International Journal of Agriculture, Environment and Biotechnology
Citation: IJAEB: 8(3): 753-761 September 2015
DOI Number: 10.5958/2230-732X.2015.00083.2

Farmers perception, knowledge and attitude towards Biotech (GM) crops at Agrowon AgriExpo – A survey.

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Paper No. 368 Received: 24 April 2014 Accepted: 24 August 2015

Abstract

Public including farmers perceptions about Biotech Crops (GM crops) is influenced by a broad range of issues, including environmental safety, ethics, cultural diversity, political environment, educational status, religious conviction, legal repercussions, economic gain, and socioeconomic impact. The present survey was done to spread the awareness about GM crops and Agriculture Biotechnology among the farmers and to know the extent of farmer's perception, knowledge, readiness and support for genetically modified crops and biotechnological applications. Face-to-face questionnaire survey was conducted with randomly selected 173 farmer respondents. The results of the survey revealed that the farmers are ready to adopt GM crops for plantation as it offers improved yield in low production cost and would like to promote the GM food to the consumers, but combined appropriate policies, awareness and communications strategy, effective regulatory system is need of time to cope with the ever-increasing misconception spread by the anti-GM lobby without any scientific background. GM crops concerns coined by the anti-GM crops sightseer visited to the "Agri Biotechnology and GM crop awareness" stall at Agrowon AgriExpo - 2014 were noted and satisfactory scientifically based answers were given. The finding of the study can help policymakers for designing the GM crop awareness system considering the farmers interest.

Highlights

- There has been no survey-cum-awareness studies conducted in an Agri-Expo hosting diverse farmer population.
- This stduy reveals that farmers are willing to adop and promote the GM crops as it offers improved yield in low production cost.
- Self sustaining long term awareness programme is need of time to avoid misguidance and delay in adoption of GM crop in India.

Keywords: Genetically Modified (GM) crops, perception, survey, agri-biotechnology and Bt crop.

The biotechnology implies an approach of creation, invention and innovation. Biotechnological tools can be used to improve and conserve agriculture, horticulture, animals, medicine and environment (Patidar at al. 2013). A genetic modification is a special set of gene technology that alters the genetic machinery of such living organisms as animals, plants or microorganisms. Combining genes from different organisms is known as recombinant DNA technology and the resulting organism is said to be 'Genetically modified (GM)', 'Genetically engineered' or 'transgenic' (Bawa and Anilkumar 2012). The technology which creates such organisms, often called as "Modern Biotechnology" or "Gene Technology", sometimes also "Recombinant DNA Technology" (Girija and Radha 2012).

People tend to fear what they don't understand and biotechnology is something a lot of people assume is too technical or too complicated to comprehend (Mahaletchumy and Brian 2015). Over Past decade, India has become the focal point of one of the biggest GM debate (Sanjeev and Gangadharappa 2010). Environmentalist, scientist, spiritualist, social workers, politicians, farmers, lobbyists, spiritualist, social workers and major corporates have all joined in the debate including social media is at the center stage and conclusive discussion is always whether to fully introduce GM crops into the nation's agriculture. The first genetically modified plant was produced in 1983, using antibiotic resistant tobacco plant (Bawa and Anilkumar 2012). The first commercially grown genetically modified whole food crop, tomato (Flavr Sarv); which made tomato resistant to rotting, was released in the market in 1994 without any special labeling in the USA. Later in 1995 Bt trait had been introduced in the commercially grown crops principally Cotton (Girija and Radha 2012). 21 years has been passed since commercialization of GM crops, India is still not able to introduce the GM food crops and only one success was the commercialize the Bt cotton since 2002. Major reason to this disparity is lack of awareness or awareness strategy design in India leads to timely delay in introduction GM food crops.

Norman E. Borlaug, Nobel Prize Laureate for Pease and Father of Green revolution, 1970: stated that "…no food products, whether produced with recombinant DNA technology or more traditional methods, are totally without risk (Borlaug 2000)". According to the father of Green revolution of India Dr. M. S. Swaminathan (2005), among the frontier technology relevant to the next stage in our agricultural revolution, the foremost is agricultural biotechnology. Most certainly, agricultural scientist and leader have a moral obligation to warn the political, educationalist, and religious leader about magnitude and seriousness of the arable land, food, and population problems that lie ahead even with breakthrough in biotechnology (Wisniewski *et al.* 2002).

Many research and research reviews all around the world has been devoted for assessing the farmer's and consumer's relationship with regard to attitude, perception, knowledge and status of need of awareness about Biotech (GM) crops (Clive 2014, Bawa and Anilkumar 2012, Sanjeev and Gangadharappa 2010, Wisniewski *et al.* 2002, Pangilinan and Bagunu 2015, Girija and Radha 2012, Kikulwe, Wesseler and Falck-Zepeda 2011, Kagai 2011, Tegegne *et al.* 2013 and Uzogara 2000). These research pointed out that the information reaching the end users and producers of GM crops should be informative, easy to understand and user-friendly. Some of research concluded that farmer's and consumer's attitude towards risk and benefit about GM crops is still mixed and differ within across different countries. Some studies found out that Farmer's and consumer's perceptions about Biotechnology and GM crops influenced the decision of policy makers in the respective country and responsible for delay in the approval process. Consumers who are familiar with government policy and have basic knowledge and share information on GM crop are more likely to approve of the technology than those who not. It has been shown and proved by many studies that there is direct association between increasing knowledge of GM technology and increase support for GM applications. It has been found by some survey designs that lack of scientific

knowledge and voice of scientist during debate about risk and benefit in various forms of media has also exhibited an confusion among the farmers and consumers, about the safety of the GM crops. There is no unequivocal evidence that genetically modified crops harm our health or the environment-yet there is an intense debate about their value and safety (Jha *et al.* 2012).

Reading is learning, seeing is believing, but doing is knowing which leads to knowledge (Clive 2014). This cycle of knowledge is very useful while spreading the awareness about GM Crops. Is spite of the potential benefit of GM crops in developing countries, their adoption is still negatively affected by public opinion including anti-GM lobby groups (Qaim 2009). Major contradiction found in European consumers generally are not against the pharmaceuticals products of biotechnology e. g. GMO derived Vaccines, but are much less willing to accept food and food ingredients derived from GM crops (Moses 1999). The "Green Revolution" led to a rapid increase in food production between the 1950s and the 1990s, but the total food production and per capita availability of food have become almost stagnant for the past decade. Therefore, there is a need to harness all the technologies, including biotechnology, for a sustainable growth in agriculture for food security (Sharma 2008).

In male dominant Agricultural communities in developing countries the female perception about GM crops has been taken for granted, their opinion will make a difference as an when it comes to adoption of GM crops as food. Females, especially from developing countries, are generally less knowledgeable, less interested, and less supportive of science and technology than males (Anunda *et al.* 2010). Female farmers should be targeted by various means, including language and message packaging (Kagai 2011). Creating effective linkage between GM crops enthusiastic extension agents, corporates, scientists, consumers and farmers will enhance the trust over the GM technology. The result suggests the need for introducing biotechnology awareness issues in relevant college course offerings. Public perception is likely to have a great impact on innovation, introduction, and diffusion of products of biotechnology and negative public perception is likely to keep the products of biotechnology away from the marketplace. Public opinion can be influenced by nonscientific consirations based on impressions created by the media and pressure groups (Sharma 2008). The objective of the study was to use "Agrowon AgriExpo" platform to know the status of knoweldge and readiness of the farmer about use of GM crops for cultivation and consumptions as food. Simultaneously, awareness was done about benefit of Agri-biotechnology and GM crops and the problems in GM crop adoption becuase of missconception and myths spread by anti-GM loby in India.

Material and Methods

Survey area

Agrowon AgriExpo – 2014 was organized by Sakal media group during 12th to 16th November 2014 at College of Agriculture, Pune (Plate 1). This event is being organized at same location since last eight years. Near about two lakh rural and urban farmers from all over Maharashtra gets an opportunity to share a common platform with about 300 Agri Industry player which includes national and international agri fraternity, consulate generals, researchers and scientists, decision makers, policy farmers, Agri Entrepreneur and corporates. The main objective of this event is to sensitize farmers about new advancement in the field of agriculture. The event was organised on four hector area by installing 250 stalls and brought opportunity to different agriculture related personal to present their product in front of the diverse farmer community.

Advertisement of the event

The event publicity had been done all over Maharashtra through daily newspapers, television advertisement, radio announcement, bulk sms, promotive mobile vehicles, printed promotion through leaflets, handbills, posters, banners,

danglers, e-promotions through mobile apps, website, mailers, portals and personalize invitations in view that every corner of the villages would get the event information. This Agrowon AgriExpo – 2014 platform was used for doing a survey of farmers perception, knowledge and attitudes towards GM crops and awareness was spread among the farmers about GM crops.

Data Collections and analysis

The study was done by installing the stall titled as "Agri-Biotechnology and GM crop awareness" at Agrowon AgriExpo – 2014 and data collection was done by face-to-face interviews with the farmers and distributing formal pre-tested questionnaires (Plate 2 and 3). Data were collected by two methods, i. e. on the spot interviews of the farmers visited the stall and randomly selected farmers by six volunteers spread across the area of Agrowon AgriExpo. Respondents were made aware about the objective of study and were asked to recall their knowledge about biotechnology and GM crops before introducing them to the questionnaires. Similar study was done Pangilinan and Bagunu 2015 to know the farmers (only males) perception towards genetically modofied crops and modification was done in current study that the both male and female respondents were considered. The questionnaire was designed in such a way that it would represent the respondents perception, knowledge and attitudes towards GM crops and about 173 randomly selected farmers were interviewed during six days of the event. Questionnaire was formated in local Marathi language and some copies of Hind and English language were also kept for noting down the responses of the farmers. Responses of the farmers through questionnaires were analyzed using descriptive statistics. Perception was analyzed by giving them option tick whether they are "Aware" or "Not Aware" about particular phenomenon related to GM crops. Knowledge and attitudes towards GM crops was analyzed by allowing them to choose options, i.e. "Agree", "Disagree" and "Neutral" to the Statements. (Kagai 2011).

Results and Discussion

Farmers perception (Table 1)

Face-to-face interview through the questionnaire depicted that about 82 % of the total 173 farmers were aware about biotechnology. It was observed that 94% of respondents were conscious about the Bt cotton ("Bt cotton" has become vernacular name to the GM cotton in Maharashtra since its introduction from 2002). It was encouraging to observe that near about 77% were aware about GM crop, which concludes that farmers are aware about different traits, but still about 23 % were unaware that these introduced traits collectively in a crop responsible for naming it as GM crops.

About 64% of the farmers were aware about Department of Biotechnology, New Delhi (DBT) an apex governmental body working for commercialization of Biotech Products in India. 64% awareness among the farmers is encouraging as the DBT has been working extensively and providing support to Biotech related research and its awareness since its inception (Figure 1)

Farmers knowledge and attitude towards GM crop (Table 2)

GM crops was first introduced worldwide primarily with an aim of to increase the productivity and offering solutions to world food problems for which during the survey it has been found that 82 % respondents agreed while 5 % disagreed to the statement and 13 % liked to be remaine neutral to this statement. (Figure 2) Day by day fast food loving population increasing which creates major health issues in children and adults, nutritious food is a need of time, when asked about GM technology can create foods with enhanced nutritional value out of 173 farmers evaluated 77% agreed and 18 % and 5 % remains stand out and disagree to the question, respectively.

The major hurdle to any GM crops approval procedure is its nature friendliness, to this the respondents replied with 65% positiveness and 13% remained

negative towards the question, while 22 did not want to comment on the issue. 25 % farmers agreed to the statement that GM technology makers are playing with God's or tempering with nature, even though 53 % disagree and 22 loved to remain silent on the issue. Unequal response in terms of, i.e. 31 agree, 47 disagree and 21 neutral response was observed to the statement that GM products are being forced on developing counties by industrial developed countries, which depicts that anti-GM crops lobby introducing irrelevant and novel myths each year which creates confusion among the farmers. 62 % of the farmers were observed to be disagreed towards the issue that GM products do not benefit small scale farmers, however 17 % and 20 % farmers were agree and remain neutral to the issue, respectively.

Plates 1-3: Agrowon Agri-Expo 2014 entrance (Plate 1). Face-to-face interviews with the farmers and distributing formal pre-tested questionnaires (Plate 2 and 3).

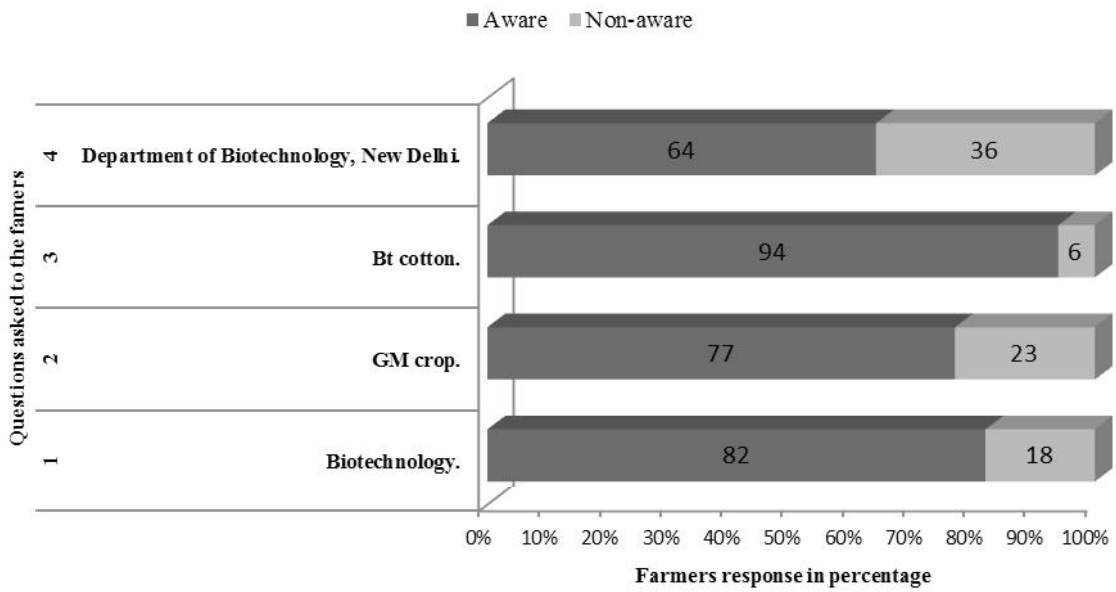

Fig. 1. Percentage of the farmers perception towards GM crops.

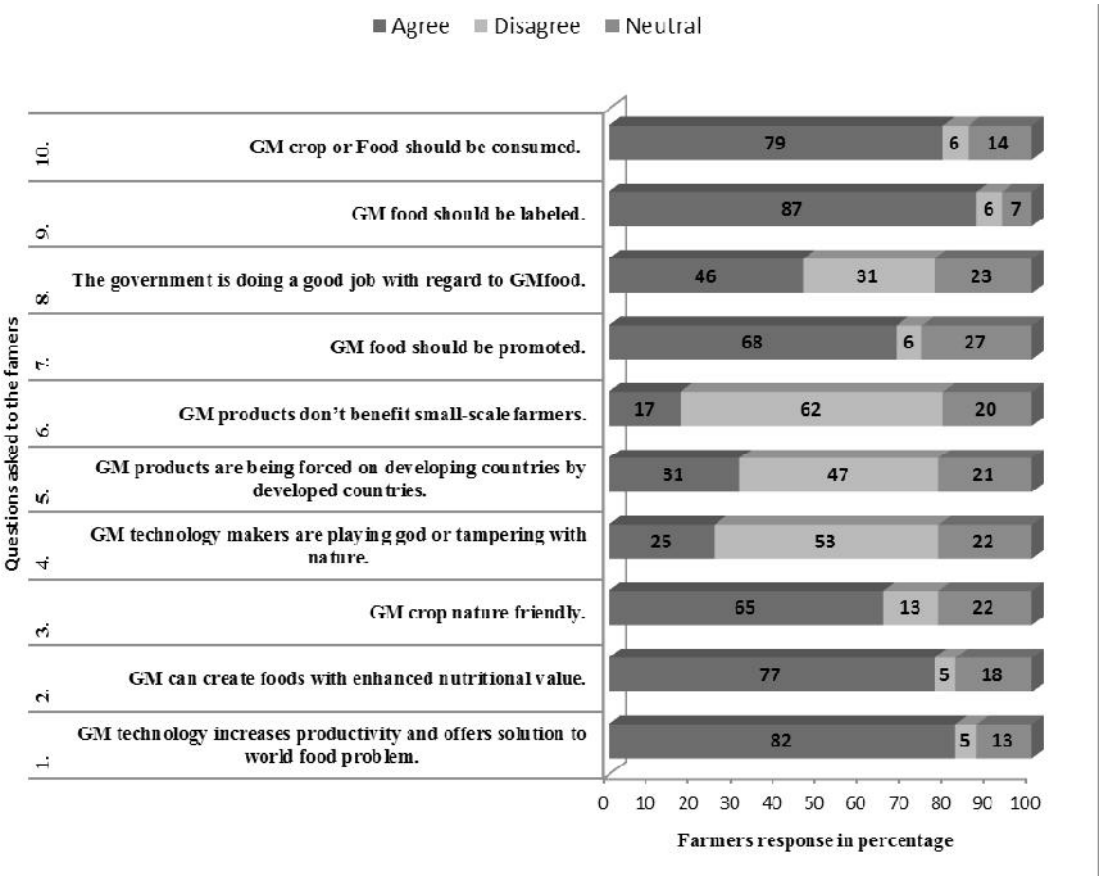

Fig. 2. Percentage of the farmers knowledge and attitude towards GM crops.

Table 1. Farmers perception towards Biotechnology

Sr. No.	Statement	No. of Farmers (173)		% of Farmers response	
		Aware	Non-aware	Aware	Non-aware
1.	Biotechnology.	139	34	82	18
2.	GM crop.	131	42	77	23
3.	Bt cotton.	159	14	94	6
4.	Department of Biotechnology, New Delhi.	108	65	64	36

Table 2. Farmers knowledge and attitude towards GM crops.

Sr. No.	Statement	No. of Farmers (173)			% of Farmers response		
		Agree	Disagree	Neutral	Agree	Disagree	Neutral
1.	GM technology increases productivity and offers solution to world food problem.	142	8	23	82	5	13
2.	GM can create foods with enhanced nutritional value.	133	9	31	77	5	18
3.	GM crop nature friendly.	113	22	38	65	13	22
4.	GM technology makers are playing god or tampering with nature.	44	91	38	25	53	22
5.	GM products are being forced on developing countries by developed countries.	54	82	37	31	47	21
6.	GM products don't benefit small-scale farmers.	30	108	35	17	62	20
7.	GM food should be promoted.	117	10	46	68	6	27
8.	The government is doing a good job with regard to GMfood.	80	53	40	46	31	23
9.	GM food should be labeled.	151	10	12	87	6	7
10.	GM crop or Food should be consumed.	137	11	25	79	6	14

Confusing i.e. 46% agree, 31% disagree and 23% neutral response among the farmers was observed in the direction of the status of government's decisions and policies making at itude towards GM crops. It was majorly because in India there is no uniform structure for approval of GM crop, the government has given freedom to individual state in the country for making decision towards approval of GM crop. Despite this fact about 68 % of the farmers would be happy to promote the GM crop, but considerable, i.e. 27 % were found not able to decide. In India no GM crops has been introduce as a food, but still 79% observed to support for consumption food products derived from GM crops, and 14% farmers were found to wait and watch situation with 6% disagree to do so. When it comes towards the consumers rights towards, what to eat, the question comes to mind whether farmers should support to the label their product as a GM food; to this question during survey, farmers maturity and responsiveness observed, when 87% response was towards labeling as a GM food to the GM crop derived product.

Conclusion

Over all study reveals that farmers are highly supportive to Agri-biotechnological applications and ready for cultivation of GM crops, which is contrary to popular misbeliefs and media's false projections about safety of GM crops, but still a proper long-term structure of awareness is needed for maintaining unprejudiced nature towards the new technology in agriculture. Improvement should be made in information sharing, supply of authentic information and routes of delivery. Information should reach to the end user in easy to understandable and user-friendly manner. Policymakers should make common policies for approval and testing of GM crops all over India which results in surge

of trust among the farmer and will eliminate the ambiguities. Delays in implementation of GM technology in food crops are due to unstructured awareness and debunking myths spread by the opponents. India has huge number of institution offering life science related course, this force who understands the mechanism of development and safety of GM crops should be assigned the work of awareness of GM crops among the farmers and consumer. Tegegne *et al.* 2013 suggested that the need for introducing biotechnology issues in relevant college course offerings; students in the biological sciences has bet er knowledge and hence less fear of biotechnology and further concluded that respondents with backgrounds in agriculture seemed to favor biotechnology products compared to others. Clive, 2014 noted in his report that, the successful approval and commercialization of Bt Brinjal in Bangladesh, is an excellent working model for other small developing countries, and it could not have been achieved without strong political will and support from government, particularly from Ministry of Agriculture. An appropriate blend of biotechnology and good agricultural practices offer an enormous advantage to India and can make India benefit by becoming a major food basket for the world (Jagadish MN 2012). At the end combined appropriate policies, awareness and communications strategy, effective regulatory system will be the only solution to the GM crop chaos, which had been spread by anti-GM crops community since last three decade all over the world.

GM crops concerns coined by the anti-GM crop sightseer and volunteers visited the "Agri Biotechnology and GM crop awareness" stall at Agrowon AgriExpo – 2014, Pune.

1. Consumption of Bt cot on leaf results in death of bollworm similarly it would create major health problem in human or other organisms.
2. GM crops seed developing companies would create monopoly over their product, results in economic burden on farmers of developing countries as they have purchase new seed every year.
3. GM crop would make soil infertile results in decrease in production.
4. Creating of GM crop is tampering with nature and interfering with Gods work.
5. In India particularly in Maharashtra farmers commenting suicide af er incorporation of BT cot on.
6. Traditional varieties will be soon endangered due use of GM varieties.
7. Use of GM crops could affect the biodiversity.
8. Threat of origin of super weeds.
9. India does not need GM crops as we self-sufficient in crop and food production.
10. Consuming of GM food causes allergy and infertility.
11. GM crops could be helpful of increase in production, but the quality would be compromised.
12. Use of GM crop results in increase in production leads overproduction as compared to demand, would result in less market value to the product. Farmers will be affected at the end.
13. Use of pest resistant GM crop results in development of resistant pest in future.
14. GM crops would fail in sensory evaluation, as India is diverse country. GM crop alters the traditional taste, colour and fragrance of the crops.
15. GM crops could damage the non-target insects and would eliminate the beneficial insects.
16. Organic farming is being threatened because of pollen transfer from GM crops.
17. Ethical values would be compromised as use of animal genes in plant and vice versa.
18. Use GM crops are enforced by developed countries on developing one.

19. Developed countries are now using GM crops as animal fodder and production of biodiesel and not for human consumption. They are moving towards Non GM crops and importing the non GM food from non GM crops grower developing counties.

Acknowledgements

This study and awarenss was done by installing stall at Agrowon Agri-Expo funded by Department of Biotechnology, New Delhi Ministry of Science and Technology, Govt. of India (Proposal code - DBT/CTEP/03/201400598) is greatly acknowledged. The authors would like to thank all the farmers for their cooperation in the fact to face-to-face data collection.

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