



Perception towards genetically modified crops of the local farmers in Magalang, Pampanga, Philippines: a basis for an intervention program on GM crops

Christian R. Pangilinan^{1,2*}, Jacqueline V. Bagunu²

¹College of Arts and Sciences, Manila Central University, Caloocan City 1400, Philippines

²College of Arts and Sciences Graduate Studies, Pampanga State Agricultural University, Magalang, Pampanga 2011, Philippines

*Corresponding author E-mail: chtianbiol@gmail.com

Copyright © 2015 Christian R. Pangilinan, Jacqueline V. Bagunu. This is an open access article distributed under the [Creative Commons Attribution License](#), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Abstract

This descriptive research was undertaken to unveil the perception of the local farmers in Magalang, Pampanga towards GM crops with the aid of a written survey instrument administered to respondents from February to March 2014. In general, it was observed that despite inadequate information regarding GM crops, their implication and impact on human health, environment and economy, and their ambivalent view about the improved nutritional quality and other health benefits of GM crops, the farmers in Magalang, Pampanga consider GM crops safe for human consumption and a solution for food security. The respondents are very positive with regards to the improved yield and low production cost that these GM crops can offer. This suggests that the local farmers are primarily concerned with the quantity of produce as well as profit of their farming activity, their business and livelihood, rather than the quality of the produce in terms of effect on human health and the environment. Lastly, the local farmers are willing to accept, to adopt and to patronize GM crops. Findings from this research can serve as a basis for an intervention program that the local government or other organizations can initiate to address local farmers' perception regarding GM crops.

Keywords: Farmers; Food Security; GM Crops; Intervention Program; Magalang Pampanga.

1. Introduction

The introduction of genetically modified (GM) crops to the market in the mid-1990s [1] has led to one of the most controversial issues today, in the agricultural science community—the alteration or modification of the genetic material of crops for increase productivity, and performance as well as the adjustment of their nutritional value. Many experts believed that this breakthrough will bring many benefits not only for farmers but, also for all consumers as a whole and many countries are now exploiting the benefits that these GM crops may offer. However, there are many questions arising from the utilization of these GM crops for food consumption and its effect on human health and safety as well as the environment.

Plants have been used in agriculture, in which the DNA has been customized are named Genetically Modified Crops or GM crops. Generally, the genetic engineering technique is used to introduce a new trait to the plant which does not naturally occur in the species [2]. Changes in the crop's genetic material may generate a wide array of benefits such as protection of these crops from environmental stresses, attacks from pathogenic microorganisms and insect infestations [3]. Also, some GM crops have improved nutritional value that are deficient from the diets of the populace such as the golden rice with enhanced levels of β-carotene that helps prevent vitamin A deficiency [4]. In biopharmaceutical, plants such as potatoes have been genetically modified to produce vaccines that are edible against pathogenic *E. coli* [4, 5] and in Boyce Thompson Institute for Plant Research at Cornell University, banana trees and tomato plants have been genetically engineered to generate vaccines in their fruit [6].

Despite the great advantages brought about by these GM crops, issues concerning the hazards that these crops may pose to the environment and human health are drastically arising. In the environmental perspective such as in the case of

Bt corn derived from *Bacillus thuringiensis*, the protein Bt delta endotoxin produced that is intended to kill pest larvae [7] may also kill Monarch butterfly larvae (*Danaus plexippus*) and other non-target species such as black swallowtail larvae (*Papilio polyxenes*) [8, 9]. Human health is also in risk when we are talking about genetically modified food derived from GM crops or by consuming GM crops itself. For instance, a gene introduced into a plant may cause the development of new allergen or may cause an allergic reaction in susceptible individuals. One study demonstrated that Brazil-nut gene spliced into soybeans could induce potentially fatal allergies in humans allergic to Brazil nuts [10]. Additionally, foods and crops that have been introduced with antibiotic resistant genes might produce detrimental effects in the sense that consumption of these GM crops might reduce the efficiency of antibiotics to fight bacterial diseases; antibiotic resistant genes generate enzymes that degrade antibiotics and that antibiotic resistant genes might be transmitted to human pathogens, making them resistant to antibiotics [11]. In contrast to the increase in nutritional value of some GM crops, other literature suggests that there is also a reduction of concentration of certain compounds [12] such as in the case of soybeans that have lower level of phytoestrogen compounds known to have protective effect against heart disease and cancer as compared to the usual strain [13].

In the Philippines, despite of many controversies arising from the hazards of these GM crops, there have been many GM crops approved for field trial, production and consumption with golden rice as one of the GM crops being developed [14]. Yet, in the year 2013, the group SIKWAL-GMO opposing the cultivation of GM crops has destroyed 1,000 square meters of the golden rice in Bicol region [15]. Many researches here and abroad were conducted to elucidate the understanding, acceptance and perception of the public particularly the consumers with regards to GM foods and crops. Even in the Christian ethical perspective, GM crops have been scrutinized [16]. However, there have been no study conducted with regards to farmers' perception on the utilization of GM crops in a rural area, particularly in the town of Magalang, Pampanga, Philippines; hence this study.

2. Methodology

This research has employed the descriptive-survey method in order to assess the farmers' perception on genetically modified crops with the aid of a written survey instrument or questionnaire. The questionnaire was administered through one-on-one interview conducted by the researcher with the participants. This was undertaken from February to March 2014 in selected barangays in the town of Magalang, Pampanga. Prior to the administration of Part II of the questionnaire, the author made a brief introduction on genetically modified organisms to help the local farmers understand the implication, advantages and disadvantages of GM crops as well as the status on its cultivation and commercialization here and abroad.

2.1. The respondents

One hundred (100) local male farmers in the town of Magalang were the target respondents in this study. Only four (4) representative barangays where the farmers reside were selected. Twenty five (25) percent of the respondents were from Barangay Ayala, twenty five (25) per cent from Barangay Turu, twenty five (25) per cent from Barangay Sto Niño and another twenty five (25) percent from Barangay San Vicente.

2.2. The questionnaire

The survey questionnaire was composed of three (3) parts in which the level of understanding of the participants, their perception or awareness on GM crops and the willingness to adopt and patronize the technology were taken into consideration. Part I is composed of five (5) questions regarding the knowledge that the participants have with regards to GM crops. Part II focuses on the perception and awareness of the participants with respect to the health, economic and environmental impact of GM crops which is composed of ten (10) questions. Lastly, Part III, which is composed of five (5) questions focused on the willingness of the participants to embrace the use and cultivation of GM crops. Demographic profile such as age, number of years in farming and crops currently cultivated was also considered. The respondents were asked to indicate their level of agreement to the survey questions using a 5-point Likert scale.

2.3. Interpretation and analysis of data

The data gathered were analyzed following the rule of the Five Point Likert Scale. Strongly disagree was scored as one (1), disagree as two (2), neutral as three (3), agree as four (4) and strongly agree as five (5). The mean of the answers from the test questionnaire was calculated per question or statement. The mean obtained was interpreted based on the scale formulated below:

Table 1: The Scale Used in the Interpretation of Data

Average/Mean	Verbal Interpretation
4.20 – 5.00	Strongly Agree
3.40 – 4.19	Agree
2.60 – 3.39	Neutral
1.80 – 2.59	Disagree
1.00 – 1.79	Strongly Disagree

3. Results and discussion

In an attempt to seek clarification on the perception of the local farmers in Magalang, Pampanga with respect to GM crops, a one-on-one interview with the farmers was conducted following the flow of questions from the survey questionnaire.

Table 2 presents the demographic profile of the respondents. A total of one hundred (100) participants from Barangay Turu, Sto Nino, San Vicente and Ayala were selected. Only one (1%) per cent of the participants is from the thirty (30) years old and below age group, eleven (11%) per cent of the respondents from the thirty-one (31) to forty (40) years old age group, twenty four (24%) per cent of the respondents from the forty-one (41) to fifty (50) years old age group and sixty four (64%) of the respondents from the fifty-one (51) and up age group. Majority of the respondents were from the fifty-one (51) and up age group with an average age of 51.64.

In terms of the length of farming experience, twelve (12%) per cent of the respondents said that they were practicing farming for not greater than twenty years (20) and twenty-two (22%) per cent of them have been farming for about twenty-one (21) to thirty (30) years. Forty-seven (47%) per cent of the participants have thirty-one (31) to forty (40) years of farming experience which constitutes the majority of the respondents and only nineteen (19%) per cent of the participants have been farming for more than forty (40) years. The most common crops currently being cultivated by almost all of the farmer respondents are rice and yellow corn which they refer to as hybrid and others referred them as Bt corn. Although they have been cultivating Bt corn to date, most of the respondents do not know that these Bt corn are actually GM crops based on the data from the interview conducted. Other plants and crops being grown were string beans, squash, okra, eggplant and tomato.

Table 2: Demographical Profile of the Farmer Respondents in Magalang, Pampanga

Age	30 and below	31-40	41-50	51 and up	Average Age
	1(1%)	11 (11%)	24 (24%)	64 (64%)	51.64
No of years in farming	20 and below	21-30	31-40	41 and up	Average No of Years
	12 (12%)	22 (22%)	47 (47%)	19 (19%)	33.83

Common crops being cultivated: Rice and Corn

As shown in table 3, the statement that the respondents know some information about GMO/GM crops obtained a mean of 2.01 which means that in general, the respondents disagreed to the statement. The statements GM crops are not natural, GM crops are product of biotechnology and that GM crops contain traits from other organisms obtained a mean of 2.20, 2.29 and 2.14 respectively. Thus, with reference to the scale on verbal interpretation previously formulated, the respondents also disagreed to those statements. Similarly, the respondents disagreed that they know about the PROs and CONs of GMOs with a mean of 1.89. These results clearly suggest that, in general, the local farmers in Magalang, Pampanga, particularly those that are from the selected barangays, think that they do not have enough technical background with respect to the emergence of GM crops, their implication and impact on human health, environment and economy.

Table 3: Knowledge of the Respondents on GMO/GM Crops

No.	Statements	Total Score	Mean	VI
3	I know that GM crops are products of science/biotechnology research.	229	2.29	D
2	I know that GM crops are not natural.	220	2.20	D
4	I know that GM crops contain traits from other organisms.	214	2.14	D
1	I know some information about GMO/GM crops.	201	2.01	D
5	I know about the PROs and CONs of GMOs.	189	1.89	D

Table 4 shows the perception and awareness of the respondents towards GMO/GM crops. The respondents agreed that "GM crops are relatively safe for human consumption" having a mean of 3.87. When it comes to the statement "GM crops will not disturb the balance of nature", the respondents are neutral with a mean of 3.16. The statements "GM crops reduce chemical pollution on soil" and "GM crops are pest resistant thus can lower production cost", obtained a mean of 3.85 and 3.68, respectively. This means that the respondents agreed to the statements. However, the respondents are neutral if "the GM crops will have improved nutritional quality" and "GM will help us boost our immunity" with a mean of 3.12 and 2.88, respectively. On the other hand, the respondents agreed to the statement that

“cultivation of GM crops is cost-effective as compared to non-GM crops” with a mean of 3.53. Also, the participants strongly agreed that “GM crops will increase crop yield” with a mean of 4.57 and they agreed that “it will be a solution for food security” (with a mean of 3.65). Lastly, the respondents are neutral to the statement “raising GM species will not affect the gene pool of that species” having a mean of 2.96, which might be due to their lack of technical information or background on GMO.

Based on the results, it was noticed, that despite their lack of information on GMO, the farmers considered them as safe for human consumption and that they can be a solution for food security. With regards to the “improved nutritional quality” and other health benefit such as the possible “immune-boosting value” of GMOs, the respondents were neutral or ambivalent consequently unsure. The respondents are very positive with regards to the improved yield and low production cost that these GM crops can offer as evidenced by their strong agreement to the statements. Clearly, while they are ambivalent about the environmental, nutritional and health benefits of GM crops, the local farmers in Magalang, Pampanga strongly believe that GM crops can result in high crop yield at lower production cost.

Table 4: Perception and Awareness of the Respondents Towards gmo/GM Crops

No.	Statements	Total Score	Mean	VI
13	GM crops will increase crop yield (high yielding).	457	4.57	SA
6	GM crops are relatively safe for human consumption.	387	3.87	A
8	GM crop production reduces chemical pollution on the soil.	385	3.85	A
9	GM crops are pest resistant thus can lower production cost.	368	3.68	A
14	Cultivation of GM crops is a solution for food security.	365	3.65	A
12	Cultivation of GM crops is cost effective as compared to non-GM crops.	353	3.53	A
7	The use of GM crops will not disturb the balance of nature.	316	3.16	N
10	GM crops have improved nutritional quality.	312	3.12	N
15	Raising GM species will not affect the gene pool of that species	296	2.96	N
11	GM crops will help us boost our immunity (i.e., edible vaccine) and in preventing diseases.	288	2.88	N

Table 5 presents the acceptance and willingness of the respondents to adopt and patronize GM crops. As shown in the table, the respondents strongly agreed to the idea of accepting field trials of new GM crops in their farm with a mean of 4.42 (SA). Likewise, the respondents agreed to the statements: (1) I will cultivate GM crops in my farm if given the resources, (2) I will buy and eat GM crops/food in the market, (3) I will encourage other farmers/consumers to cultivate/consume GM crops/foods and (4) I am willing to serve GM crops/foods to my family and friends. This clearly suggests that the local farmers of Magalang, Pampanga are very open to accept and willing to adopt and patronize GM crops.

Table 5: Acceptance and Willingness of the Respondents to Adopt and Patronize GM Crops

No.	Statements	Total Score	Mean	VI
16	I will accept field trials of new GM crops in my farm.	442	4.42	SA
17	I will cultivate GM crops in my farm if given the resources.	419	4.19	A
19	I will encourage other farmers/consumers to cultivate/consume GM crops/foods.	392	3.92	A
18	I will buy and eat GM crops/food in the market.	370	3.70	A
20	I am willing to serve GM crops/foods to my family and friends.	368	3.68	A

The level of understanding of the respondents may be attributed to the lack of information dissemination program given to the farmers despite the fact that some of the GM crops they cultivate were already GMO (Bt corn). There is reason to believe that they were not given proper awareness before these crops were introduced to them. The neutral or ambivalent concern of the respondents with regards to the nutrients and health benefits, while being affirmative to the quantity of produce and profit, can be attributed to the fact that farming is their business and livelihood and their aim is to continuously gain profit to sustain their family’s needs and the sustainability of their farming business. Likewise, their acceptance to adopt and patronize GM crops may be correlated to the statement GM crops are relatively safe for human consumption, which they agreed as well because these crops are high yielding and cost effective.

4. Conclusion

From the foregoing findings, it is evident that the local farmers in Magalang, Pampanga do not have adequate background with respect to the emergence of GM crops, their implication and impact on human health, environment and economy. This inadequacy notwithstanding, the farmers consider GM crops as safe for human consumption and a solution for food security. Plus, while they are ambivalent about improving nutritional quality, and other health benefits such as the possible immune-boosting value that the GM crops may provide, the respondents are very positive that cultivation of GM crops lowers the production cost (cost-effective) and results in high yield. This suggests that the local

farmers in Magalang, Pampanga are focused more on the quantity of produce as well as profit rather than the quality of produce, its effect on human health and the environment. Lastly, the local farmers are willing to accept, to adopt and patronize GM crops. The findings from this research can serve as a basis for an intervention program that the local government or other interested groups and organizations can initiate regarding GM crops.

Acknowledgment

Sincerest gratitude is due to the farmer respondents of Barangay Turu, Ayala, Sto Nino and San Vicente for the courtesy and hospitality given to the researchers while conducting the interview/survey.

References

- [1] Kaneko, Naoya and Chern, Wen S. (2003). Consumer Acceptance of Genetically Modified Foods: A Telephone Survey. The Ohio State University
- [2] James, Clive. (2007). "Executive Summary". Global Status of Commercialized Biotech/GM Crops: 2007. ISAAA Briefs 37. The International Service for the Acquisition of Agri-biotech Applications (ISAAA). ISBN 978-1-892456-42-7.
- [3] Conway, G. (2003). From the Green Revolution to the Biotechnology Revolution: Food for Poor People in the 21st Century. Speech at the Woodrow Wilson International Center for Scholars Director's Forum.
- [4] Nuffield Council on Bioethics. (2014). Possible benefits of GM crops in developing countries. Retrieved from: <http://www.nuffieldbioethics.org/gm-crops-developing-countries/gm-crops-developing-countries-possible-benefits-gm-crops-developing-co>. Accessed on 10 March 2014.
- [5] Mason HS, Haq TA, Clements JD, Arntzen CJ. (1998) Edible vaccine protects mice against Escherichia coli heat-labile enterotoxin (LT): potatoes expressing a synthetic LT-B gene.
- [6] Langridge, William H.R. (2000). Edible Vaccines. Scientific American, Inc. <http://dx.doi.org/10.1038/scientificamerican0900-66>.
- [7] Bessin, Ric. (2004). Bt-Corn: What It Is And How It Works. University of Kentucky College of Agriculture. Retrieved from: <http://www2.ca.uky.edu/entomology/entfacts/ef130.asp>. Accessed on 10 March 2014.
- [8] Pimentel, David S. and Raven, Peter H. (2000). Bt corn pollen impacts on nontarget Lepidoptera: Assessment of effects in nature. The National Academy of Sciences
- [9] Wraight C L, Zangerl A R, Carroll M J, Berenbaum M R. (2000). Proc Natl Acad Sci USA 97:7700–7703. <http://dx.doi.org/10.1073/pnas.130202097>.
- [10] Nordlee, J. A., Taylor, S. L., Townsend, J. A., Thomas, L. A., and Bush, R. K. 1996. Identification of a Brazil-nut allergen in transgenic soybeans. N. Engl. J. Med. 334:726–728. <http://dx.doi.org/10.1056/NEJM199603143341103>.
- [11] Bakshi, Anita. (2003). Potential Adverse Health Effects of Genetically Modified Crops. Journal of Toxicology and Environmental Health, Part B, 6:211–225, 2003.
- [12] Fagan, J.B. (1996). Assessing the safety and nutritional quality of genetically engineered foods. In Draft assessment of genetically engineered organisms in the environment, distributed by the Edmonds Institute, July 1996, to delegates to the 1st meeting of the Open-Ended Ad Hoc Working Group on Biosafety (CBD).
- [13] Lappe, M. A., and Bailey, E. B. 1999. Response to letter to the editor. Med Food. 2:281–283. <http://dx.doi.org/10.1089/jmf.1999.2.281>.
- [14] IRRI. (2014). Philippines issues GM food safety reminder. Retrieved from: <http://irri.org/blogs/item/philippines-issues-gm-food-safety-reminder>. Accessed on 11 March 2014.
- [15] Clark, Liat. (2013). Filipino farmers destroy GM crops designed to alleviate malnutrition. Retrieved from: <http://www.wired.co.uk/news/archive/2013-08/12/gm-crop-vandalism-philippines>. Accessed on 11 March 2014.
- [16] Kroger, Daniel. (2003). Genetically Modified Crops: An Assessment from a Christian Ethical Perspective. East Asian Pastoral Review. Vol 40. East Asian Pastoral Institute. Ateneo de Manila University.