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# ASSESSMENT OF AGRICULTURAL SCIENTISTS' KNOWLEDGE OF GENETICALLY MODIFIED CROPS: IMPLICATIONS FOR FOOD SECURITY IN NIGERIA

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***Abstract***

*One of the current challenges facing Nigeria is food insecurity. At the moment, Nigeria occupies 96$^{th}$ position in the Global Food Security Index Ranking (GFSIR). One striking feature of Nigerian agriculture is unpopularity of GMCs in the fight against food insecurity. However, scientists' knowledge of these GMCs is unknown in Nigeria, thus, making it difficult to ascertain farmers' readiness to adopt. This study therefore ascertained Agricultural Scientists' knowledge level in GMCs with a view to ascertaining their capability in disseminating GMCs to farmers in order to alleviate food insecurity challenge in Nigeria. Simple random sampling technique was used to select 240 Scientists from Universities, Research institutions and Extension Experts from ADP/Ministry of Agriculture and Natural Resources across the 6 geo-political zones in Nigeria with the use of structured questionnaire. Data were analyzed with use of F-test and described with frequency and percentage and Equal Interval Approach. It was observed that 59.2% of the Scientists had high knowledge of GMCs. However, there was a significant difference in the scientists' knowledge of GMCs across agricultural zones with the F-value of 15.2; p≤ 0.05. Further results of Duncan Range test revealed that North central zone (Mean = 154) zone had the highest knowledge compared to other zones. The high knowledge of GMCs recorded among scientists therefore, becomes an entry point in using GMCs to fight food insecurity challenge in Nigeria. Thus, farmer's readiness to adopt GMCs and cultural practices associated with their cultivation are highly depended on advice and recommendations from the Agricultural scientists in Nigeria.*

***Key words*****:** *Genetically Modified Crops, knowledge, food security, scientists*

## INTRODUCTION

Food insecurity is a global phenomenon and is more prevalent in the developing countries including Nigeria and this forms the reason why food security programmes are the target of every successive government in Nigeria since independence in 1960 [16]. This is because millions of Nigerians are vulnerable to food insecurity and malnourishment. Globally, the Food and Agriculture Organization [10] of the United Nations report showed that 868 million people were undernourished between 2010 and 2012 alone while an estimated 20.4 million of these people were still food insecure as at 2015 in Sub-Saharan Africa where farming is the predominant occupation of over 70% of the populace. However, over 70% of these food insecured persons are in Nigeria, Niger, Mali and Chad in African countries [30]. According to the world population records of 2016, there is a rapid population growth in Nigeria with total population of about 187,908,541 and with the growing estimated population rate of 80 million per year. It is also projected that by the year 2050, the population will double to two billion people [30]. Several projections also suggest that global food production may need to increase between 60 and 100 percent in 2050 because of the increasing demand and changing patterns of demand [5]. About 70% of these population lives on less than N370 (US$ 1.00) per day, suffering from hunger, malnutrition and poverty. Feeding its teeming population has become a big task for the Nigerian agricultural sector [7].

Nigeria as an agrarian community has both human and natural resources that should place us among the first 3 countries in the world in terms of food production. The nature and fertility of the Nigerian flag is captured in the National flag design with green colour

denoting the fertility of the Nigerian soil [18]. Unfortunately, the populace suffer amidst plenty based on the assertion of [11]. United State Agency for International Development [28] reported that about 14 million crop farmers are engaged in food production. The report further showed that farmers in Nigeria are characterized by old age, illiteracy, low income, cultivate less than 2 hectares of land, do not use productivity enhancing inputs, and lack knowledge of modern farming technology/practices. This is the basis for the growth of the country import at 11.0% per annum with negative consequences on the Gross Domestic Products (GDP) and the economy at large [4]. The dependent of Nigeria on other countries of the world for importation of food crops like rice, wheat and other agricultural produce despite the abundance of manpower and natural resources with favourable climate calls for interrogation. Agriculture contributes over 41.8% to Nigeria Gross Domestic Product (GDP) in 2009 and 2010 and the sector employs about 70% of the workforce [21, 29]. Unfortunately, agriculture which in the past was the biggest sector now scored 23 percent in its contribution to Gross Domestic Product (GDP) in 2015. The GDP average Growth Rate was 1.47% from 2013 to 2015. It was 3.10% in the fourth quarter of 2015 compared with 9.19% in the previous third quarter and then came low to 11.57% in the first quarter of 2015 [6]. This decline in the performance of agricultural sector must have fueled the increase in food security programmes in the Nigeria.

Agricultural primarily concerns with the production of crops and rearing of animals. [9] report showed that crop yield in Nigeria is only 20 to 25% of that obtained in other developed nations of the world. This implies that crop production is not increasing as a rate to meet population growth. Also, utilization of improved seeds and seedlings are very low at 5% when compared with East Africa 25% and Asia 60%. About 90 percent of farmers in some Africa countries including Nigeria are smallholders who are poor and dependent on local varieties of crops for agricultural production as means of livelihood [9]. However, the use of local varieties of crops by farmers is no longer a solution to agricultural sector for any country that would meet the food requirements of its population.

One of the best strategies to increase food production is the adoption and utilization of Genetically Modified Crop (GMC) techniques. [12] opined that Scientists in Indonesia are more knowledgeable about GM foods and are more pre dispose to information and explanation to GM farmers, consumers and other end users. Fortunately, Nigeria agricultural sector with the aid of Agricultural Scientists has the potentials to help poor farmers out of their predicaments by their acceptance of GMCs use and the role they play in ensuring the success of the new Genetic Engineering (GE) techniques recently discovered. To eliminate micronutrient deficiencies, increasing yields and the nutritional value of crops is needed by genetically modification process. However, the knowledge of Nigerian agricultural scientists in GMC is largely unknown and this makes it very difficult to ascertain farmers' readiness to adopt. Hence, the need for this study.

The study was designed to assess scientists' knowledge and knowledge level of agricultural scientists in GMCs with a view to ascertaining their capability in disseminating GMCs to farmers in order to alleviate food insecurity challenge in Nigeria.

## MATERIALS AND METHODS

This study was carried out in Nigeria. Nigeria has a land area of 923,769km$^2$ and a population of over 168.8 million people [20]. It is surrounded on the West by the Republic of Benin and the Republic of Niger; on the East by the Republic of Cameroon; on the North by Niger and Chad Republic's and on the South by the Gulf of Guinea. Nigeria is situated in the West African region and lies between longitude 3$^o$ and 14$^o$ and 4$^o$ and 140$^o$ (Fig. 3). The climate is equatorial and semi-equatorial. That is the wet and dry season and agriculture production mostly depends on natural rainfall. Temperatures across the country are relatively high with a very narrow variation in seasonal and diurnal ranges 22

$=36^0$C. (Nigeria Embassy, 2015). Nigeria has six Geo-political zones. They are North Central Zone, North-Eastern Zone, North-Western Zone, South-Eastern Zone, South-Southern Zone, and South-Western Zone. The target population was Agricultural Scientists across the six geopolitical zones in the country. Nigeria comprising of Agricultural Scientists from Agricultural Research Institutes, Universities and Government Agencies that are into crop activities.

A multi stage sampling technique was used to sample scientists across the six geopolitical zones across the country. At the first stage, a purposive sampling technique was used to sample three out of the six zones based on the population of scientists and the presence of research institutions where GMCs centers are located. At the second stage, stratified sampling technique was used to ensure that homogenous samples are obtained. At the third stage, simple purposive sampling technique was used to select prominent research institutions and universities in the three states selected based on their involvement in GMOs researches. At the forth and the last stage, proportionate sampling technique was used to sample Twenty (20) respondents each from FCT ADP, UNIABUJA and 80 respondents from NABDA/OFAB and NABMA to give a total of 120 were sampled in FCT Abuja. While twenty (20) respondents each from IITA, UI, and Oyo MANR/ADP making 60 respondents were sampled in Oyo state and twenty (20) respondents each from NRCRI, MOUAU, Abia MANR/ADP making 60 respondents were sampled in Abia state to give a total sample size of two hundred and forty (240) respondents in the study area. Data collected were described with frequency counts, frequencies, Equal Interval Approach and F-tests.

## RESULTS AND DISCUSSIONS

### Socio-economic characteristics of Scientists

Evidence in Table 1 show that about 64.6% of the respondents were male while only about 35.4% were female. The findings revealed that male dominated the population of scientists/researchers in Nigeria. This implies that male scientists in Nigeria will have more awareness of GMCs than their female counterparts since they dominate the population of scientists in most of the research stations where GMCs are developed. This may not be farfetched as gross inequality has been established between male and female in terms of access to education in Nigeria by extant literature such as [22, 17, 2] among others. In addition, [26] reported that the literacy rate for Nigerian girls and women stood at 47% while male was 53%,yet the female forms the larger proportion of the population. Some of these findings pointed to the fact that in Africa, the female social role has been traditionally linked to the home and it has always been assumed that they can only find happiness and fulfillment only as mothers and wives [2]. Therefore, there is likelihood of having more male scientists/researchers than the female based on the fact that male traditionally have better access to education.

The finding is in consonant with the report of [27] on gender and science which stated that less than 40% of world researchers are women. Obviously, it implies that a significant gender gap has persistently occurred throughout the years at all levels of science and technology not only in Nigeria but across all African countries. However, women have made tremendous efforts towards increasing their horizon in technology research and higher education with the achievement over the years in Science and Technology but the population of male scientists still outnumber that of the female. Consequently, this result agrees with the study of [23] which established that agricultural and biological sciences/domain is still dominated by male scientists/researchers, particular in Nigeria.

Based on age distribution in Table 1, it was revealed that the mean age was approximately 38 years. Specifically, the findings showed that about 45.8% were found between 31 and 40 years of age, 21.7% of the scientists/researchers fell with the age range of 41-50 years while very few (7.9%) of the scientists/researchers were between 51 years and above. The findings showed that

scientists/researchers interviewed for this study were found in their youthful and active ages. The implication is that they are expected to have some youthful characteristics like innovation proneness, minimal risk aversion, faster reaction time, less fear of failure, less conservativeness, greater physical strength, greater knowlegde acqusition propensity, faster rate of learning, love for adventure and preference for boldness with high business oreintation [25]. The above characteristics if possessed may serve as a learage to promote their ability to developed GMCs that will assist in the fight against food security in Nigeria.

This result is in agreement with the findings of [23] that posited that more than half of the scientists/researchers whom perception was sought on GMCs across universities and research institutions in South Western Nigeria were less than 60 years. Similarly, [24] study supported the activeness of people whose age are within the age brackets of 31 and 40 years and stated that they are usually energetic, sensitive and productive. This means that respondents who fall within these age groups are in their prime age and can be efficient, effective and productive in delivering their research activities as expected.

Results in Table 1 further showed that about 78.4% of the respondents were married while 20.8% of the scientists were single and only very insignificant proportions (0.8%) were divorcees. Marital status in many African countries has been attached to responsibilities which has a strong correlation to job commitment and performance as opined by Adeoye *et al*. (2009). In addition, being married also would have encouraged them to be more committed towards their research activities. Marital status has been attributed to stability and stability will also enhance job performance based on the assertions of Adeoye *et al*. (2009) that reported that marital status was a significant variable that contributed to job performance of workers in an organization. The findings therefore showed that scientists/researchers interviewed for this study have the tendency to be committed since majority were married. The commitment is a function of stability that may invariably has significant influence on job performance. By this, it is expected that GMCs should be a common crops found in Nigeria if knowledge and acceptability are high.

With respect to religion, the results in Table 1 revealed that 79.2% of the total respondents in the study area were Christians when compared with Islam of barely 17.1% and African traditional religion 3.8%. This shows that Christianity is the dominant religion among the respondents. Although, both Christianity and Islam are the two dominant religious bodies in Nigeria and these have been found to influence certain farming practices. This result is in conformity with the assertions of [23] that posited that majority of the respondents were Christians. Moreover, this study is one of the specific studies that have showed the influence of religion on GMCs in Nigeria. For example, the study submitted that respondents' religion affiliation had significant effects on their perception towards genetically modified technology in Southwest, Nigeria and this was attributed to their different beliefs, norms, cultural values and taboos which are the basis doctrine of these religious organizations. Similarly, [31] asserted that religious beliefs could either promote or prohibit the adoption and utilization of GMCs in many parts of the world but the significance importance of GMCs in sustainable food production cannot be underestimated in developed countries of the world.

Results in Table 1 also showed that 34.6% of the scientists/researchers sampled were PhD holders, about 30.0% hold M.Sc degree while 29.2% and 6.2% were holders of First degree and HND certificate, respectively. The findings showed that respondents were well educated. This high level of education is expected to significantly influence their awareness and knowledge of GMCs. Also, education has been found to positively influence people disposition towards the acceptance of GMCs. [8 and 19] reported education as one of the factors identified as crucial to the adoption of genetically modified crops and animals. This means education has the potentials to increase scientist/researchers

propensity to seek for more knowledge about GMCs especially in Nigeria as food insecurity is one of the target areas that researchers are encouraged to tailor their research interest toward in the 21st century with a view boosting agricultural productivity for a food secured nation.

Table 1. Distribution of respondents by their socio-economic characteristics

| Socio-economic characteristic | Frequency | (%) | Mean | Std. Dev. |
|---|---|---|---|---|
| **Sex of respondent** | | | | |
| Female | 85 | 35.4 | | |
| Male | 155 | 64.6 | | |
| **Age (Years)** | | | | |
| <= 30 | 59 | 24.6 | | |
| 31 – 40 | 110 | 45.8 | | |
| 41 – 50 | 52 | 21.7 | | |
| 51+ | 19 | 7.9 | 37.5 | 8.4 |
| **Marital Status** | | | | |
| Single | 50 | 20.8 | | |
| Married | 188 | 78.4 | | |
| Divorced | 2 | 0.8 | | |
| Widowed/ Widower | | | | |
| **Religion** | | | | |
| Islam | 41 | 17.1 | | |
| Christianity | 190 | 79.2 | | |
| African traditional religion | 9 | 3.8 | | |
| **Educational Qualification** | | | | |
| HND | 15 | 6.2 | | |
| B.Sc | 70 | 29.2 | | |
| M.Sc | 72 | 30 | | |
| Ph.D | 83 | 34.6 | | |
| **Occupation** | | | | |
| Research only | 105 | 43.7 | | |
| Teaching only | 19 | 7.9 | | |
| Research and teaching | 69 | 28.8 | | |
| Extension service | 47 | 19.6 | | |

Source: Computed from Field Survey, 2018.

The finding conforms to the study of [23] that reported that about 45% of scientists sampled across Southwest universities in Nigeria on their perception towards genetically modified organisms were holders of M.Sc. the study further supported the fact that this high educational qualification will be an added advantage in enhancing respondents ability to conduct research owing to their strong analytical skills that must have risen from their educational experience over the years.

Furthermore, Table 1 revealed that about 43.7% indicated that they engaged solely in research activities, 7.9% indicated teaching as the only activity carried out by them while 19.6% were extension expert with the responsibility of information dissemination about GMCs and 28.8% combine teaching and research as their main occupation. This showed that diverse areas of concerns with regards to GMCs were involved in this study. Based on the above statistics, it can be deduced that over 70% of the sampled respondents carry out research and teaching activities. These activities are germane to acquisition of more knowledge about GMCs. The involvement of extension personnel is an indication of ensuring that research outputs will not be left fallow in research stations as their duties among others is to ensure that the research outcome gets to the final consumers [15]. This will enable to create more awareness about GMCs among the populace and an increased in awareness is expected to help in the fight against food insecurity.

**Awareness of GMC by Respondents**

The distribution of the respondents based on awareness of GMCs and the awareness level as shown in Table 2 and Figure 1. Evidence in Table 4 shows that about 87.1% of the respondents indicated their awareness of GMCs technology. This finding further confirmed the earlier report in Table 1 where respondents' awareness of the existence of GMCs were tested. In addition, about 87.1% of the respondents were aware that GMCs are products of genetic engineering and about 81.3% revealed their awareness that GMCs technology became popular in Nigeria in recent times. In addition, about 84.2% and 69.2% showed their awareness that GMCs have potential benefits for increasing food production and that Nigeria has not commenced commercialization of GMCs respectively. Furthermore, a little above average (57.1% and 55.0%) registered their awareness that GMCs technology is more

expensive than the non-GMCs and USA multi-national agencies introduced GMCs to Nigeria, respectively. Nigeria institutions like NBMA, GON SHEDA and NABDA were set up to run the affairs of GM technology (60.4%), Nigeria government has signed GMCs Bill into law (56.7%), Nigeria government drafted biosafety laws and measures on GM technology (57.9%), GMCs have not been commercially grown (59.6%).

On the level of awareness of GMCs as measured in Chapter three, results in Figure 1 show that about 52.5% of the respondents were rated high in their awareness level. About 36.7% had moderate awareness while very few (10.8%) had low level of awareness. The findings showed that respondents had reasonable level of awareness of the GMC technologies, although they indicated that despite the fact that GMCs can be used to fight hunger, it's adoption and utilization has not been used to produce food at commercial scale.

The study agrees with the findings of [14] that pointed to the fact that Nigeria is not known among countries where GMOs have been used to fight hunger. The study listed countries like United States, Brazil, Argentina, India, Canada, China, Paraguay and South Africa as those that produce food using GMO technologies. This shows that only South Africa featred in the use of GMO technology at this period among the developing countries. However, [13] reported that in 2006, about 38% of food using GMOs were grown in the developing countries and GM crop production also reaches a significant level in Paraguay, South African, Uruguay and Australia

Table 2. Distribution of respondents based on their awareness of GMC

| **Awareness of GMC | Frequency | Percentage |
|---|---|---|
| Awareness of GMCs technology | 209 | 87.1 |
| GMCs are products of Genetic Engineering | 209 | 87.1 |
| GMCs technology became popular recently in Nigeria | 195 | 81.3 |
| GMCs has great potential benefits for increasing food production | 202 | 84.2 |
| Nigeria has not commenced commercialization of GMCs | 166 | 69.2 |
| GMCs technology is more expensive than non-GMCs | 137 | 57.1 |
| USA Multinational agencies introduced GMCs to Nigeria | 132 | 55.0 |
| Nigeria institutions like NBMA, GON SHEDA and NABDA were set up to run the affairs of GM technology | 145 | 60.4 |
| Nigeria government has signed GMCs Bill into law | 136 | 56.7 |
| Nigeria government drafted biosafety laws and measures on GM technology | 139 | 57.9 |
| GMCs have not been commercially grown | 143 | 59.6 |

Source: Computed from Field Survey, 2018.
**Multiple Responses.

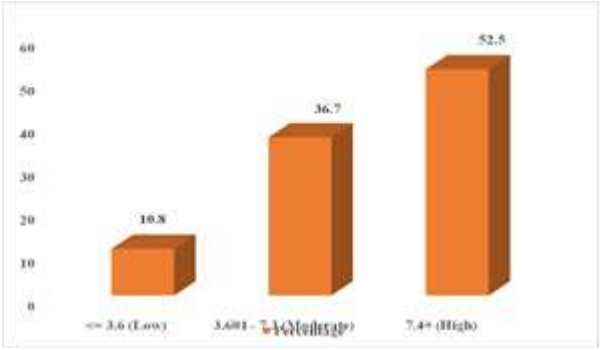


Fig. 1. Level of awareness of GMCs among respondents
Source: Computed from Field survey, 2018.
Maximum score = 11 Minimum score = 0 Range = 11

## Knowledge level of GMCs Merits and Demerits by respondents

Results in Tables 3 and 4 show the respondents' knowledge of GMCs merits and demerits respectively. Table 3 indicated that respondents had high knowledge of GMCs merits in the study area with the mean value of 3 and above**.** This implies that respondents' exposure to GMCs research activities and teaching over the years has improved their knowledge. Respondents opined their high knowledge stating that GMCs has better yields with the highest mean value of 4.29. This is closely followed by the knowledge that GMCs has higher productivity (4.25) and

better quality (4.23). Knowledge that GMCs reduced pesticide use as well as that it increases farmers' income had 4.15 respectively. GMCs has better resistant to disease had a mean of 4.14, followed by knowledge of greater resistance to pest (4.12), better nutritional value (4.09), higher flexibility in weed management (3.90) and that GMCs has a long shelf life (3.89).

Table 3. Kmowledge Level of G MCs Merits by Respondents

| Merits Statements | Strongly Disagreed (1) | Disagreed (2) | Undecided (3) | Agreed (4) | Strongly Agreed (5) | Mean $\bar{X}$ | Decision |
|---|---|---|---|---|---|---|---|
| Better quality | 3 (1.3) | 11 (4.6) | 15 (6.3) | 109 (45.4) | 102 (42.5) | 4.23 | High |
| Better taste | 6 (2.5) | 56 (23.3) | 86 (35.5) | 55 (22.9) | 37 (15.4) | 3.25 | High |
| Longer shelf life | 5 (2.1) | 22 (9.2) | 45 (18.8) | 90 (37.5) | 78 (32.5) | 3.89 | High |
| Better resistant to disease | 4 (1.7) | 14 (5.8) | 30 (12.5) | 88 (36.7) | 104 (43.3) | 4.14 | High |
| Better yields | 1 (0.4) | 9 (3.8) | 19 (7.9) | 102 (42.5) | 109 (45.4) | 4.29 | High |
| Higher productivity | 2 (0.8) | 9 (3.8) | 21 (8.8) | 102 (42.5) | 106 (44.2) | 4.25 | High |
| Better nutritional value | 6 (2.5) | 11 (4.6) | 36 (15) | 89 (37.1) | 98 (40.8) | 4.09 | High |
| Better flavor | 7 (2.9) | 50 (20.8) | 88 (36.7) | 66 (27.5) | 29 (12.1) | 3.25 | High |
| Better colour | 4 (1.7) | 46 (19.2) | 78 (32.5) | 65 (27.1) | 47 (19.6) | 3.44 | High |
| Greater resistance to pest | 2 (0.8) | 14 (5.8) | 27 (11.3) | 106 (44.2) | 91 (37.9) | 4.12 | High |
| Reduced pesticide use | 5 (2.1) | 15 (6.3) | 31 (12.9) | 76 (31.7) | 113 (47.1) | 4.15 | High |
| Environment friendly | 11 (4.6) | 20 (8.3) | 43 (17.9) | 95 (39.6) | 71 (29.6) | 3.81 | High |
| Higher flexibility in weed management | 3 (1.3) | 23 (9.6) | 42 (17.5) | 98 (40.8) | 74 (30.8) | 3.90 | High |
| Higher farmers income | 2 (0.8) | 11 (4.6) | 29 (12.1) | 104 (43.3) | 94 (39.2) | 4.15 | High |

Note:
( ) = Percentage of total respondents
Critical Mean = 3.00
< 3.00 is low knowledge of GMCs merits
≥ 3.00 is high knowledge of GMCs merits
Source: Computed from Field Survey, 2018.

Those who agreed GMCs are environmental friendly had 3.81, GMCs has better color (3.44), has better taste than non GMCs and better flavor (3.25) respectively.

The study affirmed the fact that GMOs have been documented to have vast benefits to human endeavours, although its usage in Nigeria is still at the lowest level but respondents have wide knowledge of its merits through their experiences as researchers and scientists in their various fields of study.

The high knowledge recorded on the merits of GMCs may not be unconnected to numerous factors like experiences, conferences attendance and personal study of latest scientific discoveries among others while their inability to use GMO technology may be due to the unfavorable economic conditions such as lack of stable electricity, lack of well-equipped laboratories and reagents in most of our higher institutions and these are largely due to the government neglect.

The study of [3] confirmed this results that GM technology has such numerous benefits as attended to by the respondents. A similar report by [1] on awareness and utilization of genetically modified foods in Nigeria, also confirmed that the introduction of genetically modified foods (GMFs) raised hopes that the problem of food insecurity would be solved.

Table 4 further revealed the knowledge of the respondents on the perceived demerits of GMCs. The results showed that some respondents expressed their high fears about GMCs technology stating that they strongly agreed that GMCs alter human genetic make-up. This has highest mean value of 3.75. Other demerit as identified by respondents in the study area includes the fear that GMCs

cause threat to environmental integrity (3.56), and that it eliminates biodiversity (3.49). Furthermore, they accept the fact that it destroys traditional farming practices (3.48) and increase production cost (3.36). Meanwhile, there is low agreement by respondents in the following; that GMCs increase input cost (2.98) and that farmers will depend on GMCs (2.83). The implication of this finding is that this attitude or mindset of fears would pose a lot of challenges to scientists and government of Nigeria which could have impede the implementation and utilization of this technology over the years.

Table 4. Knowledge Level of GMCs Disadvantages/Demerits by Respondents

| **Advantages/Merits Statements** | **Strongly Disagreed (1)** | **Disagreed (2)** | **Undecided (3)** | **Agreed (4)** | **Strongly Agreed (5)** | **Mean $\bar{X}$** | **Decision** |
|---|---|---|---|---|---|---|---|
| Alter human genetic make-up | 15 (6.3) | 37 (15.4) | 38 (15.8) | 52 (21.7) | 98 (40.8) | 3.75 | High |
| Make farmers depend on GMC companies for planting materials | 36 (15.0) | 66 (27.5) | 62 (25.8) | 55 (22.9) | 21 (8.8) | 2.83 | Low |
| Increase input cost | 29 (12.1) | 55 (22.9) | 66 (27.5) | 72 (30.0) | 18 (7.5) | 2.98 | Low |
| Increase production cost | 24 (10.0) | 51 (21.3) | 34 (14.2) | 77 (32.1) | 54 (22.5) | 3.36 | High |
| Destroy traditional farming practices | 24 (10.0) | 37 (15.4) | 35 (14.6) | 87 (36.3) | 57 (23.8) | 3.48 | High |
| Threat to environmental integrity | 18 (7.5) | 33 (13.8) | 45 (18.8) | 84 (35.0) | 60 (25.0) | 3.56 | High |
| Eliminate biodiversity | 20 (8.3) | 41 (17.1) | 36 (15.0) | 88 (36.7) | 55 (22.9) | 3.49 | High |

**Note:** figures in parentheses represent percentages
Critical Mean = 3.00
< 3.00 is low knowledge of GMCs demerits
≥ 3.00 is high knowledge of GMCs demerit
Source: Computed from Field Survey, 2018.

The finding is in agreement with [1] assertion that Genetic Modified Foods (GMFs) do not usually deliver on any of their promised benefits but rather provide pain, difficulty and death. The high knowledge of its fear may be a serious threat to food security strategies as it will be difficult for the scientists to disseminate information that is at the detriment of the end users of the research findings.

## Differences in the knowledge of GMCs across three selected zones

Results in Table 5 show that there was a significant different in the knowledge of GMCs among respondents across the three selected zones with North Central having the highest mean (154) based on the results of Duncan rage test with the F-value of 15.2; $p \leq 0.05$.

Table 5. Results of Analysis of Variance showing significant difference in the scientists knowledge of GMCs

| | **Sum of Squares** | **Df** | **Mean Square** | **F** | **Sig.** |
|---|---|---|---|---|---|
| Between Groups | 4542.04 | 11 | 2728.15 | 15.2 | 0.05 |
| Within Groups | 12205.15 | 228 | 561.31 | | |
| Total | 16747.19 | 239 | | | |

Source: Computed from Field Survey, 2018.

Table 6. Results of posthoc test using Duncan showing location of differences in the scientists' knowledge of GMCs

| **Zone** | **Subset for alpha = .05** | | |
|---|---|---|---|
| | 1 | 2 | 3 |
| Southwest | 101.67 | | |
| Southeast | 118.33 | 118.33 | |
| North central | | | 154.01 |

Source: Computed from Field Survey, 2018.

This implies that scientists in the North central zone of Nigeria had better knowledge of GMCs than those in the other zones. This may not be unconnected to the fact that they

had more facilities to conduct research in GMOs than the other ones. This will make them to be more exposed to the GMCs technologies. Hence, their higher knowledge.

## CONCLUSIONS

The study shows that there were more male scientists than the females and scientists awareness of GMC technology was rated high. Knowledge of the GMC technologies among scientists was also high but there was a significant difference in the knowledge of the technology among scientists in the north Central part of Nigeria than the other region. It was affirmed that there were more institutions with better facilities to conduct state of the earth researches in this part of the country than the other. This high knowledge of merits of GMCs may be a good entry point to solving the problem of food insecurity in the country. However, the high knowledge of demerit may equally serve as a serious threat to food security programme.

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