THE ATTITUDE TOWARDS GENETICALLY MODIFIED ORGANISMS (GMO'S) AND THEIR EFFECT ON HEALTH AND ENVIRONMENT IN SOUTHWESTERN NIGERIA : SCIENTISTS' PERCEPTION

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ABSTRACT

The study was carried out in South Western Nigeria to evaluate the perception of scientists at Universities and Research Institutes on the effect of GMO's on health and environment. It is proposed that scientists' perception would influence the on-going debate as preclude to Nigeria being a signatory to the use of GMO's. Using a simple random sampling technique, a total of one hundred and eighty respondents were selected from a population of 760 and then interviewed. Data were collected through the use of a structured questionnaire with a reliability coefficient of 0.92 and analysis was done using frequency counts, percentages and probit regression model. Scientists were between 31 and 40 years (59.40%), were MSC holders (44.44%), got their information on GMO's from journals (89.60%) and were male (56.70%). Majority of the scientists had low awareness of the GMO's products (52.8%), low perception (54.5 percent). There is significant relationship between awareness, age, religion, sources of information (radio, newspaper, scientific periodicals) and their perception toward GMOs. There is no significant difference in perception and awareness between scientists at Universities and research institutes.

Keywords: Genetically Modified Organisms, Health, Environment, Nigeria, Perception

INTRODUCTION

It is estimated that there are roughly 790 million undernourished people in developing countries, whose food intake is insufficient to meet basic energy requirement on a continuous basis. Sub-Saharan Africa accounts for 180 million of these undernourished people [1]. Consequently, large majority of the chronologically undernourished are in poor peasant farming community who cannot meet their food needs because of their grossly inadequate means of production. In developing countries, 50% of farms are smaller than one hectare and increase food production cannot come from recruiting new-lands [1]. In south Asia for example 119 million of the potential 228 million hectares were readily under cultivation in 1988-1990 and in Latin America and Caribbean only 190 million of the 1089 million are cultivated. However, the remaining land cannot be converted to crop production as they are already used for forestry, animal production or conservation. As well, land degradation is already in effect due to overgrazing, deforestation and poor farming practices. Therefore to increase yield per hectare as a result of limited availability of land, there is a need to embrace technology that will augment the conventional food production improvement in developing countries [2].

Over the past 30 years agricultural productivity growth resulting from successful research and development, tripled food production in developing countries, outstripping population growth and the population of under-nourished people dropped from 35% to 17% [2]. Natural resources constraints are one major factor limiting agricultural intensification and growth. Arable land per person in developing countries has shrunk from 0.32 hectares in 1961/63 to 0.21 hectares in 1997/99 and expected to drop to 0.16 by 2030[11]. Extreme poverty and hunger push people into marginal land and more fragile ecosystems characterized by drought stress and low soil fertility. However there is major limitation in agriculture, where genetically modified technology would overcome and make contribution and thus fill the gap created by hunger and food insecurity. Genetically modified technology can be used to develop new plants adaptable to this marginal area [3].

However, as the detrimental social and environmental changes are occurring in developing world, a revolution in biotechnology and associated information technology is improving the health, well being and lifestyle of the privileged and creating more wealth in a few rich countries [4]. Biotechnology is a technology that uses biological system, living organism or its derivatives to make or modify products or processes for specific use. However, human communities have played a major role in distributing and shaping natural diversity in all parts of the world. For approximately 10,000 years human beings have modified the trait of plants and animals through process of artificial selection; as many previously wild species are domesticated to suit the needs and preference of human beings, the performance and genetic architecture of this species are irrevocably changed [4]. Human civilization is built on the selective use and exploitation of biological diversity. By learning about the natural world and using the knowledge to shape it in numerous ways, human have practiced biotechnology both consciously and unconsciously for millennia.

New fields of genetically modified technology research are promising and graining increasing support although significant proportion of the world population has expressed reservation about the effect of the creation of agricultural food and fibre using genetically modified technology on health and environment [5]. Thus, only a small number of developing countries have introduced genetically modified organism, due to the significant constraints imposed by their current institutional and technological capacity. Napier [5], used ethical orientation, perception, level of trust in sources of information, awareness and demographic characteristics as variables in the study of ethical orientation of Ohio residents towards genetically engineered organism. Other variables include human nutrition, trophic interaction, ethnic , environment and economy as variables affecting the perception of the safety of Indian foods from genetically modified crops.

Presently, biotechnology is largely associated with genetic manipulation at the DNA level. Biotechnology is a basket of tools that have in common the use of DNA manipulation procedures to obtain products or define new processes with desired characteristics. The cadre of processes and products is rather large, although those that have recently received the greatest attention are the genetically modified organisms [6]. The genetically modified varieties are the result of two separate stages in the production process. The first leads to the creation of receptor variety that has adequate expression of character of economic value. The second encompasses the production, starting from the receptor of marketable varieties of the same species. Genetically modified technology can be applied to some specific problems of agriculture, indicating the potential for benefits such as pest resistance, tolerance to biotic and abiotic stresses, efficient use of farmland/ reduced environmental impact, and improvement of product quality [7]. It is therefore necessary to study the perception of GMO's by scientists in Universities and Research Institutes in order to assist in agricultural policy formulation on the use of GMO's in Nigeria. The general objective of the study

is to evaluate the perception of GMO's by scientists at agricultural research institutes and universities in south western Nigeria, in terms of their effect on health and environment. The study specifically identified the demographic characteristics of the scientists, determines their awareness of GMO's products, perception of GMO's and explored the relationships between variables of the study.

METHODOLOGY

The study was carried out in southwestern zone of Nigeria which has 6 states, namely: Lagos, Ogun, Osun, Oyo, Ekiti and Ondo State. The study area lies between Latitude 50 and 90 North and longitude 20 and 80 east. It is bounded by the Atlantic Ocean in the south, Kwara state in the North and Republic of Benin in the west. It has a land area of 114.24 squares kilometers. The population of the area according to the 1991 census is 22, 330670. Scientists in the faculties of Agriculture and Biological sciences of five from the nine universities with faculties of Agriculture in the study area, were randomly selected namely University of Ibadan (U.I), Obafemi Awolowo University (OAU),University of Agriculture Abeokuta (UNAAB), Federal University of Technology Akure (FUTA), Lagos State University Epe (LASU) and Olabisi Onabanjo University Ago-Iwoye (OOU)with a population of 685 scientists. Similarly five from eight agricultural research institutes were randomly selected from the study area. These are: Institute of Agricultural Research and Training (IART) National Institute of Horticultural Research (NIHORT), Forestry Research Institute of Nigeria (FRIN), Cocoa Research Institute of Nigeria (CRIN) and National Institute of Oceanography and Marine Research (NIOMR) with a total of 175 researchers. One hundred scientists and 80 researchers were randomly selected from the universities and agricultural research institutes respectively to give a sample size of 180.

Scientists' perception of the effect of GMOS on health and environment was measured using a 3 point Likert scale of Agree (3), Undecided (2) and Disagree (1). The independent variables of the study are demographic characteristics, awareness of GMO's products and sources of information on GMO's. Demographic characteristics were measured nominally, while respondents indicated their awareness of GMO's from a list 21 products. Scientists indicated their sources of information on GMO's from the list of Radio, Internet, Fellow Researchers, Cable TV, Newspapers, Scientific Periodicals, and Journals. Data were analysed using frequency counts, percentages, t-test and probit regression model.

RESULTS AND DISCUSSIONS

Majority of the scientists were males (56.7 percent) while 43.3% were female as shown in Table 1. This suggests that agricultural and biological science is still dominated by males. This agrees with the results of human resources management study in National Agricultural Research by International Service for National Agricultural Research (ISNAR) in 1988. About fifty nine percent (59.46%) were between 31 and 40 years, and 61.7% were married. About forty percent of respondents had MSC, 29. 4 percent had Ph.D while about 17.5 percent had M. Phil. The result shows considerable level of education among the scientists, because low educational level among researchers hinders research ability and analytical skill. About 67.8 percent were Christians, while about 32 percent were Muslims. These religious affiliations have effect on respondents' perception towards GMO's due to beliefs and taboos. About nineteen percent were specialized in Agric-economics, 17.8 percent agric-biology. Veterinary, medicine, cell biology, food technology and fisheries had 2.2 percent each, while animal science and microbiology accounted for 13.3 percent and 11.1 percent respectively. The relatively highest proportion of biological based scientists has a positive implication in the knowledge and awareness of GMO's and therefore the general perception towards GMO's. Majority of the respondents have between one to five years working experience (89.5%), while only 4.4 percent had above 5 years working experience suggesting that the necessary experience on the job could be lacking among scientists.

From Table 2, the results show that about sixty seven percent (66.7%) of the respondents got their information on GMO from internet about fifty seven percent (57.2%) from fellow research, about sixty three percent (63%) from newspaper and about ninety percent (89.6) got their information from journal. This means that scientists in Southwestern Nigeria have access to journals on recent agricultural and biological innovations. It also indicates that the scientist are information technology compliant, as a greater proportion of them get their information from internet, which implies that the frequency with which they use the internet to source for information may be high.

Table 3 indicates that GMO products; potatoes with high starch content, cholera curing potatoes, cholera curing tobacco and blight resistance potatoes had highest awareness by scientists with 68.9 percent, 67.2 percent, 68.3 percent and 72.8 percent respectively. This supports the assertion that potatoes are one of the major staple food in Nigeria and cholera is a major disease that is endemic in the country. However Bt cotton, Hybrid QPM, iron rich rice and Bt hybrid rice varieties had the least awareness

Table 1 Respondents Demographic Characteristics (n = 180)

Variables		Frequency	Percentage
Gender	Female	78	43.30
	Male	102	56.70
	Total	180	100.00
Age	21-30	28	15.70
	31-40	107	59.40
	40 and above -50	45	24.90
Educational level	B.Sc.	15	8.33
	M.Sc.	80	44.44
	M.Phil	32	17.80
	Ph.D	53	29.40
	Total	180	100.00
Religion	Christianity	122	69.80
	Islam	58	32.20
	Total	180	100.00
Area of specialization	Agric-Economics	35	19.40
	Agric-Extension	12	6.70
	Animal-Science	24	13.30
	Agric-Biology	32	17.80
	Agronomy/ Crop Science/ Soil Science	33	18.20
	Micro-Biology	20	11.10
	Veterinary Medicine	4	2.20
	Cell Biology	4	2.20
	Food Technology	4	2.20
	Catering & Hotel Mgt	8	4.40
	Fisheries	4	2.20
	Total	180	100.00
Working Experience	1-5	107	59.50
	6-10	47	26.10
	11-15	18	10.00
	15 and above	8	4.40
	Total	180	100.00

Table 2 : Scientists' Sources of Information on GMOS

Sources of information	Frequency	Percentage
Radio	51	28.30
Internet	120	66.70
Fellow Researchers	103	57.20
Cable TV	77	42.80
Newspaper	113	62.80
Scientific Periodicals	81	45.00
Journals	151	89.60

Table 3: Respondents Awareness of GMO Products

GMO products	YES	NO	MEAN	SD
Balanced Amino acids in seeds	103 (57.00)	77 (42.80)	0.43	0.50
Potatoes with high starch content	124 (68.90)	56 (31.10)	0.31	0.46
Cholera curing potatoes	121 (67.20)	59 (32.80)	0.33	0.47
Tuberculosis curing tobacco	111 (6.170)	69 (38.20)	0.38	0.49
Cholera curing tobacco	123 (68.30)	57 (31.70)	0.32	0.47
Tuberculosis curing potatoes	96 (53.30)	84 (46.70)	0.47	0.50
Carotenoid rich tomatoes	113 (62.80)	67 (37.30)	0.37	0.48
Ring spot Resistance Papaya	103 (57.20)	77 (42.80)	0.43	0.50
Blight Resistance potatoes	131 (72.80)	49 (27.20)	0.37	0.45
Golden rice	116 (64.40)	64 (35.60)	0.36	0.48
Yellow mottle virus resistance rice	106 (58.90)	74 (41.10)	0.41	0.49
Bt(Baccillus thuringensis) Soya beans	95 (52.80)	85 (47.20)	0.47	0.50
Bt cotton	83 (46.10)	97 (53.90)	0.54	0.50
Hybrid QPM(quality protein Maize)	81 (45.00)	99 (55.00)	0.55	0.49
Iron rich rice	80 (44.40)	100 (55.60)	0.55	0.49
Bt hybrid rice (Bt HR)varieties	90 (50.00)	90 (50.00)	0.50	0.50
Acid tolerant maize	95 (52.00)	85 (47.20)	0.47	0.50
Acid soil tolerant papaya	98 (54.40)	82 (45.60)	0.456	0.50

by scientists with 46.1 percent, 45, percent, 44.4 percent and 50 percent respectively. This is a reflection of the fact that most crops in Nigeria are local varieties products, only few improved and high variety crops are planted in the country. From the table, mean score of the pooled awareness scores of 18 GMO's products is 8.13. It then implies that respondents with low awareness are aware of less than eight GMO's products, while those with high awareness are aware of at least 8 GMO's products. This reveals that 52.8% have low awareness and 47.2% have high awareness of GMO's products. Thus the greater number of respondents with low awareness of GMO's products will have an implication on the utilization of the GMO's technology.

Table 4 shows the perception of respondents (scientists) towards GMO's. With respect to environmental issues about forty three percent (43.3%) agreed that genetically modified technology can increase crop production in marginal land, while 32.2 percent disagree and 23.9 percent were undecided. About forty two percent (42.2%) agreed that GM crops are resistant to pest and diseases, while 38.3% disagreed and 11.1 percent were undecided. On health issues 45 percent agreed that GM foods with a higher content of digestible iron are likely to benefit consumers with iron deficiency. 20.6 percent were undecided, while 33.3 percent disagreed. About forty eight percent (47.8%) agreed that GM food with possible allergy risk should be fully labeled, 21.7 percent were undecided, while 26.7 percent disagreed.

Table 5 presents the results of probit regression model. The probit model seeks to explain the relationship between the perception of GMO's by scientists and the 14 identified independent variables. The signs of the coefficients of the independent variables and the significance of the independent variables were estimated to determine the relationship of each variable and the perception of GMO's. The model reveals that perception of GMO's is positively affected by awareness, gender, marital status, educational qualification, religion, years of experience, radio, fellow Researchers, Cable TV. However on the other hand, it is negatively affected by age, area of specialization, internet, newspapers, scientific periodicals and journals.

Some factors that influence the perception of GMO's were significant at 10 percent and 5 percent level of significance. Awareness and Newspapers were significant at percent level of significance. Age, religion, Radio, and scientific periodicals were significant at 10 percent level of significance. The implication of this finding is that the older scientists have higher perception on GMO's. Results also revealed that the higher the awareness on GMO's products the higher their perception. Also the more frequent they use these sources of information such as radio, newspaper and scientific periodicals, the higher

Table 4: Perception of Respondents Towards GMO on Environment and on Health

Perception statements	Agree	Undecided	Disagree	MEAN	SD
Environmental issues					
GM technology provides crops that are tolerant to salinity.	33(18.30)	48(26.70)	93(51.70)	2.27	0.88
It increases crop production in marginal land	78(43.30)	43(23.90)	58(32.20)	1.88	0.88
GM crops survive in soil subjected to intensive tillage	89(49.40)	35(19.40)	46(25.60)	1.65	0.92
GM crops adapt to soil with poor fertility.	85(47.20)	40(22.20)	50(27.80)	1.75	0.90
GM crops are tolerant to acid soil.	38(21.10)	71(39.40)	50(27.80)	1.83	0.76
They are resistance to pest and diseases	76(42.20)	20(11.10)	69(38.30)	1.79	1.05
Health issues					
GM foods with higher content of digestible iron are likely to benefit consumer with iron deficiency	81(45.00)	37(20.60)	60(33.30)	1.86	0.90
GM foods need to be tested for allergy transfer before they are commercialize.	92(51.10)	27(15.00)	52(28.90)	1.67	0.95
GM foods with possible allergy risk should be fully labeled.	86(47.80)	39(21.70)	48(26.70)	1.71	0.91
Failure to remove antibiotic resistant marker gene used in research before a GM food is commercialized Presents potential health risk	37(20.60)	81(45.00)	41(22.80)	1.79	0.93
GM foods lead to horizontal gene flow to human guts.	76(42.20)	37(20.60)	52(28.90)	1.70	0.98

their perception.

Table 5 shows the t-test analysis the comparing scientists' awareness and perception of GMO's in Universities and agricultural research institutes. Significant differences were recorded for awareness, and perception at 10% level of significance, while these variables were not significant at 5% percent level of significance. Non-significant differences for, awareness, perception and knowledge are expressing that these variables are effective in the same way in the research institutes and Universities.

CONCLUSION

The study revealed that majority of the scientists got their information on GMO's through journals and are aware of some GMO's products. However, 54.5 percent of the scientists had low perception of the effect of GMO's on health and environment in the study area. In addition it was revealed that awareness, age, religion, radio, newspapers and scientific periodicals as source of information were significantly related to their perception towards GMO's, . Similarly there was no significant difference in awareness, and perception of GMO's between scientists in agricultural research institutes and faculties of agriculture in the universities.

REFERENCES

[1] FAO (2000). The state of food and Agriculture 2000. (Electronic Version).www,fao,org/news/2001/000903-e.htm

[2] FAO (2001). The state of food insecurity in the world 2001 (Electronic Version) www.fao.org/docrep/003y/500e/500eoo.htm

[3] Gabrielle J. Persley and Doyle J. (2001) "Biotechnology for Developing Country Agriculture", In Per-Pinstrup and P Raju (Eds). The unfinished Agenda. Journal of Perspectives of overcoming hunger. Hunger, Poverty and Environmental degradation. International Food Policy Research Institute Washington DC. 243-245.

[4] McCouch RS (2002) Is Biotechnology an answer? Who will be Fed in the 21th Century? In Keith W, Nicole B and Pinstrup A (Eds) Challenges for Science and Policy IFPRI Washington DC 31-39.

[5] Napier T.L. Tucker M.A., Henry L. and Yang X (2004). Ethical Orientation of Ohio Residents towards genetically engineered plants and animals. An urban/rural comparison, Journal of food, Agriculture and Environment.12 400-411.

[6] Swaminathan, MS (2000). Genetic Engineering

Table 5: Results of Probit regression model

	Regression Coeff	S.E	t-value
Constant	-4.73	0.51	-8.06
Awareness	0.042	0.01	2.85**
Gender	0.17	0.21	0.78
Age	-0.14	0.01	-1.83*
Educational qualification	0.09	0.07	1.21
Religion	0.22	0.12	1.77*
Area of specialization	-0.003	0.03	-012
Working Experience	0.01	0.16	0.68
Radio as source of information	0.14	0.81	1.78*
Internet source of information	-0.93	0.11	-0.84
Fellow researchers source of information	0.12	0.08	1.40
Cable TV as source of information	0.08	0.72	1.11
News papers source of information	-0.21	0.78	-2.69**
Scientific periodicals as source of information	0.16	0.08	-1.86*
Journals as source of information	-0.68	0.13	-1.51
X^2	849.766		
Df	160		
N	180		
P	0.000		

Table 6: Summary of t-test analysis

VARIABLES	GROUPS	N	MEAN	SD	S-E MEAN	T	Df	P	Decision
Awareness	Universities	140	8.31	5.38	0.45	1.90	68	0.06	Not
	Research Institutes	140	6.80	4.92	0.78				significant
Perception	Universities	140	83.11	16.62	1.40	0.50	64	0.60	Not
	Research Institutes	140	81.65	16.46	2.60				significant

and food security .Ecological and livelihood issues 37-44 In: GJ Persley and M.M Lantin (Eds) Agricultural biotechnology and the Rural poor, Consultative group on International Agricultural Research, Washington DC, USA.

[7] Zakiri A. H. (2002) Sustainable Development and Agricultural Biotechnology, in Prospect for food security and agricultural sustainability in developing regions. New Roles of International Collaborative Research. The 10th JIRCAS International Symposium Pg 141-146.