

Perception of Botswana College of Agriculture (BCA) Lecturers Toward Consumption of Genetically Modified Foods (GMF) in Botswana

¹Stephen Kayode Subair and ²Ithuteng Moagisi

Department of Agricultural Education and Extension, Botswana College of Agriculture,
 University of Botswana, Private Bag 0027, Gaborone, Botswana

Abstract: A survey was conducted in August, 2006 to determine the perception of BCA Lecturers regarding the consumption of genetically modified foods in Botswana and also to determine the relationship between the perception of the respondents and their selected personal characteristics. This was a descriptive census study with all the 67 BCA Lecturers as the target population. Due to some reasons, a total of 47 Lecturers (71% of the target population) eventually participated in the study. Data were collected using a questionnaire. The questionnaire was developed by the researcher with the help of some literature. The questionnaire was validated by three researchers from a nearby Agricultural Research Station. The reliability estimate of the instrument was calculated and found to be 0.88, indicating a good degree of reliability. The data collected were analyzed using frequencies and percentages to interpret the personal characteristics of the respondents. Means, standard deviations and rankings were used to interpret the perception of Lecturers regarding the use of GMF in Botswana. Results revealed that respondents did not agree with the use of GMF in Botswana. In most of the cases, negligible relationships were found between the perception statements and the selected personal characteristics of respondents, indicating that their personal characteristics did not influence their responses towards the consumption of GMF in Botswana.

Key words: Consumption, population, questionnaire, instrument

INTRODUCTION

Due to the world population increasing to levels beyond imaginable figures, one might wonder if it is possible to provide enough food for the ever growing population. The global agricultural productivity is decreasing as a result of declining soil quality and depletion of water resources. At the moment, nations are proposing solutions to advocate practices that will promote long term productivity and sustainability of agriculture and hence reduce the risks of serious health hazards and environmental risks. Recently there is reasonable increase in concern about the ability of the international food production systems to feed the exploding world population in the twenty first century; and doing so in a way that will not cause massive environmental harm.

It is evident that farmers today produce inadequate food yet there are many mouths to feed. There have been reports of severe famine and drought especially in Africa and some people are even wondering how in the near future the world would survive if there are no changes in food production. Some expert have taken the initiative to venture into advanced food production by focusing

mainly in the filed of biotechnology. Most of their research is geared toward genetically modified food technologies^[1].

Technologies for genetically modified foods offer dramatic promise for meeting some areas of greatest challenge for the 21st century. Like all new technologies, they also pose some risks, both known and unknown. Controversies surrounding GM foods commonly focus on human and environmental factors, labeling and consumer choice, intellectual property rights, ethics, food security, poverty reduction, and environmental conservation.

Traditional breeding on the other hand is regarded as a powerful and proven technology that has contributed significantly to the abundance of agricultural production that industrialization, and most of the developing nations currently enjoy, but due to a sharp increase in the world population the technology is outweighed. It is known that traditional knowledge of cross breeding has been practiced for centuries to suit the human needs.

Recent technological advances in molecular biology have provoked reactions from different parts of the society, ranging from optimism to moral outrage and^[2]. The concern is that biotechnology is still young and needs to be revisited as the technology matures.

Genetically modified foods have received some discussions in governments, schools and industry circles, but often the concerns about the seriousness of the risks are downplayed due to the narrow perceptions by the public. Botswana seems to be on the fringe of debates taking place in other countries on the labeling of genetically modified foods. This is not yet a debatable issue in the country although Genetically Modified (GM) foods are already being sold in retail stores and supermarkets. Some supermarkets such as Woolworths have taken GM foods off from its shelves because they feel that the foods are unsafe hence were the first to address the concerns of customers by taking GM foods off their shelves. Although the issue of genetically engineered foods seemed to be of no concern in Botswana, the matter was a source of great media and public debate in other countries, putting producing companies against health organizations. On one hand, producer companies said the foods were safe, nutritious and a solution to the huge global demand for food, while on the other hand health organizations argued that the foods were not safe and demanded they must be labeled in order to ensure that consumers are made aware of the type of food they want to buy.

Botswana depends more on imported agricultural products, and continuous supply of new technology to increase its food resources in Southern Africa. It is hoped that these new technologies would help Botswana increase its level of production hence food security. At the moment, the government of Botswana has no regulations regarding the use of GM organisms or foods. However, lack of public awareness on GM food products in Botswana has resulted in many people believing that these products pose a threat to human health. Botswana is a Middle Income Country with the necessary infrastructure and manpower capacity to undertake research into all products that enter the country to ascertain their safety, toxicity or harmful effects. Majority of these manpower in agriculture comes from BCA, hence BCA was considered suitable as the target population of this study.

The country has committed itself to the Protocol of the Convention on Biological Diversity (PC-BD) for which a National Bio-Safety Framework (NBF) has been drawn and is basically waiting to be passed by parliament. Under this framework, it is expected that countries exporting foods or organisms that have been genetically modified will have to warn the receiving country in advance and to let the country know the ingredients used in the modification process. As it is, Botswana has the capacity to make such assessment in the interest of public safety. This is more important as it comes at a time when there have been conflicting reports about the safety of the consumers.

Meanwhile there are some benefits associated with GM products. In crops it is believed it could enhance the taste and quality of food products. Not only this, but also to reduce maturation time, increase nutrients, yields, and stress tolerance, and improve resistance to diseases and pests. In animal products, the benefits are to increase resistance, productivity, hardiness, and feed efficiency. Nowadays chickens which were once raised for longer time to reach maturity can now be raised for only 6 weeks to reach the market weight. Other benefits include better yield in meat, eggs, and milk and improved animal health and diagnostic methods. It is also believed that biotechnology reduces environmental risks as it involves friendly use of bio-herbicides and bio-insecticides and on the other hand help in conservation of soil, water, and energy and the use of better natural waste management^[3]

There are also some controversies associated with GM products. These include among others potential human health impact such as allergies, transfer of antibiotic resistance markers, unknown effects, and potential environment impact: unintended transfer of genes through cross-pollination, unknown effects on other organisms (e.g., soil microbes), and loss of flora and fauna biodiversity^[4].

Statement of the problem: Genetically modified products are hitting the food markets at an alarming rate despite mixed feelings about their uses in terms of health hazards they are associated with. The reason may be that the world had no choice but to accept them and review their effects later out of desperation for foods. Even though some expert in agriculture have given the green light for their use, others are optimistic and reluctant to approve them; this is because, basically the world does not know much about the GM foods. It is likely that after a few decades negative signs may appear in humans or other living organisms. The problem therefore is: are we sure that the use of GM Foods is safe and will not pose health hazards in the near future

Purpose and objectives of the study: The purpose of the study was to determine the overall perception of BCA Lecturers toward the consumption of genetically modified foods in Botswana. Based on this purpose, the following specific objectives were developed;

- To describe the demographic characteristics of the lecturers in BCA.
- To determine the perceptions of BCA lecturers toward the consumption of genetically modified foods in Botswana.

- To find out the relationships that exist between some selected demographic characteristics of the lecturers (i.e. age, gender, nationality, education, work experience and their perception toward the consumption of genetically modified foods.

MATERIALS AND METHODS

The design of the study was a descriptive census study. The population of the study consisted of the lecturers of BCA. The target population (N = 67) was identified using the college directory to determine the population size of the study. Of all the respondents, only 47 lecturers responded giving an overall of 70% respondents. Those who did not respond were either on annual leave or study leave or were not in during the time of data collection. The target population was considered appropriate because BCA is the citadel of learning in Agriculture. A self administered questionnaire, designed by the researcher, based on reviews of appropriate literature was used to collect data in the study. The questionnaire consisted of a five-point likert type scale anchored as follows: (1) = strongly disagree, (2) = disagree, (3) = I don't know (4) agree (5) = and strongly agree. Three expert from a near by Agricultural Research Station were asked to review the instrument for content and face validity and their suggestions were incorporated in the questionnaire before it was used. The instrument was pre-tested with thirty eight lectures from the Faculty of Science, University of Botswana. The Crombach's alpha reliability coefficients were computed for the 36 statements used to measure the perception of the respondents, and was found to be 0.82 confirming that the statements were reliable enough. Frame error was controlled by obtaining the list of the respondents from the college directory, while selection error was avoided by checking the list obtained thoroughly to avoid duplication of names of the Lecturers.

The instrument was hand delivered to the targeted group. A follow up visit was conducted 10 days after the delivery of the instrument to the 7 lectures who did not submit their completed questionnaire. This was to control non-response error. This follow-up visit enabled the researcher to get information from all the 47 lecturers who participated in the study.

The data collected were processed using Statistical Package for Social Sciences (SPSS). Perceptions of the lecturers toward the consumption of GM foods were analyzed using means standard deviations and rankings. Frequency and percentages were used to describe the demographic characteristics of the lecturers. Correlation

Table 1: Demographic characteristics of respondents

Characteristics	Frequency	Percentage (%)
Gender		
a) Female	11	23.40
b) Male	36	76.60
Age		
a) Under 34 years	4	8.51
b) 35 to 44 years	6	12.77
c) 45 to 54 years	11	23.40
d) 55 to 64 years	14	29.79
e) 65 + years	12	25.53
Marital status		
a) Single	19	40.43
b) Married	28	59.57
Nationality		
a) Local	25	53.19
b) Foreign	22	46.81
Highest education level attained		
a) Degree	0	
b) Masters	21	44.68
c) PhD	26	55.32
Department		
a) BS	9	19.15
b) CSP	13	27.66
c) AEL	7	14.89
d) AEE	6	12.77
e) ASP	12	25.53
Work experience		
a) less than 10 years	6	12.77
b) 11 – 20 years	9	19.15
c) 21 – 30 years	21	44.68
d) 31 years and greater	11	23.40
Total	47	

co-efficient of the relationships between the selected personal characteristics and the perception statements regarding the genetically motivated foods were established.

RESULTS AND DISCUSSION

Objective 1: Demographic characteristics of the respondents: Table 1 describes the personal characteristics of the lecturers of the Botswana College of Agriculture using frequency and percentages. The personal characteristics examined were: gender, age, marital status, nationality, highest education level, department and work experience. Out of 67 staff members on 47 (70.19%) responded to the questionnaire. It was found that about 23.40% of those who responded to the questionnaire were females and 76.60% were males. The low percentages of females showed that females are still hesitant to enroll in the field of university lecturing compared to secondary school teaching where there are more females in Botswana. The respondents' ages ranged from 34 to 65 years and above with the median age between 45 and 54 years which was about 23.40%. Results also showed that those within 55 to 64 years were 29.79% while those with 65 years and above were 25.53%. These results are not surprising because most of the staff have PhD, which is relatively obtained very late in ones

Statements	sd	mean	rank	decision	Age r	gender	Nationality rbs	Educ rs	Work exp. r
1 I have read or heard about GM foods	1.21	4.87	1	Agree	.02	.03	.01	.04	.06
2 GM foods may be risky to consumers in the long run	1.10	4.49	6	Agree	.04	.01	.06	.02	.07
3 Use of genetically modified organisms could breed new animal and plant disease	1.55	4.34	7	Agree	.03	.02	.01	.04	.05
4 Biotechnology increases new sources of cancer	1.36	3.57	28	Agree	.02	.01	.50	.10	.015
Gene technology may implicate the resurgence of infectious diseases	1.40	3.34	30	Agree	.03	.01	.02	.03	.04
6 Use of GM foods may increase food allergies	1.37	3.70	25	Agree	.04	.02	.03	.04	.05
7 Biotechnology may produce super pests and parasites	1.35	4.28	12	Agree	.02	.03	.02	.03	.02
8 Cultivation of GM foods may pose threat of interfering with the ecosystem	1.40	4.09	17	Agree	.03	.01	.03	.02	.03
9 GM technology tampers with nature by mixing genes from other species	1.37	4.15	16	Agree	.01	.02	.02	.03	.06
10 Potential benefit of GM foods is to reduce maturation time	1.33	4.32	10	Agree	.04	.05	.01	.04	.08
11 GM foods increase food security for growing population	1.32	3.81	24	Agree	.01	.04	.02	.06	.04
12 GM foods require minimum labour to produce	0.91	4.36	9	Agree	.01	.03	.02	.06	.02
13 Some GM foods have longer shelf life than none genetically modified foods	0.82	3.87	23	Agree	.04	.01	.03	.02	.05
14 Biotechnology improves animal production	0.88	4.02	19	Agree	.05	.02	.03	.03	.01
15 Biotechnology increases resistance to animal and plant	1.12	4.06	18	Agree	.07	.03	.02	.01	.05
16 GM foods are currently available in the nation food markets	1.37	4.17	15	Agree	.02	.04	.01	.03	.03
17 Some processes foods in the nation food supermarkets contain at least one ingredient from a genetically modified organism	1.04	4.21	13	Agree	.03	.04	.05	.05	.01
18 People should be educated more about GM foods before they are introduced to them	0.96	4.81	3	Agree	.01	.02	.03	.03	.06
19 I would purchase food products that have been genetically modified	1.05	2.89	33	Disagree	.06	.04	.02	.02	.07
20 I have once consumed genetically modified foods	1.24	3.04	32	Agree	.03	.02	.04	.04	.05
21 Labeling of GM foods is very important	1.34	4.85	2	Agree	.06	.08	.09	.09	.04
22 People have no idea whether or not they are eating GM foods	1.22	4.00	20	Agree	.01	.01	.04	.04	.01
23 GM technology is driven more by profit than by consumer's interest and health	1.04	4.55	14	Agree	.04	.01	.02	.04	.06
24 South African countries are refusing to accept the import of genetically modified foods	1.08	4.74	5	Agree	.01	.03	.02	.01	.02
25 Scientists need better testing methods before making GM foods available for human consumption	1.09	2.38	4	Agree	.02	.02	.04	.01	.05
26 Government should import GM foods	1.19	3.60	34	Disagree	.05	.01	.03	.04	.07
27 I support the use of GM foods that are designed to protect people and animals against disease	1.15	4.30	27	Agree	.02	.03	.04	.05	.01
28 Biotechnology is still young and needs to be revisited as the technology matures	1.01	3.98	11	Agree	.02	.03	.05	.52	.49
29 Cultivation of GM foods will help local farmers to compete in the world market	1.32	3.31	21	Agree	.01	.04	.01	.02	.09
30 Biotechnology has been recognized as an important tool in improving agricultural produce	1.35	3.31	31	Agree	.02	.05	.04	.04	.06
31 GM foods are tested for human safety before they are used	1.24	3.40	29	Agree	.04	.02	.02	.03	.07
32 Most may be genetically modified	1.21	4.38	7	Agree	.01	.01	.04	.02	.04
33 There are laws/regulations pertaining to the labeling and safety testing of the GM foods in Botswana	1.11	2.26	36	Disagree	.04	.02	.01	.05	.03
34 The South African policy on the use of GM foods may directly influence their use in Botswana	1.16	3.68	26	Agree	.03	.01	.04	.06	.08
35 Botswana has regulation governing GM organisms.	3.91	22	Agree	.03	.01	.05	.04	.02	
36 The country is in position to start using the GM foods	1.31	2.38	34	Disagree	.04	.02	.04	.05	.06
37 Overall mean		2.29							

life especially in African societies. Those between 45 to 54 years were 23.40% while 12.77% fell between 35 to 44 years and 23.40% fell under 34 years of age.

Most of the respondents were found to be married as shown by the high percentage of 59.57% and only 40.43% were single. Fifty three percent of the respondents were foreigners while 46.81% were locals.

In terms of level of education most of the respondents (55.32%) were PhD holders and 44.69% had Masters' degree and no one had a Bachelor's degree or Diploma as his or her lowest educational level. According to departments, 19.15% were from Basic Science, 27.66% from Crop Science, 14.89% from Agricultural Engineering and Land Survey while the department of Agricultural Economics, Extension and Education and that of Animal Science and Production were 12.77% and 25.53% respectively. It was found that most of the respondents were from CSP department followed by ASP, BS, AEL and lastly AEE. Most of the respondents (44.68%) had been in the field for 21 to 30 years and 23.40% had working experience of more than 31 years while those between 11 to 20 years of experience were 19.15%. Other respondents (12.77%) had less than 10 years of working experience.

Objective 2: Perception of bca lecturers on the use of gm foods in botswana: The respondent's perception statements were measured using the rating scale of 1 to 5 points with strongly disagree awarded 1 point, disagree; 2 points, I don't know; 3 points and agree; 4 points while strongly agree; was awarded 5 points. At the end of two decisions were reached, either the respondents agreed or disagreed to the statement. Those who did not know were merged into disagree decision. A mean of 3 and above was used to denote agree while a mean below 3 was used to denote disagree. The results were then ranked as in Table 2 below. The overall mean perception was 2.29 indicating that the respondents did not agree with most of the perception statements and therefore were not favorably disposed toward the use of GM foods. Out of 36 items, the statement 'I have read or heard about GM foods' was ranked 1st with the highest mean of 4.87 showing that majority of the respondents agreed to reading or hearing about GM foods.

Labeling of GM foods was found to be important as it was ranked 2nd with a mean of 4.85. The statement people should be educated more about GM foods before they are used came 3rd in ranking showing the importance of education in creating awareness on the consumption of GM foods.

Other statements which ranked higher included 'scientists need more and better testing methods before making GM foods available for human consumption with

Table 2: The data regarding the relation between selected demographic characteristics and the perception of lecturers toward the use of GM foods

Coefficient	Descriptors
.70 or higher	Very strong relationship
.50 to .60	Substantial relationship
.30 to .49	Moderate relationship
.10 to .29	Low relationship
.01 to 0.9	Negligible relationship

a ranking of 4 and a mean of 4.74. The statement 'some African countries are refusing to accept the import of genetically modified foods' was ranked 5th with a mean of 4.55.

The respondents found some statement least important in their perceptions regarding the consumption of GM foods in Botswana. For example they ranked the statements government should import GM foods' and 'the country is in position to start using GM foods' number 34 with a mean of 2.38 respectively. The least ranked statement was there are rules/regulations pertaining to the labeling and safety testing of GM foods in Botswana which ranked 36, with a mean of 2.26, showing that most of them did not agree that the country had any rules or regulations regarding the use of GM foods. The ranking and mean of other statements are reflected in Table 2.

Objective 3: Relationship among selected demographic characteristics and the perception of lecturers towards the use of GM foods: The data regarding the relationship between selected demographic characteristics and the perception of lecturers toward the use of GM foods are presented also in Table 2.

In describing the correlation coefficient of the relationships among the demographic characteristics examined, Davis descriptors shown below were used:

The demographic characteristics of the respondents examined were age, gender, nationality, education and work experience. Almost all of the demographic variables had a negligible relationships (.01-.09) with the statements measuring the perception of the lecturers towards the consumption of GM foods. This is an indication that most of the demographic variables examined did not affect the responses of the lecturers toward the consumption of GM foods in Botswana.

However, a moderate to substantial relationship was found between educational level of respondents (.52) and work experience (.49) respectively, regarding the statement Biotechnology is still young and needs to be revisited as the technology matured. This tend to indicate that the lecturers somewhat agree with the fact that GM foods need more research in order to ensure the safety of GM foods.

CONCLUSION

- It was found that the college had more males than females. Therefore, female candidates should be encouraged to join the academic staff of BCA if gender equality is to prevail.
- Majority of the respondents were above 45 years, married and therefore could be said to be responsible and are laying good examples on marriage life considered very important in African culture. Those who are yet to marry are hereby encouraged to do so in order to meet the cultural demands of Africans.
- Majority of the respondents were PhD holders, therefore the College has enough qualified personnel to work at the College. The Lecturers should be encouraged to do more research in the area of GM foods
- Majority of the respondents have been in the field for 21 to 30 years, indicating that they are men full of experience needed to work as College lecturers. However, those staff members with MSc degree should be encouraged to pursue their PhD in the nearest future.
- Respondents' perception on GM foods in the country, pointed to the fact that GM food is not popular among those who are supposed to be knowledgeable about GM food. Therefore the GM food should be banned in the country while alternative source of food production should be explored.
- Educational levels and work experience of the respondents have a moderate to substantial relationship with their perception regarding the use of GM foods. Therefore it could be said that owing to high level of education of the respondents and their high work experience, they are not comfortable with the consumption GM foods.

Implications of the study: There are major areas of environmental concerns which obviously need to be re-examined by agricultural biotechnology companies and researchers. For example, The transfer of a gene for herbicide resistance into wild plants would lead to the development and spread of weeds that could not be controlled. This would render both the herbicide and the resistant crop useless to the farmer. Again, The transfer of a gene for a natural insecticide into wild plants would have a very serious effect on populations of beneficial insects as well as pests-and many beneficial insects are

already under considerable pressure as a result of the widespread use of insecticides. Loss of significant numbers of insects would lead to the loss of many insect-pollinated plants and, the loss of the birds and small mammals that feed on these insects. Also the spread of modified plants with survival advantages would lead to the loss of wild plants. Increasingly, plant breeders are realizing the value of preserving wild species and older cultivated varieties as a means of enriching the gene pool of new cultivars^[1]. Even if there are no obvious adverse environmental effects, cross-pollination of conventional crops by GM crops could endanger the livelihood of organic farmers, whose produce might no longer be recognized as truly organic. Before the widespread introduction of genetically modified crops there is an obvious need for a significant number of carefully controlled trials, in isolated areas that can be monitored closed, in order to determine whether or not these risks pose any real environmental hazards. While there have been a considerable number of such trials, there is not yet any clear evidence of safety or otherwise. In the UK and elsewhere there have been some incidents of environmentalist protestors destroying fields of trial crops. There has been criticism also of agricultural biotechnology companies, some of which have admitted to ignoring or breaking the regulations governing trials, for example by not allowing an adequate buffer zone between GM trial crops and conventional crops^[1]. Despite the widespread cultivation of GM crops in the US and elsewhere, governments in Europe and Africa are cautious about permitting their introduction before the evaluation of stringently controlled trials.

REFERENCES

1. Nicholl, D.S., 1994. An Introduction to Genetic Engineering. Cambridge University Press.
2. Lantin and Parsley, 1999. Agricultural biotechnology and the poor. Proceedings of an international conference, CGIAR, Washington, DC, pp: 21-22.
3. Conway, G., 2000. Crop Biotechnology, Benefits, risks and ownership. The proceedings of GMF safety; facts, uncertainty and assessment. Edinburgh OECD.
4. Hails, R.S., 2002. Assessing the risks associated with agricultural practices. Nature, pp: 1.
5. Davis, J.A., 1971. Elementary Survey Analysis. New Jersey: Prentice-Hall.