. media has become saleable. It no more plays a neutral role but are in cahoots with the MNCs and has played a role in promotion of Bt cotton. Mr.J.H. also voices the same opinion when he says that media as a business industry has promoted Bt by running the advertisements. Barring few exceptions, media in general have promoted GMOs without understanding its repercussions.

In the final analysis, all the journalists echo the same opinion as Mr.W. when he says that “before we talk about GM technology, whether it should be adopted or not, there should be a change in the policy and attitude towards the farmer. Issue is not GM technology, but on making the terms of trade fair for the farmer”. Mr.J.H. says almost the same thing that “agriculture cannot happen keeping in mind the interest of the end- user alone. Policy has to keep in mind the condition of the cultivator and try to ameliorate his sufferings. If the government wants

farmers to adopt GM technology, then government has to ensure that the farmer gains from this. The government should fix atleast Rs 5,000 as the minimum procurement price for one quintal cotton, so that farmer is able to recover the costs of its cultivation".

Content Analysis

Analysis of the Engagement of Political Leaders with GMOs

A study was made of the questions asked regarding GE crops in the Lok Sabha and Rajya Sabha of the Indian Parliament, in order to understand the engagement of the political leaders with the issue. This involved compiling the questions posed by Members of Parliament (MPs) of all political parties. The Lok Sabha (House of the People), is composed of directly elected representatives of the people and the Rajya Sabha of members who are not directly but indirectly elected by the Legislative Assemblies of the various states.

The Question Hour is one of the most significant items of business in Indian parliamentary proceedings and assumes considerable importance in the democratic life of the nation. It is during the Question Hour that the members can ask questions on every aspect of administration and Governmental activity, with the government being collectively and severally answerable to the people and its representatives. The asking of questions is an inherent and unfettered parliamentary right of members. Questions are asked primarily to elicit information, to ensure accountability, and for exercising a kind of legislative control over executive actions. The information given through the answers has a high presumption of authenticity and wrong or inaccurate answers can be construed as an attempt to mislead the House.

The nature of the questions asked and the complexity and detail of answers provided ideally reflect the vital need and demand for information in a democracy where the Public's perceptions and awareness are represented in Parliament, both directly and indirectly (through media reports and NGO advocacy), by elected members of both houses. They also reflect the outlook, views and perceptions of the ruling and the opposition parties, giving insights into the entire political mechanism surrounding new technology introduction into civil society.

The governments perceived obligation to the people whether to promote, regulate or prohibit GMO's is clearly apparent from the questions.

An analysis of the questions on GMO's raised by the Members of Parliament in both Houses of Parliament, was done for the period of 2001 – 2007 involving a survey examination of 57 questions raised in the Lok Sabha and 76 questions in the Rajya Sabha. We found that over the last seven years the issues concerning GMO's have been frequently debated both in the Rajya Sabha and in the Lok Sabha. The published parliamentary debates by themselves act as an important source of information and spread awareness regarding GM products and technologies in India. Most importantly the questions and the answer sessions put forward 9 Issues related to GM food and technology. These issues are as follows:

1) The necessity for GM technology and for more Information on GM
2) Government Policies, Rules and Regulations relating to GM technology
3) Import of GM Technology and Implications for Indian Farmers
4) Field Trials of GMO's
5) Impact of GM on Health/ Environment/Social/ Economic conditions
6) Case of B T Cotton
7) Illegal and Spurious GM Seeds
8) Risk Issues in GM Food
9) Public reaction to GM in India such as Farmer's protests, NGO Advocacy and Media Reports

While examining the nature of questions raised by the MP's we observed that most of them were inclined towards asking for first level information on GM technologies, crops and the already implemented BT cotton. But others were more nuanced and critical, leading to the layering and complexity of information

being generated for purposes of public debate on the issue of GM technology. A cross cutting analysis of questions raised in both the houses proved helpful with respect to the comparative weightage given to the above themes and the glaring silence on certain issues in both houses.

1. Necessity for GM technology and for more Information on GM

We found that this issue was very widely discussed and broadly covered in both the houses of the parliament. The need for information and awareness over the introduction of new technologies such as GM were discussed with an almost equal weightage of 28% of all relevant questions in Lok Sabha and 26% in Rajya Sabha. This relatively high percentage is also reflected in the quantitative analysis done by this project, where the Government is expected by the Public to disseminate information. We found certain differences in the nature of information regarding the inquires about GM technology in both the houses of parliament, for instance in the Rajya Sabha questions were raised seeking more information on the role of the government especially on issues such as introduction of GM technology, new policies and directions adopted by the government, ongoing field trials and/or banning of GMO's in the country and information on the policies and actions taken by the DBT and GEAC and other committees formed under the supervision of the government .

Importantly, it was in the Lok Sabha that we found that the questions were directed towards the *Promotional Aspect* of GM technology. The members of the Lok Sabha voiced the Government's obligation to make the GM technology available to the people. The information asked was based on the role and steps taken by the government to promote the GM technology in India, some even inquired about the implementation of various scientific reports such as that of M.S Swaminathan Report which is presumed on the need for the introduction of GM technology in India. Interestingly, these questions raised in the Lok Sabha also corroborate indirectly the cautious approach of the government highlighted in our Media Analysis for this project. In the Lok Sabha we observed that there exists an immense pressure on the government as to why it is not *making* these

technologies available to the public or why it is not *promoting* the GM technology to the public?

Another aspect that arises is on the growing need for *Public Awareness* regarding GM technologies which is to be taken care of by the constituted Task Force of the government. More awareness and dissemination of information regarding the GM foods, its applications, implications and other concerned issues being made available to the Public was voiced in Parliament.

2. *Government Policies, Rules and Regulations relating to the introduction of GM technology*

We observed that directives issued by the government over GM technology were more discussed in the Rajya Sabha. The growing concern over these rules, new policies, and regulations on GMO's adopted by the government was expressed more in the debates raised in the Rajya Sabha. Precise issues, and questions related to ***specific food items*** such as GM Brinjal, GM Soy, BT Cotton and Golden Rice and especially discussions on the ***permissions granted by the government*** were discussed in the Rajya Sabha.
Lok Sabha?

3. *Import of GM Technology and Implications for Indian Farmers*

Only one question regarding this issue was discussed in the House of Lok Sabha similarly even in the Rajya Sabha the issue was of limited concern. Questions remained focused on whether GM *Processed Food imports* have been introduced in India.

4. *Field Trials*

We observed that the issue of field trials figured as a part of the theme on the need for more information from Ministers. We broadly classified these questions into the category of Issue 1. Simultaneously we also found that the theme of field

trials were not vital as compared to the other questions raised. NO questions were asked in the Rajya Sabha regarding the field trials of GMO's and only 2 questions were asked in the Lok Sabha and that also asking for mere information as to whether field trials of GM foods and crops were conducted by the government in the country.

5. *Impact of GM on Health/ Environment/Social/ Economic conditions*

This issue was very minimally but equivalently discussed in both houses of the Parliament (10% of all questions in Lok Sabha and 7% in Rajya Sabha). The questions were related more to the implications of GMO's on health and environment and were focused more on the category of Farmers. The economic implications for instance of GM seed for the latter, was dealt with. Consumers were not taken up as a category at risk in any significant way, een if GM food was to be introduced into India.

6. *Case of B T Cotton*

After issue 1, on the nature and necessity of information on GM technology, it is the case of BT cotton, the first GM implemented technology in India, that finds a predominant place in the questions raised in both the houses. The percentage of questions discussed in Lok Sabha 36.8% and in Rajya Sabha 26.3% of the total number, reveals the tremendous political significance of this theme for the members. Numerous questions focusing on yield, varieties, success and failure of BT Cotton, impact on Farmers etc were put forward by the MP's for the government to answer. The introduction of this technology into food production was a concern as also the cost to farmers.

7. *Illegal and Spurious Seeds &*

8. *Risk Issues in GM Food*

For both these issues, we found that surprisingly none of the questions related to the notion of "risk". The technical understanding of "risk" assessment and

minimisation which is an important issue in the current GMO debate worldwide was absent in the parliamentary debates. The issue of spurious seeds was raised only as part of Government regulation obligations.

9. Public reaction to GM in India such as Farmer's protest, NGO Advocacy and Media Reports

We observed that it is the Rajya Sabha that gave more importance to themes on GMO's covered by the Media. The MP's quoted reports and articles published in leading national newspapers and in turn questioned the government to give answers based on the issues raised by the media directly voicing public opinion and also by publishing certain reports that underlined the policies and actions taken by the government on GM foods and crops. As a result, Public Reactions to GM technology were more raised in the parliamentary debates of Rajya Sabha. In the Lok Sabha questions were asked based on issues raised by NGO's such as Gene Campaign, and Greenpeace who have pro-farmer, pro-environment stand against the introduction of GMO's in India.

However an important feature which emerges in the media analysis for this project and in the parliamentary debate on GMO's is that the reactions and opinions of different stakeholders such as Media, NGO's and Farmers are being incorporated. But none of the Parliament Houses, despite being the elected representatives of the people are voicing or raising questions on behalf of a very significant category in the GM debate i.e. the Consumer and The Household. We observe that even the government is not giving due attention to that section of the society whose consumption of the GM products will in turn decide the fate of all the above mentioned stakeholders.

Analysis of Media Reportage of GMOs

Media is the most significant feedback mechanism for any government machinery as it highlights the perceptions and opinions of the publics which are vital to any existing political and social institutions of a democratic society. Media plays a significant role in the legitimization of specific kinds of knowledge generated by public participation, which develops a crucial function in decision making and policy framing. In the recent years, widespread concerns surrounding the ambiguity, lack of awareness and complexities around issues concerning GM foods have increased in India. As a result significant dilemmas have been posed over science-society relationships where the legitimacy and moral authority of scientific "facts" are being challenged. Therefore, it has led to a widespread recognition of a need for new mechanisms of science communication in the society (Augustinos et al., 2009)[1]. The media emerges as one of the most important actors in this process of science communication, especially in the areas of GM foods as it creates a direct link with the public and has a great significance in the formation of public opinion than any other agency of society. Henderson et al. (2007) maintains that it is through the coverage of media and its extensive analysis that contestations over GM foods have become public "battlegrounds" where different stakeholders strategically compete with each other to set the contour of debate and influence public policy and decision making.

Media is viewed as a significant site for gleaning the ways in which public understandings of contentious scientific issues are shaped by dominant and recurring representations, images and metaphors (Conrad, 2001; Petersen, 2001). The importance of examining media content is extremely crucial as it aids us in understanding how controversial issues—such as the GM food debate - are framed and represented for public consumption.

In India, we observe that the Media plays an important role in fulfilling the task i.e. of not only disseminating information and communication on matters of GM technology, but for effectively contextualizing public debate and extending a democratic engagement with science (Brossard, D. et al., 2009). It becomes necessary in India to analyse the role of print media in particular because rather than just presenting received wisdom from the community of scientists about scientific issues, the print media makes science accountable to the broader democratic society, as through its coverage it ideally encourages discussions, which further opens up innovative issues and alternatives to public view (Priest, 1999). It is due to the pervasiveness of print media that the reader, who consumes the news, is able to construct an understanding of new and controversial science (Friedman, 1999). While analyzing many articles, we found that the newspapers were more responsible in reporting the major issues and incidents related to GMO's. The regional newspapers actually described what exactly the technology of say BT cotton is and thus provided more awareness for the reader in their reports.

The Methodology used for examining media in the context of GM debate has been that of Content Analysis. The method of content analysis absorbs and identifies the frequent occurrence of extensive thematic categories and their evaluative nature over designated periods of time. For this project we are using the print media as our case material. The three English language newspapers that were selected were, one national newspaper *The Hindu*, along with two regional daily newspapers The Daily News which is published in Maharashtra and the Tribune which is published from Punjab. We believe that examining the newspapers in particular are of direct relevance to this project. The Quantitative research component of this very project shows that the farmers trust the media as a source of information on new technologies in agriculture. The data also revealed that it is the print media that has delivered maximum awareness and provided more information to the people on the issues of BT cotton, GM technology. From the examination of various articles and reports, one crucial

outcome that has emerged is that the print media has been largely responsible for bringing the entire GM debate into the public arena.

The content analysis of the newspapers reveal major diversities in their approach and reporting of the events especially related to GM foods, for example, in The Hindu we find a wider handling of the matter as the coverage is not mainly restricted to reporting the events in its main newspaper but it also involves wide debates, expert opinions and interviews of scientists and other personnel (in supplements *Business Line*(financial daily section) and magazine *Frontline*), as a result it manages to showcase diverse views from various disciplines over the issue of GM foods. However, the DNA has managed only to focus on news reporting of events that have occurred in the area of GMO's over the recent years. Interestingly, The Tribune surpasses even a national newspaper like The Hindu, especially in its coverage where we find that the issues related to GM foods are present in all sections such as in the main articles, editorials, financial columns and supplements *Spectrum*. Most importantly, it is the only paper that devotes a complete supplement titled *Agriculture Tribune* where issues of GM crops and BT cotton have been very frequently highlighted.

The analyses of these newspapers has been done from the period of 2000- 2008 for The Tribune and The Hindu and 2006 – 2008 for the DNA (reason for short coverage and paucity of material from DNA to be explained by Gene campaign). The time period is crucial as it reveals the issue cycles that dealt with the GMO's over the years. The first three years (2001 – 2003) marked the introduction of the BT cotton and the print media echoed the positive applications of BT cotton by using descriptions like "Eco Friendly", "Boon for Indian Farmers", "Savior for Farmer" interestingly such articles were also published alongside those which dealt with issues concerning food safety and food quality concerns in India[13]. Articles dealing with concerns and apprehensions over the GM crops during these years were not mainly published as main articles of the news paper and the speculations were based on purist arguments which were voiced in articles like "Whose science, devil's or God's?" (2001, Agriculture Tribune).However, it

was in the year 2006 that we observed an increase in momentum of write ups that dealt majorly with the negative impact of GMO's in India and the nature of such articles were inclined towards highlighting the voices of the anti GM groups.

It was in this year that we witnessed the voices of NGO's and organizations like Greenpeace, GE Free India who are working towards the eradication of GMO's in India. Intriguing articles were published which primarily showed the outlook and opinions expressed by cross section of experts from various fields and were brought together on one platform, with varying viewpoints on this complex issue. Articles titled "Crop of Questions"(August 20,Spectrum), represented the opinions of well-known environmentalists (Sunita Narain), NGO's (Greenpeace campaigner Divya Raghunandan) and representatives of farmers' community , corporate (Usha Barwale Zehr, a scientist with Maharashtra Hybrid Seeds Company Limited (Mahyco), who is currently working on BT brinjal) and the government's version was culled from the Genetic Engineering Approval Committee (GEAC), (August 20, Tribune)[14]. The most positive aspect of such coverage was that in one write up the readers were provided awareness and understanding of GM technology, Gm crops, their implications for issues such as bio safety, health hazards etc. This critical approach to GMO's was also at its peak for the year 2008 where reports of illegal cultivation of GM crops came up as a new issue for debate.

Based on level and depth of reporting we have focused on the following issues on the descending order of coverage:

1) Pros and Cons of GM crops as expressed by different stakeholders
2) Perceived Risks and Benefits of Genetic Engineering
3) Case of BT cotton - the first GM crop introduced in India
4) Illegal Trials of GMO's on fields of farmers and Illegal sale of BT cotton seeds
5) Government's position vis-à-vis regulation, information and sale of seeds

6) Implications of GMO's for perceived world hunger and Food Security
7) GMO and Farmer Suicides - Farmers' Movements against GM foods along with Consumer Mobilization

We shall now take the above broad themes one by one and examine the analysis done within the newspapers

1) Pros and Cons of GM crops as expressed by different stakeholders

GM crops are viewed in many contrary ways by different experts. As a result the newspaper supplements Frontline and Sunday Tribune have published articles (" *GMO debate", 2001 Hindu, "Crop of Questions*", "*To Propose Alternatives, 2004, Tribune*,), where a panel of experts from the Anti Gm lobby and Pro Gm lobby were made to put out their conflicting viewpoints together. For the biotechnologists and scientists the introduction of GM seed has led to increased productivity in certain agro-climatic zones. Promoters claim that farmers, including those in Punjab, Haryana, Gujarat, Madhya Pradesh, Andhra Pradesh, Karnataka and Maharashtra, are very happy with the output of Bt cotton. Environmentalists do not buy this line and blame Bt cotton for large-scale farmers' suicide, death of hundreds of cattle and most importantly the giving up of cultivation of traditional crop varieties. The examination of such articles revealed that the experts on both sides of the lobby agree that the greatest threat surrounding GM issues is the lack of data provided to the public. The impacts of the GE crops are not known to the common man (2001, Tribune). One of the key issues that emerged therefore was that of Labelling, and both sides argued that the government should make labelling mandatory for GM crops and foods especially when BT brinjal has already hit the markets for the consumers to eat.

The examination of the papers reveal the need to bring the GM debate into the public arena for this the government and its departments (DBT) have to first provide complete information to the public to open new possibilities of debates and novel issues are to be raised by the people of India. The permission granted

by the GEAC to Mahyco for the commercial release of its transgenic cotton seed with certain conditions has been argued and criticized by Devinder Sharma who questions the approval of experimenting and introduction of controversial crop variety by the DBT treating it as a dangerous step (*Business Line*, May 18, 2000). Why DBT has turned a blind eye to all the protests voiced against private controlled technology? Why civil society groups or educational institutions, universities or ICAR are not involved in reviewing and evaluation of GM's and western reports in India?? One of the basic ideas propagated by many news reports is that even the committees formed under the DBT, meant to supervise the standards of GMO's, comprise of those very scientific personnel that are pro GM technology and therefore would justify its application and usage. It's for this very reason that many advocate that more awareness and most importantly the involvement of public and other stakeholders of society should be encouraged to assess the GMO's application and question the credibility of the scientific communities and other pro - GM technologists.

2) Perceived Risks and Benefits of Genetic Engineering

In the initial years when BT cotton was about to be introduced many articles reported on the benefits of GM crops in India, GM crops were seen as a "Boon" and "Savior" for the Indian Farmers (Tribune, 2002). Reports like "*Benefiting from GE crops*", (Hindu, August, 2001) strongly maintained that the GM crops would bring immense benefits to the Indian farmers. It is also seen that such views were mainly put forward from the scientist community, advocators of GM implementation in India who argue that GM crops and seeds are especially beneficial for Asian countries such as India as they imply positive Health and Nutritional benefits (Interview with scientists Joseph Hulse, Hindu, 2000). Interestingly such articles were published along with others that talked about Food Safety and Food Quality concerns in India.

"*Rewards and dangers of genetic engineering*" (Science Tribune, 2002) provide in depth details and information of genetic engineering, it defines GE and provides complete details of the entire process of GE technology. Further it lists out the benefits of GM in the fields of medicine and agriculture. The benefits of genetic engineering is seen through gene manipulations which has increased the production and nutritional value of fruits and vegetables in terms of carbohydrates, starch and proteins besides extending their shelf life and making them more appealing with respect to color, shape and size (2002, Tribune). However within a similar article we find the issues of "risks" and "doubts" being placed on GE. The write ups of the last eight years (2000-2008) reveal that the Risk Assessment and Food Safety views associated with the GMO's are of prime importance. For example, it is maintained that if the assessment of risk associated with GMO's is done properly then the GM crops would bring immense benefits for the Indian farmers. It is also seen that such views are mainly put forward from the scientific community and advocators of GM implementation in India. The entire argument placed by the scientific community on the notion of '*risk*' strongly maintains that the acceptance and rejection of GMO's by society would be based on the current knowledge of assessment of risks (Hindu, 2001). The issues of risk that were raised over Gm technology were based on the failures and difficulties faced by established cases of GE like BT cotton, Dolly the Sheep, Friesian Cow etc (2002,Tribune). The GM foods are posed as health hazards for human's especially new born babies and pregnant women. The newspapers cite many medical researches that are done in this area to revive fears about GM food (Tribune, 2006). The lack of adherence to risk assessment protocols and the safety issues concerning GM crops undergoing tests in the country and its health effects on people were most notably raised before the Genetic Engineering Approval Committee (GEAC) by P.M. Bhargava. But the most important need realized by the Committee was that the review of GE crops in India should not be solely done by the scientists but by various other members of the civil society (*Hindu*, June 29, 2008). Similar to UNDP reports the Hindu has echoed that risk communication and awareness is an essential feature of the

regulatory framework. Transparent and credible decision-making involves exchange and communication of risks between all stakeholders in the risk management process.

3) Case of BT cotton the first GM crop introduced in India

We find that sections of newspapers like DNA, especially the Business column contain success stories of the GM crops, such as that of BT cotton. The revolutionized success growth of cotton exports is attributed to the use of genetically engineered technology. However the bias of this perspective is very well exposed in many reports ("BT *cotton doesn't hike yield", February 27, 2008, DNA)* which affirm other reasons that were responsible for the success of the cotton crop such as the climatic and environmental conditions during the particular period. So it was not solely BT cotton variety that raised the production of cotton.

Indian agriculture experts have debunked recent claims that BT cotton has been a boon to Indian farmers. According to the latest International Service for the Acquisition of Agri-biotech Applications (ISAAA) report, BT cotton cultivation has helped India increase its production and become the second largest cotton producer, next to China (DNA, 2008). However refuting the above claim many experts such as from the NGO's and other agricultural organizations point out that BT cotton only reduced the pest attack and has no role in boosting the productivity of crop.

4) Illegal Trials of GMO's on fields of farmers and Illegal sale of BT cotton seeds

The report *"GM paddy runs into rough weather in TN*", 2006, DNA highlighted the illegal cultivation of GM food crops on the agricultural lands especially in Chennai. "*Spurious Bt cotton seed being sold Agriculture Dept warns of action" (Tribune, 2002),* also shows that unscrupulous traders have started cheating the farmers by selling them spurious seed of BT cotton in Punjab and it is the

newspaper that has highlighted this story and informed the state government and Punjab Agricultural University that farmers have started visiting Rajasthan, Haryana and Gujarat in search of Bt cotton seed. Immense coverage of such incidences have been reported by both national and regional newspapers "*Unapproved Bt cotton seed on sale in Punjab" (2004, Tribune).* Farmer are unaware of the trials being conducted in their fields as described in article *"Concern over field trials of GM food*", (2006, Hindu). The importance of spreading this awareness regarding risks and GMO's was seen in the coverage on the "Navbharat scandal", where one aspect that stood out starkly was the practical difficulties faced by the State in testing and monitoring the use of GM seeds (*Frontline*, November 23, 2001). The farmers who were using the seeds neither knew whether they were genetically modified or not, nor were they aware of the implications of using them. By examining such cases on GMO's in the newspapers we also come to a conclusion that under the Right to Information Act it is seen as the fundamental right of citizens of the country who in turn will be consumers of the GM products to know and acquire complete knowledge regarding any technological innovation.

5) Government's position vis-à-vis regulation, information and sale of seeds

Despite the intense pressure on Indian government by the private and scientific institutions it showed remarkable restraint on the application of GMO's (*Business Line*, May 23, 2000). The government acts as a watchdog and has shown a cautious attitude in the issue of GMO's. This is also seen in an article where the government has downplayed the over exaggerated claims by the Industrial sectors on success of BT cotton (Gangadharan, DNA, 2007). From 2006 we find more coverage of perceptions and opinions of State ministers and some government officials on GM foods and crops. The stringent stand taken by the state officials against the cultivation of the crops is evident from the following statements: "The government may issue a law banning GM crop trials. We hope the Centre will support us," said Tamil Nadu agriculture minister Veerapandi

Arumugam. (The minister's reply came in the wake of severe concerns raised by legislators across party lines).

Congress leader, Peter Alphonse, said: "GM crops will wipe out traditional crops"

PMK legislator Velmurugan, said: "GM crops are being dumped in India to harm the farming sector." (Ram, DNA, 2006).

However, the cautious approach of the government is questioned recently in the article titled “Flawed moves for National Biotechnology Regulatory Authority”, (Hindu, 2008) where the proposed bill for the Creation of a National Biotechnology Regulatory Authority is viewed as an entirely industry centric move as it has a hidden agenda of supporting the GM technology in the country. Without assessing the flaws in the existing system of bio technological interventions, it is argued, how can new system of GM be incorporated,(*Hindu*, 2008).

6) Implications of GMO’s for perceived world hunger and Food Security

Many newspaper reports question whether GMO’s are really a solution to the problem of poverty and environmental degradation across the world? Modern bio-technology, especially the creation of GMO’s, is often presented as a magic solution or universal panacea for the problems of poverty, inadequate food access and nutrition and even environmental degradation across the world. The reality, as always, is far more complex, as even today the total food production in the world is adequate to feed the hungry of the world; the problem is rather one of unequal distribution, which deprives a large part of the population of even their minimal nutritional requirements. Similarly farmers, especially in developing countries, face many problems that biotechnology does not address, much less solve: lack of infrastructure, poor or unstable market access, volatile input and output prices, and so on (*Frontline*, June, 2001) On the impact of GMO’s on Food

Security system, we would find that the scientific personals and advocators of bio technology would advocate that the GM crops and seeds are especially beneficial for the Asian countries such as India, and the anti- Gm lobby should not completely negate it as it implies positive Health and Nutritional benefits. However an article titled “Negotiating for Food Security” (2001, Frontline) distinctively maintains that India should not be made a dumping ground of GM foods and seeds that are stocked up in the West solely on the basis of a purported eradication of food security.

7) *GMO’s and Farmer Suicides - Farmers’ Movement against Gm foods along with Consumer Mobilization*

As compared to the national newspaper like The Hindu the regional papers The Tribune and DNA have managed to bring out the attitudes and perceptions of the farmers about the introduction and production of GM food crops in our society. Many reports like “*Another Punjab farm suicide*” (DNA, 2005), are devoted to the Farmers Suicides especially in Vidharbha *“One Suicide Every 8 hours” (*DNA, 2006) where most famers are cotton producers and this also attracts our concern towards the already existing problems and difficulties faced by the Indian farmers. Some articles are devoted to reason out that one should not be too influenced by the magic of the technology but should also observe the economics of the GMO’s especially in the case of farmer suicides. There have been over 2,000 suicides by farmers in Vidharbha over the last few years. Two-thirds of these farmers mainly grew cotton and, from 2004, genetically modified (GM) BT cotton (DNA, 2006).

Recently we witnessed a rise of Farmer protests in the northern states against the GM crops, (*Farmers seek ban on GM crops, 2008, Tribune*). Interestingly even consumers and rice exporters, including those from Punjab and Haryana, have joined the farmers to chorus against genetically engineered (GE) field trials for rice in India and demand for a Ban on Gm crops. The protest comes at a time

when Indian regulators are considering the applications for (experimental) seed production for Bt brinjal, the first such genetically modified vegetable anywhere in the world with the Bt gene extracted from bacillus thurengiensis in it (2008, Tribune).

In conclusion, the content analyses of print media in general, provide us an outcome that it has managed to highlight the diverse perceptions and attitudes held by various stakeholders in the debate. The analysis reveals an important feature that the basic awareness about the GM foods may have to be created among the consumers through government ministries, consumer interest groups, and biotech food-crop companies. The Hindu and The Tribune have been more responsible in placing the GM debate on to a wider public platform and have managed to convey the attitudes and perceptions of the scientists, academics, agriculturalists, activists and also farmers but most importantly the newspapers have not highlighted the Consumer viewpoints in their coverage. What is the level of consumer awareness regarding the GM foods? The attitudes and perceptions of consumers regarding GM foods, and their concerns over consumption of Gm foods (more recently on BT brinjal) are not covered by the print media.

India is being perceived as a giant emerging market for GM foods with more than 1.1 billion consumers (Deodhar, 2008). Therefore, it is important that consumer questions are addressed first, before GM foods are introduced in India. A significant percentage of the quantitative data in this study itself reflects consumer outlook and perceptions - whether they be expressing the interests of farmers, pesticide/fertilizer and seed dealers or government officials.

V. Stakeholder Consultations on Research Findings of KAP Study on Ag Biotechnology in India

Introduction

There is substantial understanding of the way GM technology is perceived in developed countries where studies have been ongoing on attitudes to GM Foods but there is no comprehensive scientific study as yet to assess the public attitude to GMOs in India although, a couple of reports have appeared recently on willingness to pay and the performance of Bt cotton.

There is a critical need for a study on attitudes and perceptions to GMOs in view of the fact that Bt cotton has been on the market for some years and the anticipated release of Bt brinjal, the first GM food has seen a confrontation between government agencies and civil society groups opposed to the release of GM foods. The reactions to the approval granted to Bt brinjal by the GEAC in October 2009, most recently, has once again shown that there is resistance to GM foods in certain quarters and that there is no dialogue between government and non government actors over this subject. A writ petition in the Supreme Court [Gene Campaign PIL no. 115 (2004)] has been asking for a regulatory system that is technically strong, more transparent and inclusive, and involving the public in decision making. Public resources are being spent on developing a wide range of genetically engineered products in the absence of laws on labeling and liability. Yet the need to "educate" and inform the public about GMO's, or offer consumers a choice, cannot be achieved by labeling alone.

Decision-makers in the public and private sectors clearly need to look for social science research which can be factored into expert issues such as risk analysis and not just relegated to the pragmatics of technology application alone. By focusing on public attitudes and perceptions about biotechnological innovations, this study attempts to both create and fulfill such a need. Its pioneering and representative national character and scope lends it its special character to reveal that food is a significant site for public engagement with science. Today,

complex technological innovations have not only transformed production and distribution but severely altered consumption habits and practices. Public policy on science and technology needs to come to terms with broader cultural shifts, especially towards consumer practices.

At present, the GMO governance system in India is inadequate in its representation of consumers, women, the farming community and other stakeholders. Expert Committees and Panels, conferences and discussion forums do not include this diversity of representation nor are there any formal channels to communicate with the public to take aboard their views and remedy this lack. Bringing about transparency in governance in this and other sectors has been the focus of activist struggles for several years.

At the same time, the mode and level of representation by NGO's, of those they work to represent on public and official forums, itself needs a reality check against a study of this kind. To ascertain the manner in which the public can be directly or indirectly involved in technology decisions affecting their life and the complex world situation they are part of, requires new forms of mediation and feedback mechanisms based on the facts provided by this study.

After the three year research study was concluded and the results analysed, we decided to conduct a series of stakeholder consultations to discuss the results of the research study with a broad cross section of stakeholders.

Stakeholder discussions

Stakeholder consultations were organised in Guwahati, Chennai, Bangalore, Delhi & Ranchi to discuss the outcome of the research study. These consultations were attended by scientists, journalists, NGOs, seed companies, farmers, industrialists, law makers, senior academicians, students, activists in people's science movements and researchers. The methodology of the study, its goals and the research highlights were presented and the floor was opened for discussions. The purpose was not just to present the research study to a range of diverse stakeholders, but also to prompt debate to generate awareness and

encourage engagement with the subject of technology adoption, especially in the sector of agriculture. The debate threw up issues related to production, consumption, social, cultural, ethical and political aspects of GM foods along with expected roles and responsibilities of various sections and of people in the society.

The discussions began with a presentation detailing the methodology used in the study. We placed emphasis on this not just from the debate point of view, but also to make it a pedagogic exercise, to facilitate capacity building in this field among informed discussants who could use such methodologies for similar studies.

Following the presentations on the methodology and discussions, a presentation was made capturing the research highlights. This led to lively and enthusiastic debates which captured the diverse viewpoints prevailing in the country.

Presenting Methodology

Society –technology relations

- Relations between society on the one hand and science and technology on the other are dialectical and dynamic
- Society provides impetus for technological development and in turn social structure and culture get transformed by technology
- Hence science and technology are major forces of social and cultural change.
- Historically science and technology have transformed agriculture and through agriculture economy culture and polity

---

- Initially all societies employed organic methods in agriculture on the basis of local knowledge
- The green revolution not only transformed agriculture but also society and culture
- We are going to witness social and cultural changes that would be brought by modern biotechnology techniques in which the seed will acquire a different meaning.
- Can we engineer changes democratically?

- Modern agribiotechnology also will transform agriculture and social relations in the production process and cultural change in the form of changes in attitudes, values and meanings.
- In contrast to the green revolution, farmers, the primary stake holders as the end-users of technology, and consumers of the products would like to know what the technology means and what it would do before they make their choice.

Objectives of the study

- Were to understand the perceptions and attitudes of farmers and consumers about the new technology which attempts to change the character and composition of the seed and the associated practices of agriculture and the consequences of the new technology

----

What is Methodology?

- Methodology is not merely a set of techniques
- To carry out a study of perceptions and attitudes towards new technology which has just begun to be introduced is a challenge given the Indian context

---

Inputs from peers

All research partners are agreed that our approach is not based on *a priori* concepts and attribution of meanings to GM food.

- Axiom: individuals are active agents capable of reflecting on events and objects
- To document their perceptions that are mediated by their socio-economic status and their systems of meanings, values and attitudes.

- A draft methodology was shared with peers and commentators and reworked after getting feedback from scholars from both inside and outside India, particularly from those who have had experience of conducting similar studies in the US and Europe.

The context

- India has diverse agro-climatic zones; irrigated and unirrigated regions,
- Regions which experienced green revolution technologies and regions in which green revolution technologies were unevenly used
- Population is highly differentiated:
- Farmers are differentiated in terms of their economic social and cultural endowments

- Over 50 per cent of the farmers are small and marginal farmers; different levels of education and differential access to information

---

Differentiated consumers

- Consumers are also a stratified group:
- ranging, for instance, from the poor farmer to the rich, leisure class,
- from young girls and boys to homemakers and professionals.
- Rural consumers consist of farmers, landless labor, those engaged in non-farm occupations.
- In relative terms urban consumers tend to have more disposable income compared to rural consumers.

Two phases

- Phase I of the study explored basic perceptions of and attitudes of farmers towards agriculture and its components like seed, fertilizers and pesticides.
- Questions relating to: what is a good seed, source of procuring seed, crops cultivated, amount of land leased out and land leased in by farmers.
- what according to farmers is needed for good agriculture -- land, good seed, water, access to technology -- whether or not the needed inputs are available in quantity and quality. Whether farmers consider it worthwhile to pursue agriculture?

Phase I: Consumers' study

- The study with consumers included perceptions of safe food and willingness to take risk with foods. The first phase of the study employed survey method, which used a questionnaire, and a qualitative method that

employed FGD and interview techniques. The insights gained from the phase I of the study helped us design the second phase of the study

---

Phase II

- Phase II examined the perceptions of and attitudes to risk, with respect to:
- altered/ modified crops and food,
- new concepts of agriculture and new agriculture technologies including
- new agrochemicals with advantages and risks in the highly differentiated farming context.
- In most parts of the country farmers have the experience of using chemical fertilizers, pesticides, and high yielding varieties introduced as a part of the green revolution.

Perceptions of attitude to food

- Perceptions and attitudes are based on experiences and meanings people attach to food: what features in food are considered desirable for maintaining and promoting health and aesthetic consideration- taste, appearance etc.

- Our aim was to capture perceptions and attitudes towards food of a broad and somewhat representative section of the farmers and consumers in rural and urban areas given the diversity in agriculture, and social and cultural structures.
- For this purpose we adopted the survey method to achieve a broad, representative coverage of farmers and consumers to capture the

perceptions and attitudes of urban consumers on modified food. what kind of risks could be associated with such modified foods.

- The study is the first comprehensive study.
- A combination of quantitative-statistical surveys and qualitative methods like Focus Group Discussions (FGD) and interviews were used to understand the experiences regarding existing agricultural technologies and perceptions of risks associated with new technologies and modified crops and foods.

Understanding risk

- This study attempts to understand perception of and attitude to risk among diverse stakeholders, with respect to the production and consumption of food and their view on the regulation of risk.
- Theories of risk have neglected food issues but in the wake of 'food scares' since the eighties, public confidence in the food industry and government regulatory bodies has been seriously undermined, giving rise to serious thinking on the issue.
- The mathematical-technical approach to risk analysis, failed to embody the social and cultural context of decision-making.

Risk research

- Risk research has concentrated almost exclusively upon the so-called 'irrational' views of the general public.
- The sociological, cultural approach attempts to overcome these biases by studying risk within the wider social and ideological context and by refusing to judge lay perceptions as somehow "inferior".

Cultural dimension of risk

- some approaches explain the apparent irrationality of lay risk perceptions, and the implication that the public can be educated to overcome perceptual bias and to accept more rational assessments of risk.
- In the face of all these approaches, qualitative approaches are gaining favor as more able to provide the cultural context for understanding public perceptions and attitudes to food and agriculture issues.

Cultural dimension of risk

- Food choices and food risk perceptions are culturally and identity driven.
- Food related risk is construed in India may vary by food type and across regions.
- to capture this important yet elusive dimension of public attitudes and perceptions to risk in food and agriculture practices is a challenge.

Operationalizing concepts

- The concept of GM crops and foods was presented as those crops and foods that were different to conventional crops and food because they had been changed in some fundamental way.
- 'GM" seeds were presented as new varieties produced by a process which involved introducing parts of plants, animals or insects to provide some useful attribute such as improved ability to fight pests.
- Bt cotton was presented as a seed in which a modification was made by introducing parts of insects to minimize the use of pesticides.

Interviews

- Senior officials who would not be amenable to an FGD setting were interviewed independently.
- nature of concerns expressed by the political leadership analyzed by examining the record of parliament debates.
- Media reportage from leading newspapers was studied to examine the perceptions in the media and the way they presented the issues around Agbiotechnology. Three papers were selected. *The Tribune* published from Punjab in North India, *The Hindu*, a largely southern newspaper known for unbiased reporting and the *Daily News & Analysis* (DNA) from western India.

Selection of states

- The study on farmers and consumers was conducted in five states:
  - Andhra Pradesh, Maharashtra, Punjab, Jharkhand and Assam to represent four regions - North, South, East and West of India.
- Andhra Pradesh and Maharashtra have been cultivating Bt cotton since 2002-2003. Both states have pockets of intensive agriculture as well as conventional agriculture.
- Jharkhand and Assam have largely conventional agriculture. Do not cultivate cotton and hence have no exposure to Bt cotton.
- Punjab is known for its early adoption of the green revolution and intensive agriculture practices, has both cotton and non cotton growing regions.

Sampling for Farmers Survey

- Two districts were chosen in each state. The sampling was purposive.
- In each district, two villages were selected randomly using the census list. In each village 200 farmer households were selected randomly for survey.
- This brought the total sample per district to 400 farmer households and the total sample size per state to approximately 800 farmer households.
- The following districts were selected: Andhra Pradesh- Mahboobnagar and Guntur; Maharashtra - Amravati and Yavatmal; Punjab - Bhatinda and Patiala; Jharkhand - Ranchi and Dumka; Assam - Golaghat and Jorhat.

Sampling for Urban Consumers

- In each state one city was chosen for this survey: Hyderabad in Andhra Pradesh, Nagpur in Maharashtra, Chandigardh in Punjab, Ranchi in Jharkhand and Jorhat in Assam.
- A stratified random sample of about 500 urban consumer households was surveyed in each city. This sample consisted of the following five different consumer groups, of approximately 100 each, selected randomly:
  - Professionals (lawyers, chartered accountants, doctors, scientists etc.),
  - Students
  - Government employees
  - Housewives
  - Academicians

Sample frames

- The professionals surveyed were identified through professional associations, lawyers from the Bar Association, list of doctors from leading hospitals, etc.
- The list of academics surveyed were identified from universities and from teachers associations.
- The government employees surveyed were identified through major government offices in the city.
- The housewives surveyed were identified on random basis drawn from the voters list.
- The students surveyed were identified from hostels and colleges.

Methodology for FGDs

- Three FGDs were held in each district in each state. Two FGDs were held with two different farmer groups in villages belonging to different mandals (blocks). One FGD in each district was held with shop owners who deal in seeds, fertilizer and pesticide.
- Each farmer FGD had about 15 members. About ten shop owners/dealers constituted the other FGD. FGDs with urban consumers were organised in groups of 15-18.

Distribution of farmers in the sample

State	Freq	%
Andhra Pradesh	812	20.0
Maharashtra	836	20.6
Assam	804	19.8
Jharkhand	800	19.7
Punjab	800	19.7
Total	4052	100

Distribution of farmers in the sample across districts

District wise Sample Size in each state							
	Andhra Pradesh	Maharashtra	Assam	Jharkhand	Punjab	Total	
District	%	%	%	%	%	%	Freq
Guntur	50.2	-	-	-	-	10.1	408
Mahabubnagar	49.8	-	-	-	-	10.0	404
Yavatmal	-	50.4	-	-	-	10.4	421
Amaravathi	-	49.6	-	-	-	10.2	415
Golaghat	-	-	38.1	-	-	7.6	306
Jorhat	-	-	61.9	-	-	12.3	498
Ranchi	-	-	-	50.1	-	9.9	401
Dumka	-	-	-	49.9	-	9.8	399
Bhatinda	-	-	-	-	50	9.9	400
Patiala	-	-	-	-	50	9.9	400
Total	100	100	100	100	100	100	4052

Analysis of data

- Contingency analysis was carried out to examine association, between demographic variables (independent variables) and the dependent variables -that are empirical indicators of experiences, perceptions, attitudes towards risks associated with agriculture and food.

- While the survey results provided statistics regarding the association between the dependent and independent variables,
- FGDs and interview provided insights into the meanings that people attach to agriculture and food in different contexts.
- Meanings cannot be measured: they can only be interpreted and understood.

- this study is an attempt to use more than one source of data to produce a narrative that captures the perceptions of farmers, consumers input dealers, who represent the interests of industry, scientists and professionals, policy makers, media and political leaders and attempts to explicate the anxieties and tensions that new technologies generate.

Presenting Research Highlights of the Study

Farmer Responses

Table: 1 What kind of new pesticides do you want?

What kind of new pesticides do you want?	%
Pesticides that will control pests well but be risky for health	15.7
Pesticides that will control well but will reduce soil fertility in the long run	20.5
Will only partly control pests but will not affect soil fertility	69.0

Figure 1. Would you cultivate cash crops from seed having insect poison in it to control pest

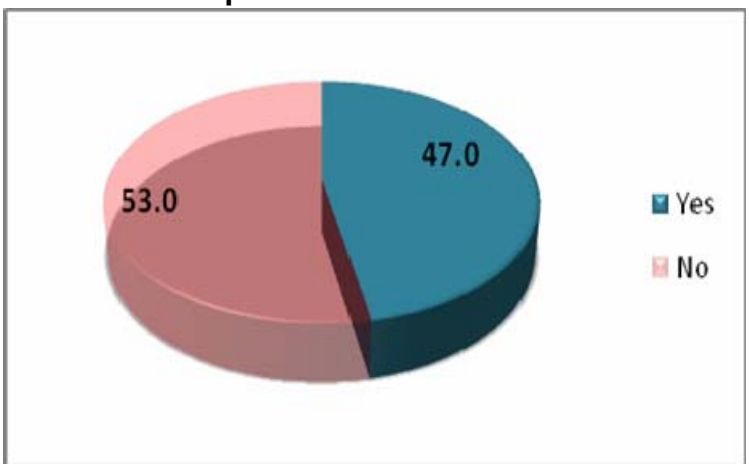


Figure2. Would you cultivate food crops from seed having insect poison in it to control pest

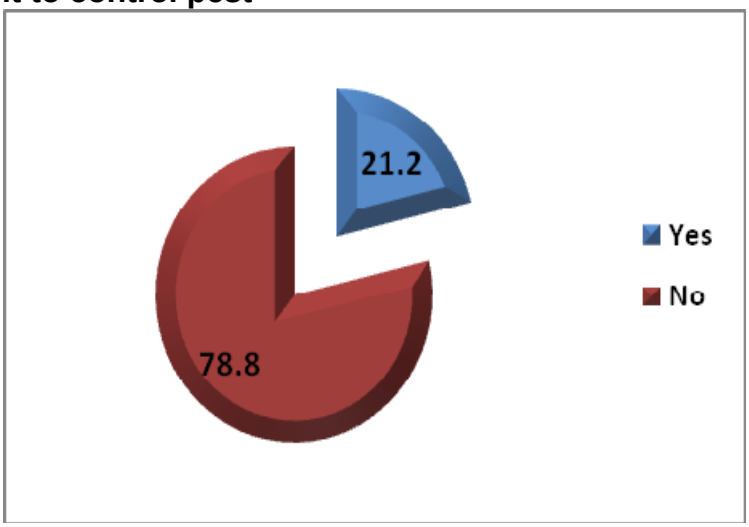


Figure 3. Will you use new types of seeds if you can reduce pesticide use but had to monitor the no, of pests every morning?

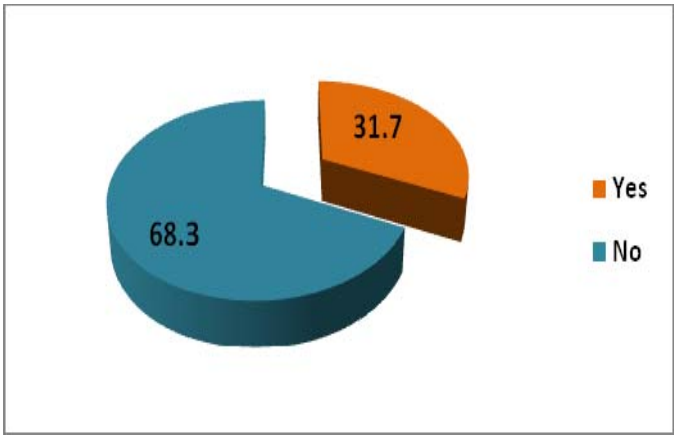


Table 2. Will you use chemicals that would kill all weeds but also kill

	Freq	% yes
Surrounding plants	746	18.4
Medicinal plants	262	6.5
Fodder plants	617	15.2
Saag & Leafy greens	537	13.3
Mixed cropping was impossible	738	18.2
Base Total	4,052	100.0

Figure 4.Do you feel free to choose your seed?

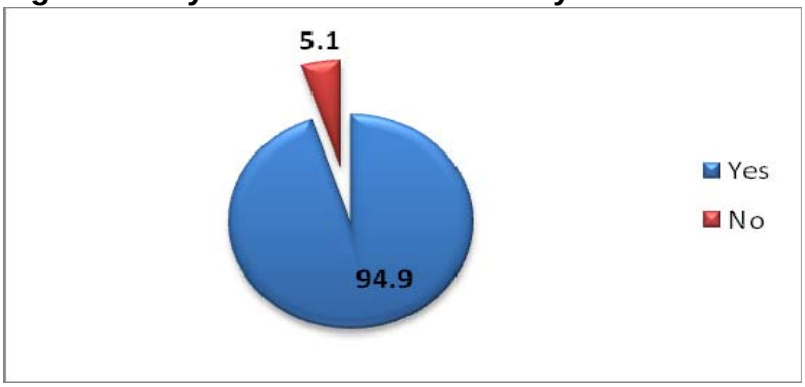


Figure 5. Who influences your choice of inputs

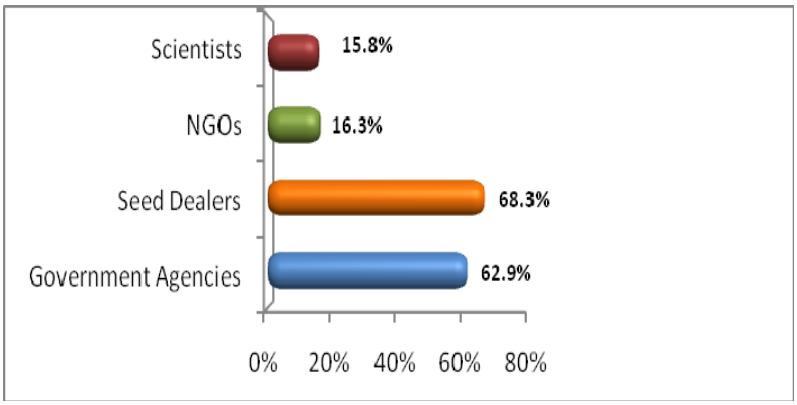


Table 3. Who do you trust most as a source of Information

Who do you trust most as a source of Information		
	Low	High
Government Agencies	12.8	87.2
Seed Dealers	18.8	81.2
NGOs	71.0	29.0
Scientists	61.5	38.5
Media	52	48.0
Base Total	4,052	

Figure 6. Would you eat new foods that were highly nutritious but were grown from seed containing animal or insects parts

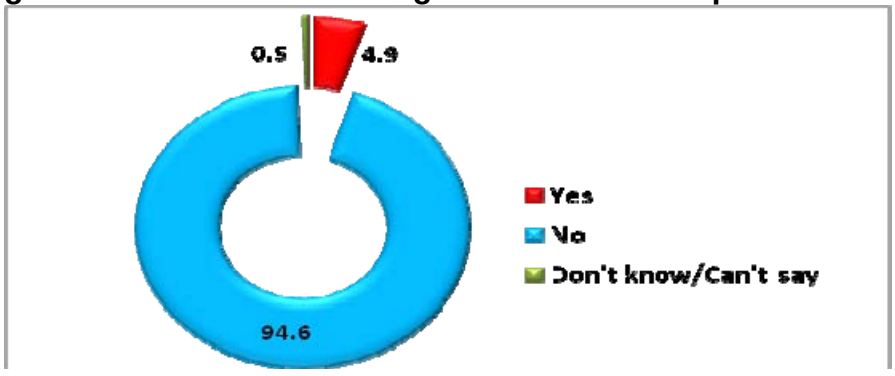


Figure 7. If new seeds are created that have benefits but also risks, who should regulate/monitor these seeds?

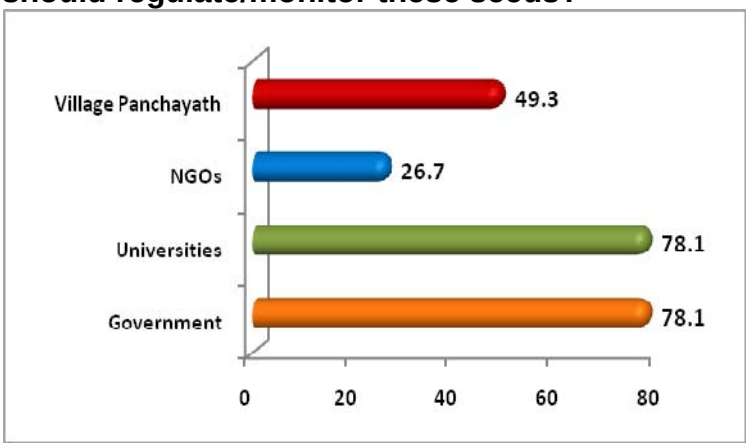


Figure 8. Did you notice any harmful effects of Bt cotton on

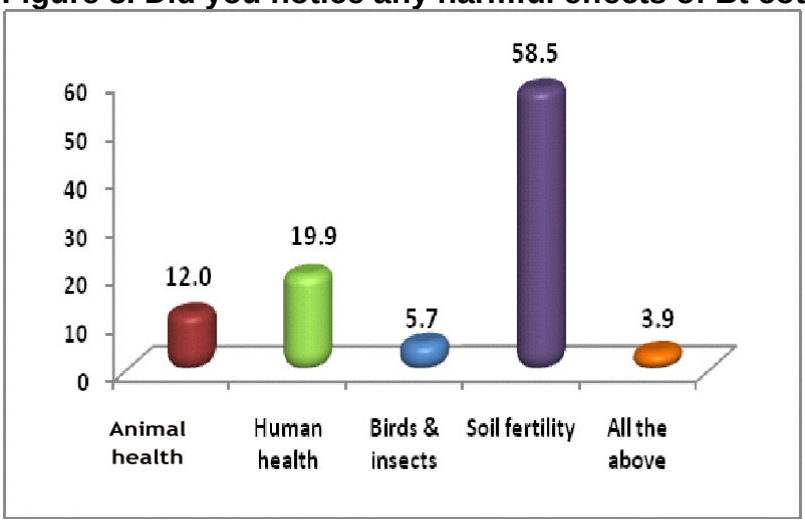


Table 4. Are you satisfied with the following

	Satisfied	Not Satisfied	Can't Say	Total Respondents
Quality of seeds	84.3	14.3	1.4	2,054
Fertilizers	70.2	29.3	0.5	2,053
Pesticides	65.0	33.5	1.5	2,053
Others	37.4	19.5	43.1	527

Table 5. Will you use seed if

	Yes	NO	Total Respondents
Yield is high but grains cant be stored long	70.1	29.9	2,053
Yield is medium/low but grains can be stored long	24.3	75.7	2,051
Earth worms &friendly insects are killed	20.4	79.6	2,052
Yield is high but grain is uneven	25.7	74.3	2051
Yield is high but taste is poor	26.7	73.3	2067

Consumer Responses

Figure 9. Have you heard about GM food?

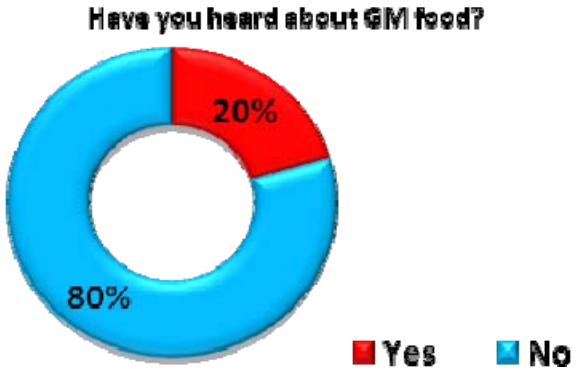


Figure 10. Do you think that GM foods are available in the market?

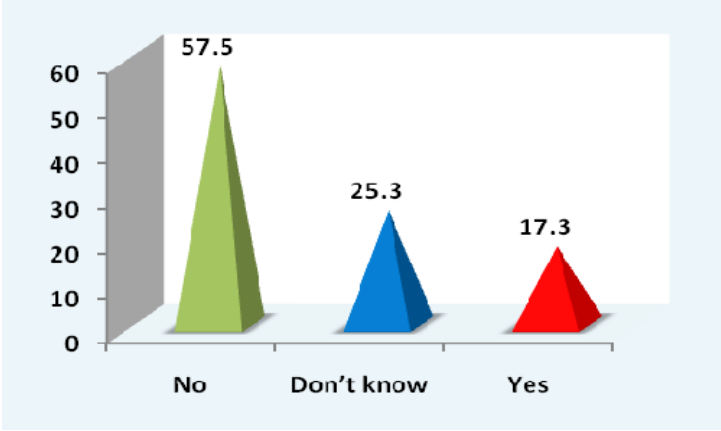


Figure 11. Have you heard about the benefits of GM food?

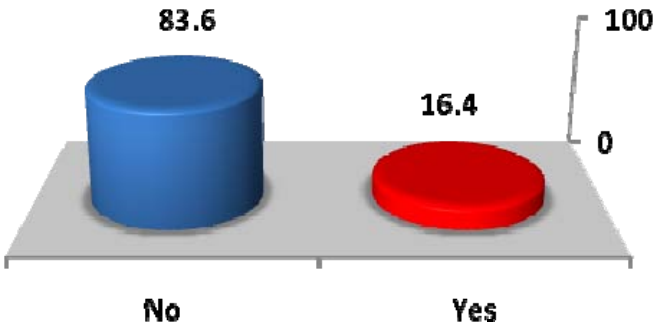


Figure 12. Have you heard about any risks related to GM food?

Figure 13. Who do you think benefits most from the use of GM foods?

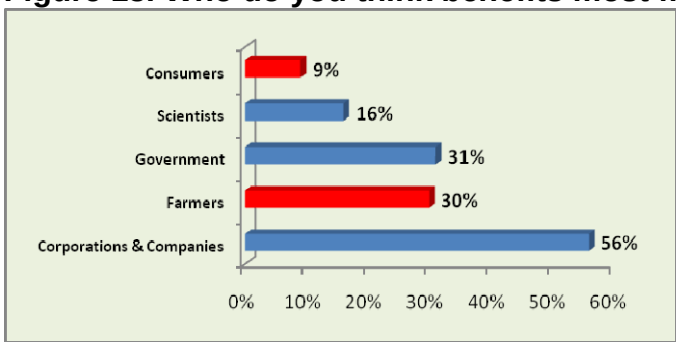


Table 6. Do you think.

Do you think.			
	Agree	**Can't Say**	**Disagree**
GM Crops tamper with nature	28.5	60.1	11.4
More research needed, Inadequate knowledge	64	30.2	5.9
Unsafe For Health	19.5	65.6	14.8
Harmful to Environment	16.5	66.4	17.1
Violate Social values	18.1	67.6	14.3

Figure 14. Do you think consumers have the right to know about the ingredients in food?

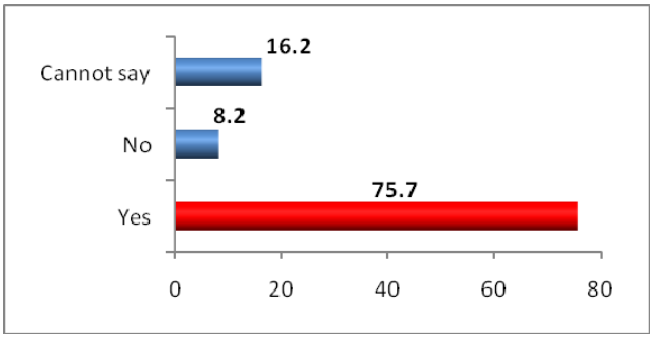


Figure 15. Do you think GM food is labeled in India?

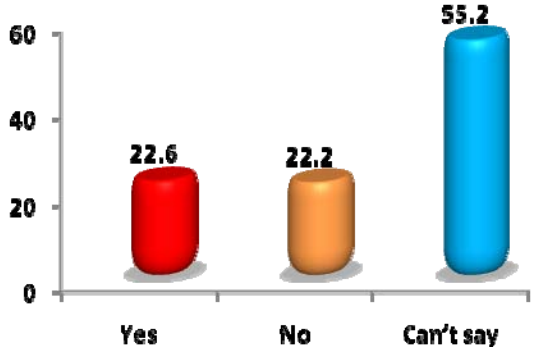


Figure 16. Who should ensure labeling of GM foods?

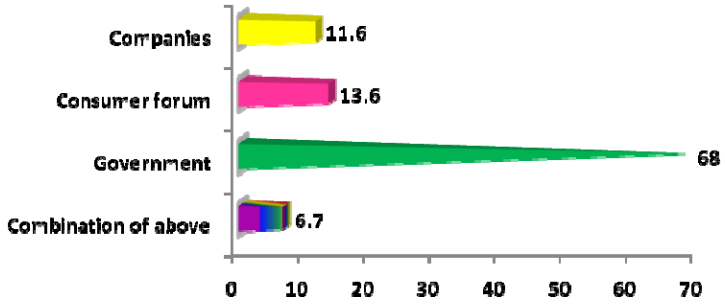


Figure 17. Do you think GM foods/crops are being tested adequately?

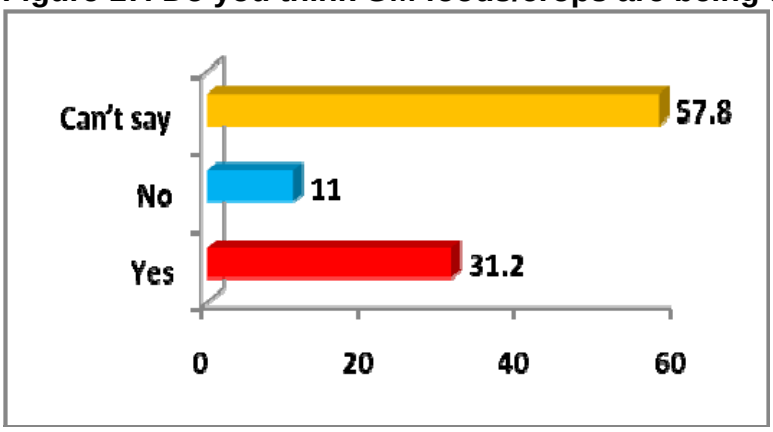


Figure 18. Who is testing these?

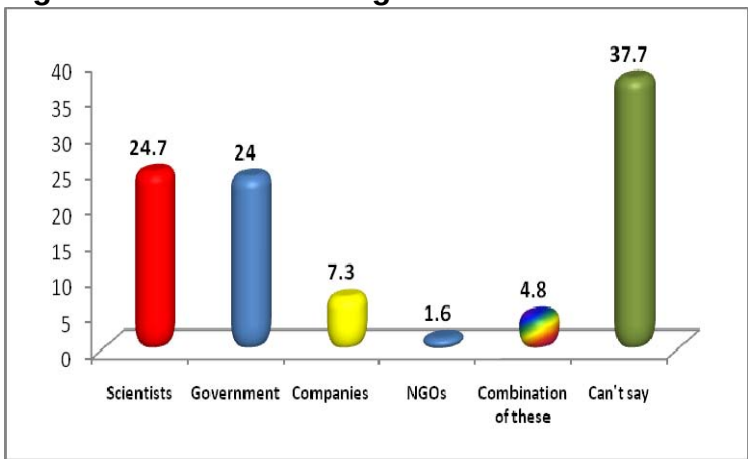


Figure 19. Whose testing would you trust most?

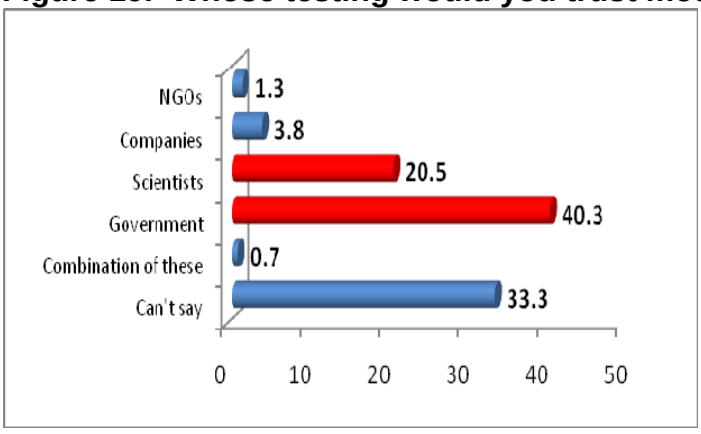


Figure 20. Do you think some agency should monitor the long term effects of GM food on public health?

Figure 21. Who should do this monitoring?

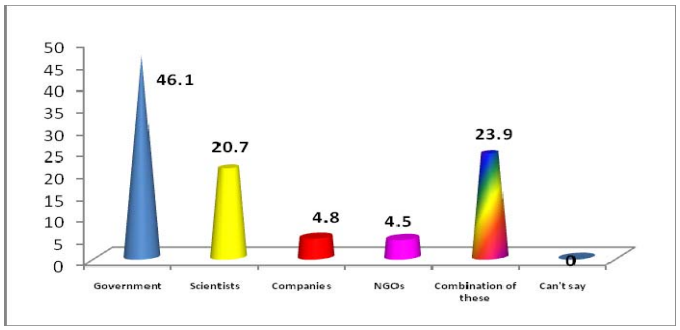


Figure 22. What feature of food is most important to you?

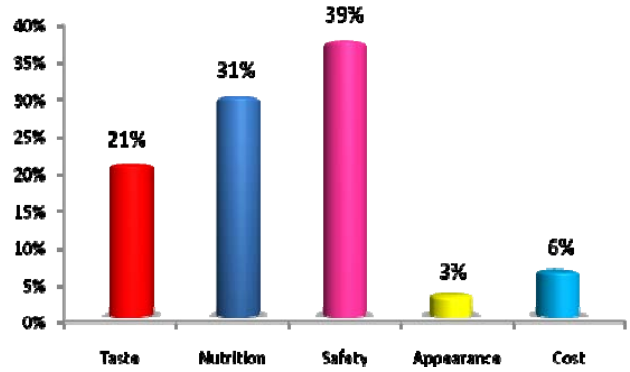


Table 7. Who according to you provides the most reliable information on GM foods?

	Freq	%
Government	2046	80.2
NGOs	699	27.4
Media	1618	63.5
Companies	841	33
Scientists	1376	54

Key Findings from FGDs and Interviews

Urban Consumers

Q. What are GM Crops?

- Related to Biotechnology example Bt cotton.
- Has something to do with putting something artificial in vegetables to make them grow big.
- They are unnatural.

- Tomatoes in the market are genetically modified. GM tomatoes are very nice looking, but no taste at all.
- Worried that GM foods would have negative effects.
- Willing to consume GM foods, provided all tests for safety have been conducted.
- If GM could give me freedom from pesticides, I will eat it.
- Would such products be safe for us?

- Will consume GM food if it is cheap.
- Vegetarians opposed to eating GM foods that have a gene from insects and animals.
- "I will get nightmares imagining insects running inside my stomach".
- Most not averse to GM food with genes from other plants.
- "If it will be a better crop, I have no taboos. Educated people do not have taboos like this".

- Non-vegetarians also opposed to GM food with genes from cows and pigs.
- Risks in the long-term to health and environment.
- Genetic engineering could lead to genetic disorders.
- Who knows what unknown evils this new technology will bring?

- Specialised knowledge needed to conduct tests to rule out risks.
- Bottom-line is we should not tamper too much with nature.

Students

- Have heard of GE but don't know how it is done.
- It involves taking gene from a resistant species and incorporating into the desired variety.
- GE gives disease resistance. We also get more production. Regarding taste, I am not so sure.

- Productivity is better in hybrids.
- Don't think that hybrid tastes good; it only increases the yield.
- Food in the villages is better in quality.
- Bt cotton, is a good technology, has reduced expenditure on insecticides.

- Bt technology will have to be very fast to cope with new problems. When one pest is suppressed, other pests are going to come.

- In Bt cotton, mealy bug has become an even worse problem. Does GM technology have the solution for that?

- When we introduce a new technology in India, it must be suited to its conditions.
- There are many contradictory studies. We do not know whom to believe.
- Media carries two kinds of articles: pro and anti GM technology.

- The cow is sacred. Eating food with cow genes would be outside the acceptable behaviour of society.
- Common man is concerned with meeting basic needs. If GM food is cheap, he will eat it.

- Before launching such products, there should be proper tests.
- We are eating food with high pesticide residue. We can survive GM food too with all its harmful effects.

Senior media

- In the government promoting GM technology, I see murder of all democratic values as GM is being pushed by eliminating all other choices by taking off from the markets hybrids, local varieties etc. which are affordable. As a journalist trying to chronicle this whole process, I find this absurd and suspicious. I suspect this is because; there is a huge margin in case of Bt seeds.(J.H.)

- It is a very controversial technology. Apart from isolated meetings and seminars, there is hardly any awareness on this issue among the general public.

- Though farmers in Punjab cultivate Bt cotton, they do not have knowledge about it. Farmers have great faith in PAU.

- If PAU asks farmers to cultivate Bt, crops they will do so. (SSB)

- While the public sector is not able to get clearance for their indigenously grown Bt seeds, Monsanto gets about 75 varieties of Bt Cotton cleared in a single meeting. There must be huge exchange of kickbacks for such approvals. (S.B.)

- I don't know how good GM technology will be? Would it eliminate the need for pesticides altogether? As far as I know, Bt is effective against only one pest, but what about other pests? (CW)

- The need of the hour is sustainable agriculture which does not destroy the land and the water.

- India requires home- grown, sustainable technologies to suit our needs rather than blindly borrowing technology from the West.

- Bt technology cannot be held solely responsible for the agriculture crisis. There was a crisis even before Bt was introduced. But now the crisis situation has reached its peak, and Bt did not alleviate the crisis.

- GM technology will not be readily accepted by urban consumers. People are not willing to experiment with another new technology and repeat their experience with pesticides. They have realized the value of organics.

- The issue is not GM technology, but making the terms of trade fair for the farmer. If the government wants farmers to adopt GM technology, then it should fix atleast Rs 5,000/qt as the minimum procurement price.

- The media in Maharashtra have played an active role in promoting GM technology. The media has become “saleable”. It no more plays a neutral role but is in cahoots with the MNCs, it has played a role in promotion of Bt cotton. JH & W.

Agriculture officials

- Bt cotton was not tested properly before release because it was introduced by private companies. They took short-cuts to make more profits in a short period.

- The government machinery was not involved in any way in the release of Bt cotton to farmers.

- The companies did not provide any demonstrations of Bt cotton to the farmers before releasing the seed.

- No stake-holders were consulted on the issue of Bt cotton,

- Public institutions like the (ICAR) and agricultural universities have no role in the development of GM crops in India.

- If there were to be negative impacts from the cultivation or consumption of GM crops, there is no agency where one could register a complaint

---

- Stringent measures will not be implemented rigorously because the multinational companies are determined to promote their seeds at any cost; they can buy anyone in the system.
- An autonomous cell/structure like the Election Commission is the only way to implement measures stringently.

Flavour of the Stakeholder Discussions captured in 9 themes

- Farmers have been using high yielding varieties and hybrid seed in a package consisting of chemical fertilizers and pesticides, irrigation and institutional credit.

- They have been using more and more chemical fertilizers and pesticides to maintain the productivity levels. As a consequence, the gains of productivity have been getting eroded because of the increasing costs of chemical fertilizers and pesticides. It has reached a stage where farmers could no longer afford to procure the inputs. They also mentioned that there has been decline in the fertility of soil.

- The government was the source of the information for most of the farmers and a majority of them said that they trust government the most when it came to seeking information and advice.

- Most of all farmers want new technologies in improvement in productivity. However, they made a distinction in terms of traditional food cultivated by using traditional varieties of seed, organic methods of cultivation and the food grown by using hybrid seed, and modern technology, chemical fertilizers and pesticides. Traditional food, including wheat, rice, vegetables according to the farmers tastes better, is more nutritious and harmless in contrast to food produced by hybrid seed and which tastes different or taste-less. Traditional chicken tastes good in contrast to farm grown broiler chicken.

- When the farmers were asked about Bt cotton, they were unaware of what Bt stood for. Similarly, they were unaware whether Bt seeds had been tested for safety or even whether it was necessary for them to be tested. They adopted Bt cotton as they were told that it would enhance yield. They did not know that Bt is a crop protection

technology. It was projected as a high yielding variety by the companies and the government agencies.

- Most farmers were unaware of GM foods or if there were health and environment risks associated with them.

- A large number of farmers said that they would use seeds that increases productivity, even if the seed or the grain cannot be stored for long. Those who refused to use such seeds mentioned that the food produced from it, did not have taste and aroma, nor was it attractive to look at.

Specific Issues raised in the debates

1. ***GM crops increase yield and are necessary for ensuring food security.***

    - Increased yield and productivity from Bt seed is a myth. There is no correct and scientific proof that Bt seed increases the yield of food and it does not provide for food security.

    - There has been no systematic research on the benefits or risks associated with GM technology.

    - GM crops have not alleviated the problem of hunger and scarcity of food. On the contrary it has resulted in an increase in the number of farmer's suicides.

    - The real problem lies in the distribution of food, not increasing food production. Even if GM technology enabled farmers to produce hundreds of quintals food, the hunger problem will still be prevalent.

    - There is no need to increase the food production by introducing GM technology.

- The green revolution is tapering off and we need to take adequate steps to increase the yield and improve the food distribution system. However, the increase should be both of the yield in terms of production as well as income to the farmer.

- Companies involved in GM seed production are mainly concentrating on Bt crops. They should also develop seeds which are resistant to droughts and floods. These kind of GM seeds will increase crop production and be more important for food security and solving the problem of hunger.

- India is already producing enough food and therefore there is no need for GM food.

- This technology creates foods that may be unsafe so why take the risk .

- An increase in the yield is not possible with a single gene, it requires multiple genes. Pest control could be possible with using one gene like Bt.

- To increase production, we must look at genetic potential of the crop. If the genetic potential of the crop can be improved, then the yield will definitely increase. But GM technology so far has not got any genes which are required to increase the yield. Most of the genes incorporated in GM technology can control some pest to a certain degree and therefore there may be some marginal increase in the yield due the pest control, but GM technology as such will not increase the yield in a crop.

- Yield is not a single trait. It is the sum of many traits that includes genetic potential and protection from pest. If the seeds have genetic potential and are resistant to pests then the yield will be

high, provided there are proper cultivation conditions. But in adverse conditions the seed may not give yield.

- Food production is necessary to solve the problem of hunger, without buffer stocks, food security would be a distant dream.
- Cotton yield produced by Bt cotton is double than traditional variety and the pest problem is considerably reduced, which is beneficial to the farmers.
- GM technology is against the laws of nature and the environmental impact of this technology should be assessed carefully before using it.
- There is a difference between the Green revolution and Gene revolution. The green revolution was inclusive while the gene revolution involves patenting and monopolising of rights over the genes. This process of owning genes by a private company is not acceptable.

2. GM technology – benefits and risks

- The cost of research in GM technology is very high. Research is being done only on Bt crops like brinjal, tomato and potato and there is no encouragement by the government to facilitate research in other fields. Indian Council of Agricultural Research (ICAR) does not have a vision for GM technology. Private companies encourage research in areas that are commercially interesting, not interesting for food security.
- Public –private partnership in GM technology should be encouraged to produce crops for food security.

- In India cotton is the only GM crop available, though there are number of crops at various stages of research. Institutions in the public domain are also involved in lot of research.

- Funding for bio safety and regulatory testing is always a problem. ICAR does not give funds for this. Private companies also do not want to do biosafety testing.

- Public institutions must be strengthened, by providing more Government funds for research.

- Public institutions cannot compete with Monsanto. Only they will do research for the needs of people.

- The regulatory system for GM technology is very poor in the country. Public Institutions should take up research on seeds which are drought and flood resistant, because the MNC's are not willing to take up this kind of research as it is not profitable for them.

- GM technology has its advantages and disadvantages, but the important question that needs to be answered is whether such a technology is beneficial to our society as a whole.

- There is no inbuilt mechanism in the proposal to provide for funding. While applying for research funding to ICAR or DBT, a proposal has to be written with the technical details. But there is little or no provision to get funds for biosafety testing.

- Funding for regulation should be mandatory and in built in every research proposal.

- The sole aim of MNCs is to earn profit and they are not concerned about the needs of the poor people.

- Technology should be in the control of public institutions, not in the hands of a few companies.

- According to some of the panellists, not all private companies are making profits. But then the question that arises is how are the private companies able to undertake research in this field?

- Research in public institutions is more honest, without taking shortcuts because in public institutions the salary is fixed and paid irrespective of the commercialisation of technologies. In private companies remunerations are linked to the performance of the research staff and the commercial success of the new seed. In such a situation, shortcuts are taken and safety testing is not done properly because there is a pressure to demonstrate success and market the new seed.

- GM crops are being permitted for commercialisation without adequate testing for safety. There must be a proper process to test for all kinds of risks.

- Some panellists felt, Bt seeds are not expensive for farmers as it helps in reducing the cost of pesticides.

- Labelling of GM food should be mandatory. If the private companies do not have anything to hide, they should not have any hesitation in labelling their products and disclosing the ingredients they have used.

- People should have choice and therefore there should be both traditional/organic food as well as GM food in the market.

- Labelling should be introduced, but only after products have been fully tested.

3. **Testing of GM Products**

- According to some agriculture officials, GM technology was not properly tested as it was introduced by private companies and not by the government.
- No stake holders were consulted before introducing GM technology in the market.
- Public institutions like ICAR and other agricultural universities play no role in the development of GM crops in India as private companies produce most of the genetically modified seed.
- There is no need to introduce Bt Brinjal, as there is no shortage of brinjals in India and there is a movement against the introduction of the same.
- 60-70% of the brinjal crop could not be sold due to the pest damage, causing great economic loss to the farmers. The movement against Bt brinjal is only being created by activists. In the future we will have many GM crops.
- Traditional knowledge should be given due importance and we should not interfere in the natural process of cultivating crops.
- There is a hesitation to label GM food because the required tests for safety are not being conducted before they are released in to market.
- The emphasis in India should be on sustainable agriculture which is appropriate for the Indian climate and Indian farmers.
- Replacing traditional crop varieties with GM crops is not good for soil health.

- Genes of pollinators like bees, flowers that bees choose for nectar and plants emerging out of the seeds created from the flowers may be modified and the toxins may affect pollinators also.

- A policy on GM technology should take into account the biodiversity of the area.

- Pollen from GM plant can be harmful for pollinators like bees and butterflies. This will have a negative impact on crops as well as honey.

4. Consumer attitude to GM foods.

- There is a general lack of trust amongst the consumers about consuming GM food as there is a lack of transparency in the system.

- If the consumers are better informed about GM crops, they will oppose it even more.

- Educating and informing the consumers about GM food should be a priority for the government.

- Tests for safety of GM foods should be conducted in a transparent way so that people can place their trust in the technology. GM is a new technology and opposing labelling is proof that the companies him selves have doubts about the safety of the technology.

- Labelling of GM food requires it to be packaged. This itself may result in a loss of nutrition.

- An authentic and autonomous nodal agency should be created to conduct research and provide genuine information about research results to all stakeholders. This agency should be independent of vested interest, and free from political interference.

- The majority of people are not aware of GM food. Therefore there is a need to educate people on a massive scale.
- Consumers are quite unaware of what GM crops are, they have only a vague idea that it has something to do with biotechnology and are not natural foods.
- Consumers would be willing to consume GM food, if they were sure the food had been tested properly and there was no risk of it being harmful for health.
- GM foods should not be introduced into the market until consumers are educated enough about this technology to be able to make a real choice.
- Consumers may be willing to eat GM food if it was cheaper, but the cost factor would remain secondary to cultural and religious sentiments. Vegetarians would not eat GM food produced from seed contain insect or animal genes, even if it was cheap. Even non-vegetarians would be averse to consuming GM food if they were produced from seed contain genes from cows and pigs, if their religion had food taboos. .
- Eating GM food may lead to genetic disorders in the long run.
- There are many contradictory studies on the benefits and risks associated with GM crops . One does not know who to believe
- GM foods may not be more dangerous than the food we are already consuming, which already contains high amount of pesticide

5. The involvement of the media

- Coverage about science and technology is negligible in TV channels or in the print media, even though there is public interest in these subjects.
- According to some journalists, the reason there is no coverage of GM food in the media is because nobody is interested in reading about the effects of GM food.
- Media is not concerned about the effects of GM crops and therefore there is little or no coverage about GM foods in the media.
- There is a need to recruit journalists with a science background so that they can provide information about GM food.
- Scientists and experts who are familiar with science should take responsibility of providing information to media. Media on its own cannot acquire science related information.
- All information related to new technologies should be posted on a website so that media or other writers would be able to access it for reporting in the mainstream media.
- Information given in vernacular magazines are not authenticated, they publish information without verification.
- The media is playing an active role in promoting GM technology instead of discussing the pros and cons of the technology.
- The government is getting kickbacks for clearing Bt crops, otherwise how is it possible that Bt crops of the private companies are approved in a single meeting? But the public sector does not get clearance for crops they are developing.

6. **Using genes from animals like pigs and cows to produce GM crops**

    - Any food or medicine with such genes would be acceptable only if there was a critical need, but people have to first be convinced about the need of G M food.

    - Religious minded people may raise a hue and cry about using pig and cow genes. Linking science and religion always creates problem, but informing people about the benefits of using food containing different genes will help.

7. **People are unreasonable when they ask for risk free food, that can never happen**

    - There is no food which is risk free and people are willing to consume such food even when they know about the health risks associated with it.

    - Is it appropriate to ban a product, if one section of people oppose it?

8. **Farmers are the greatest beneficiaries of GM crops**

        - GM crops will benefit farmers, only if they are produced by public institutions and not by private companies. If G M seeds are supplied by the government, at low cost and if they are not harmful to the health or environment, the farmers and people will benefit.

        - Bt technology is good as it has helped the farmers reduce the expenditure on pesticides and increased the yield.

        - Three thousand crores have been given as subsidy to G M seeds, particularly for Bt cotton by the Andhra Pradesh government during one year. Why should government subsidise private companies.

- Farmers are benefiting from GM crops. GM food is the future and we should not discourage its use.
- Every farmer need not produce GM crops.
- GM seeds are often spurious.
- Government needs to control the private companies, it should not be the other way round, where seed companies are controlling the government
- If farmers are unable to get desired yield, they are compelled to commit suicide. Unless companies give a reliable product, the farmers will incur heavy losses. Companies must be punished heavily if their seed not good.
- There is no public awareness about the effects of GM crops.
- Even though GM is a controversial technology, the government has been trying hard to push it through by removing all other kids of more affordable hybrid seeds.

9. **NGOs provide accurate and authentic information on G M foods**

- Not all NGOs provide authentic information and even though they can be an important source of information and can act as a bridge between the government and the farmers.
- We have to encourage good NGOs and discourage bad NGOs.

VI. NOTES WITH THE FINAL NARRATIVE REPORT

Title : - Public Knowledge, Attitudes and Perceptions towards Genetically Modified Organisms in India

Key words- GMOs, GM technology, GM foods, Farmer, Consumer, Attitudes, Perceptions , India

An overview of the major research findings of the study on Attitudes and Perceptions to Ag biotechnology in India are given below

Research Highlights – Farmers

- Most farmers are more willing to cultivate cash crops with modified seed than they are to cultivate food crops with such seed. Attitude to food is conservative, there is a sacredness attached to food. Most farmers are not very willing to cultivate food crops with seed they perceive as not natural, neither are they very willing to eat such food.
- About 40% of the farmers studied said they would be willing to cultivate cash crops with modified seed. But 80 % of the farmers said they would not cultivate food crops from seeds containing a poison to control pests. The response was consistent across big and small farmers and educated and uneducated farmers.
- Soil fertility and high yield are very highly valued by farmers, as is biodiversity. The farmer is not willing to sacrifice these for other benefits offered by a technology, for instance better pest and weed control or reduction in use of pesticides.

- Half the farmers admit pesticides only partly control pests but most (70%) farmers do not want pesticides that will control all pests but negatively affect soil fertility.
- About 80- 90% of farmers said they would not use technology (HT seeds) that allowed the use of chemicals to control all weeds effortlessly but also destroyed surrounding flora (medicinal plants, fodder plants, leafy greens etc) . Farmers were also not inclined to cultivate crops with seeds that would not allow mixed cropping. This is not surprising since rural and farming communities in India use biodiversity in a number of ways. “Weeds” are not useless plants. They constitute either leafy green vegetables for the family or green fodder for the livestock that the family keeps. Surrounding flora also yields the valuable medicinal plants on which the community depends for health and veterinary care.
- The perception that food grown from seed that is ‘modified’ with animal or insect parts is different to food grown from other, normal seed, is seen across all age groups and educational status. This kind of food is viewed as “tampered”, not natural and not desirable. Farmers across the board rejected food that may be nutritious if it was grown from ‘modified’ or ‘tampered’ seed. The arguments of scientists and proponents of GM technology who argue that DNA is the same everywhere and for instance, insect DNA is no different to other DNA, will have to acknowledge the perception of people who make this distinction ! Policy makers must be sensitive to the findings that food grown from seed that is viewed as “modified” in some fundamental way may not be acceptable to rural communities. Going only by the “science based evidence” approach clearly does not take on peoples’ concern especially in an agrarian society like India with deep seated cultural and religious connotations about food.
- A section of food insufficient farmers (very small land holdings or landless) said they would not be averse to eating food grown from modified seed since they often eat substandard food. It would be cynical to construe this as acceptance of food they also consider ‘tampered’.

- Most farmers however, across all ages and education levels said they would never offer such 'modified' food in temples or use it at religious ceremonies and festivals; they would also not serve such food at their daughter's wedding feast ! The cultural embededness and conservatism associated with food is clearly demonstrated here. There is a lesson for policy makers here.
- There were interesting revelations about the agencies that farmers trust. Government was found to be the most trusted source of information and materials. The majority of farmers (87.3 per cent) across all age and education groups trusted the government more than any other institution. Seed dealers come next and scientists come third, followed by the media. The least trusted source of information were found to be the NGOs.
- In the same vein, farmers said they would take the advice of government agencies and seed dealers on selecting seed and other inputs but not of NGOs or university scientists.
- Farmers said that the government and scientists must regulate and monitor new technologies.
- The high trust in government is found across all age groups and levels of education.
- Equally the distrust of NGOs is also seen across age groups and levels of education. Scientist seem to have lost the link with farmers. There is no extension system and scientists from agricultural universities in the region seldom go to the field. For the farmer, the scientist has lost the pre eminent position he enjoyed during the days of the green revolution.

***Research Highlights* – Consumers**

- Awareness about GM crops and foods is very low among urban consumers. Even among the middle class which is educated and exposed to the media, internet and sources of information, about 80 per cent of the consumers studied had not heard of GM food.

- The study found that most consumers are not clear about what exactly GM foods are or how they are produced . Consumers have not heard much either about the risks or the benefits associated with GM foods.
- Consumers are actively aware that they must have the right to chose their food and feel they have these rights.
- Most consumers felt strongly that not enough information is available about the risks and benefits of GM foods and that much more research is needed.
- Consumers overwhelmingly thought that they did not benefit from GM foods but that companies were the prime beneficiaries.
- There is confusion about whether GM foods are labeled or not in India. Some consumers said they were, others thought they were not.
- Consumers thought that 'large' vegetables like tomatoes and cauliflowers were GM. They said these were not natural and were tasteless. Consumers also mentioned in many places that the ready to eat boiled corn dishes sold in the market were American and GM.
- Consumers place the highest priority on the safety of the food, followed by nutrition and taste in that order. Any modification that would affect safety of the food would not be acceptable to most.
- As seen in the case of farmers, consumers trust the government most as a source of information and materials, like farmers again, the least trust is placed in NGOs.
- Consumers are clear they want government to have control of regulation and monitoring of new technologies , seeds, etc. The pattern of trust is repeated with government being on top and NGOs at the bottom, with media in between. Scientists are not as distrusted by consumers as they are by the farmers.
- This poor awareness about GM food and how it is produced must be seen in the context of current government policy that is preparing to release GM foods (Bt brinjal) to a population which is uninformed and therefore unable to exercise any kind of choice. Attempts to introduce GM foods into a situation where the majority of the population is not aware of the nature of

GM foods nor of their benefits and risks is not democratic or enlightened policy making.

Key Lessons

It is seen from the study that food is embedded deeply in a cultural and religious context in India. There are cultural and religious taboos that still manifest, irrespective of educational and economic status. The position held in many circles and articulated by government policy makers and companies alike, is that people oppose GM foods because they are ignorant about them and that a good 'awareness' program will rectify this. This presumes that knowledge and awareness about the benefits of GM crops will automatically convince farmers and consumers alike, of their attractiveness and provide an incentive to accept them. This view also came up in some of our FGDs with scientists and professionals. The study results however show that the context of food is so clearly cultural that better knowledge about it is unlikely to change fundamentally held perceptions. Vegetarians for instance will not eat chicken soup however clear the scientific evidence that it is good for health. Similarly, people of a particular religious persuasion that have food taboos , will not eat taboo flesh for instance, irrespective of the scientific evidence that animal protein is more or less the same, regardless of its source.

The overwhelming sentiment with respect to food is guided by cultural –religious factors, rather than a rational analysis of the benefits of a particular food. Not unsurprising that attitudes to cash crops are more relaxed than to food crops but even there, the notion of 'tampering' in some way with the seed, is met with resistance and farmers have reservations.

The sanctity of food is underlined by the clear articulation in the rural communities that any food that had been transformed in the way that GM foods are , would be unacceptable for special ceremonies and religious festivals. People said they

would not offer such food to God in religious festivals or serve it on special occasions like a wedding feast when guests are served the best. With such strong cultural beliefs and sentiments about food, the introduction of GM food without the approval of communities, will amount to a betrayal of their cultural rights. The government must take note that validating the safety and appropriateness of GM foods by pure science ('science based evidence') may work for gear boxes but is meaningless in the context of food. Such an approach negates all the complex and nuanced attributes of food that exist for communities .It violates the civilizational and cultural rights of communities to have a complete say over the food they wish to eat…and reject.

Consumers grappling with an overdose of pesticides and its deleterious effects have developed a cynicism in a situation which is out of their control. This is most strongly seen in Punjab, a state known to be suffering from very high incidences of cancer, physical deformities and other ailments, resulting, it is likely, from the heavy pesticide load in its agriculture and food. Their statements that ' if we can survive pesticides, we can survive GM foods' is not indicative of any acceptance but of deep cynicism and dejection at the degradation of their food.

Gender does not seem to be a big determinant of attitudes to GM foods, it is the cultural and religious context that is dominant. In the farming community, age appeared to most influence decisions and attitudes to seed, fertilizer and pesticide, with younger farmers being more willing to take risks or exhibiting less conservative attitudes to eating tampered food. The other determinant was poverty. Resistance to food that was considered tampered, was lower in smaller, poorer farmers who mentioned they would eat the food that was available, even if it was not optimal.

Amongst consumers too, scientists and professionals could not be distinguished in their responses on the basis of gender. Homemakers, who were largely women, placed a greater emphasis on the safety and nutrition of food and displayed a

reluctance to bring home foods that were not natural. But women and men were equally cynical when they said that if they could survive pesticides in their food, they could survive GM foods too.

The perception about the place of government and the trust and reliance placed in it, probably has many skeins. According to the study , it is the agency in which the most number of people have the greatest trust, they see it as an agency that can be relied on to protect their interests (agency that should monitor safety of foods). The attitude to government can probably be split into what is actually received from government in terms of benefits and the recognition/ expectation that it is the government's job to perform this function (ensure well being of citizen).

In rural India, it is the government that brings in all the major benefits, whether it is irrigation, food aid, more recently the National Rural Employment Guarantee Act or any of the many food and other support systems like Mid Day Meal Schemes, Take Home Rations for mothers etc. However imperfect its delivery, the agency providing benefits is seen to be the government. At the same time there is the acknowledgement that the levels of corruption are high and this eats into citizen entitlements.

The government must be humbled by the trust placed in it by the country's farmers and consumers with respect to agriculture and food technologies. This trust should propel government agencies to be that much more conscientious in discharging their duties and responsibilities as is expected from them, to safeguard the public interest.

There is a lesson for the NGO community here that seems to be losing the trust of substantial sections of people in this study. Across all states studied, the NGO community seemed to enjoy the least amount of trust amongst government agencies, companies, scientists and media. This is worrisome since there are several excellent NGOs doing outstanding work, particularly in rural areas and

specially in the sector of food and livelihoods. Despite this, a perception seems to be gaining ground in many places that NGOs are not necessarily providing authentic information or working actively to protect the community's interests. In the case of urban consumers, the discussions threw up a divergence of views about information on GMOs. Many felt that NGOs provide useful, reliable information, others felt that NGOs doctored their information, like the companies did, to suit their ideology.

The NGO community has a very special place in society which it must struggle to keep. It is to them that society had given its trust to be its representatives and articulate their causes and concerns to government and others. If the NGO community is to recapture its relevance for the communities it seeks to serve, it must introspect and develop ways to do things differently, to regain the trust that it must continue to have.

Problems faced:

We organized training and capacity building programs in universities, including the graduate and post graduate students as also faculty. This was to build capacity for further research of the kind done in this study. Although responses to our meetings were enthusiastic, the adoption of such research themes for masters and doctoral work has not been as much as we would hope. Part of the reason is the trend among traditionally trained social and political science faculty to stay with conventional social and political science subjects. Their reluctance to approach new themes like GMOs is linked to their own lack of familiarity with the subject. This is the first ever social science research study on GMOs and it has broken new ground. We anticipate a lag period before others too begun to do studies of this and related kind.

Another problem we faced was in the field. Heads of field research units that did the data collection said that because there is so little awareness about GMOs in India (among field staff, farmers and consumers), that it took a lot of time to get

clarity about the logic behind the survey questions and what essentially they were trying to elicit. Hence it took time to get fully into the rhythm of the questions asked and the FGDs and to get good responses. These problems are not illogical for a field of study as new as this.

Conclusion

We hope that the outcome of this research will contribute to improved dialogue, and promote rational decision making in the field of Ag biotechnology and GM crops and food. This is unlikely to happen without a properly researched and well articulated advocacy program. Policy and attitude changes do not often result from the evidence of good research alone. A sustained advocacy is required to persuade policy makers that change is beneficial in the larger interest.

The research findings would be most profitably used if they would help the biotechnology policy development process in the country by taking into account the societal contexts of technology adoption. The perceptions of people and their views on technologies will have to be taken into account if technology adoption is to be rational, unbiased, not promoting any specific stakes but genuinely seeking to strengthen the public interest. We also hope that this study leads to further research to understand how to make technology choices responsive to public needs and public opinions.

VII PROJECT OUTCOMES

- Meetings
    - Inception Meeting
    - Methodology Meeting
    - Stakeholder's Meeting
- Training and capacity building workshop at Central University, Hyderabad
- Project report on Public Knowledge, Attitudes and Perceptions towards Genetically Modified Organisms in India.
- Briefing Papers
    - Analysis of Media Reportage of GMOs
    - Analysis of the Engagement of Political Leaders with GMOs
    - Why Studying Attitudes and Perceptions towards GMOs in India is Important?
    - Stakeholders Responses to main Research Findings of KAP Study on Ag Biotechnology in India

- Interactive Website - http://www.genecampaign.org/kap
- Report of Stakeholder Consultations on KAP Research Results