Building Trust in Biotechnology Development: Sharing Experience, Sharing Concerns.

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Abstract

Biotechnology development is one of the fastest and most precise means of genetic manipulations at the cellular and molecular levels for enhanced desirable end products. Its applications in Agriculture, Medicine, Pharmaceutical, Environmental and Marine sciences make it very useful in solving many agricultural production constraints and developing vaccines for protection against some communicable and terminal diseases, as well as, in the cleaning of the marine environment for the survival of the animals, fishes and other organisms in the oceans. This paper surveyed the web for available information on how GMO crops can tame hunger that is currently ravaging many countries of the world due to the effects of climate change and its accompanying agricultural production constraints. The paper studied the ten most food sufficient nations of the world, the ten most food shortages in the globe, the ten most hunger-stricken nations of the world, the ten top countries where people are dying because of severe hunger, and how population and growth rate of some sample countries studied affect food availability for effective planning. The paper also looked into the adoption of biotechnology in food production, its possible effects on food-sufficient nations, and its rejection in some hunger-stricken nations of the world. The results showed that 6 of the 10 most food-sufficient nations adopted the use of GM food, which prompted 6 of the food-shortage nations to quickly adopt GM crops. It was also observed that 4 of the countries with sufficient food, are of low population and low growth rate, therefore, could afford to feed their citizens without GM food, while 4 hunger-stricken nations that do not adopt GM crops have high death rates due to hunger and thereby pushed themselves to serious avoidable wars. The paper also comparatively assessed ten countries with the most reported cancer cases and ten top countries with the lowest cancer cases to ascertain or dismiss the general speculations that cancer is positively associated with the consumption of GMO foods. The paper, based on present findings, concluded that the adoption of biotechnology in food production is inevitable for many countries of the world, especially Africa, India, and South America, to curb famine and starvation and to be able to cope with the population growth rate. Consumption of GMO food had no direct link with cancer cases and should be ruled out until an empirical study confirms such an assumption, much so than hunger kills faster than GM foods, for which no evidence of adverse effects has been proven.

Keywords: Biotech, Genetically modified crop, Population growth, and Hunger-stricken Nations.

Introduction

Biotechnology- The word Biotech was first coined and used in 1919 by Karoly Ereky (1878-1952), a Hungarian Agricultural Engineer. Biotech is, however, best described by its importance and uses rather than making any attempt to define it. Biotech can therefore be described as follows. Any technology that utilizes biological systems, living organisms, or parts of these to develop or create different useful products for the benefit of mankind. It is a multidisciplinary field of science that involves natural sciences and engineering sciences to achieve **desired** results. It is a technology that harnesses cellular and biomolecular processes to develop **useful technologies.** It is also the use of Biology to develop new methods and organisms intended **to improve human health and society.**

It can also be defined as computational Biology, conceptualizing it in terms of molecules and its application (informatics) in organizing information associated with molecules on a large scale. It is the branch of applied science that uses living organisms and their derivatives to produce **products and processes**. It is a combined study, innovation, and practice of natural sciences and Engineering sciences to use microorganisms and biological systems of animals and plants to **benefit society** in various sectors such as health, agriculture, food industries, wastewater treatment, and other fields.

Building- The word building, by my definition, is the systematic and structural arrangement of a planned action with a trusted and accepted pattern that accomplishes a project, a task, or a policy that will benefit the majority who care to appreciate the result. Advanced The English Dictionary described the word "build" as combining materials and parts to construct something.

Trust- The Dictionary definition of trust is something held by one party (trustee) for the benefit of another (beneficiary). It went further to describe different types of trust, such as active trust, blind trust, charitable trust, Clifford trust, direct trust, discretionary trust, express trust, grantor trust, implied trust, inter vivo trust, living trust, passive trust, public trust, spendthrift trust, testamentary trust, totteen trust, trust account, trustee account, voting trust.

Biotechnology innovation is an emerging science with its usefulness in Agriculture, Veterinary Medicine, pharmaceutical, and fine chemical production. It is an emerging technology for the transition toward a carbon-free society and solving challenges such as health protection, energy, and the environment (Donald et al, 2021).

Sharing my Experiences as a Plant Breeder, an African, an Active Practicing Farmer, and a Seed Producer

Why should trust be built in Biotechnology Development?

- The case of organic food produced in one of the Western world countries in 2001
- The global food deficit and looming hunger in Tropical Africa
- Climate change and its attendant problems
- Insincerity of the antics
- Death and breakout of war due to hunger and starvation
- Biotech food and starvation, which is the best alternative

-Should international politics be played with food and nutritional security (the most essential human need)
-Vaccine production, the product of Biotech (Covid-19, Cholera, Polio, etc.) which kills faster? Exposure to COVID-19 or GMO food?
- Are there huge reports of empirical data in peer-reviewed Journals for professionals to reject it,
- Concern for Environment vis-a-vis acceptance or rejection of Biotech, the negative impact on environment, insecticides, fungicides, chemicals, oil pollutants, insect resistance, mutations, etc.
- Cowless Biotech Milk production and the impact on the environment, child growth, nourishment, choice of baby sex.

Some of the Recent research in Biotechnology

1. Synthetic DNA which is used for COVID-19 and the applications
2. Development of vaccine for CoViD 19 and HPV
3. Testing and tracing COViD-19 using biotech tools such as PCR and antigen test
4. 4-D printing and tissue engineering, which can create functional and responsive biological structures
5. Stem cell research which can offer potential treatments for various diseases and injury
6. Production of milk without cow
7. Climate-smart rice genotypes (using multi-trait selection index), drought, pest.

Kind of Trust we must build on Biotech as a Nation

1. Socio-economic Trust

2. Advances and scientific development and their implications as a people, do not stay behind because of political, religious and some beliefs and opinions of some people, or stay behind.

3. The need to remove bias and speculations, judging from the level of education and our enlightenment as a nation.

4. Build trust in its realistic breakthrough and benefit, and not on international trade politics and economic rivalry

5. Our economic growth as a nation and agricultural comparative advantage based on its application

6. Build trust in its development and its contribution, and not because of what the antics will tell or not tell you, for example (i) They all consume Biotech products such as dairy products, beef, pork, and fruits. (ii) Health benefits such as vaccines, drugs, vegetables, and fruits that contribute to Medicare, they keep pests of Biotech at home, play with them, integrate these pests into the family, and write wills in favour of these pests from Biotech.

7. The use of Biotech processes and products (i) to clean up the pollutants in the ocean, plastic degradation, and oil spillage cleaning. (ii)They consume marine and seafood that is bred and released to survive in the oceans. (iii) The antiques, their wives, and children work in the establishment of a Biotech business and make a fortune out of it and obtain a living on such.

8. The European Union's stand and approach should be objectively adopted by Nigeria and other tropical African countries. In August 2012, 3 maize GMOs, 2 GMO soybeans, and one cotton variety have been approved for food and use. Similarly, one oil seed rape was declared safe by the European Food Safety Authority (ESAFE), which conducted an assessment on them and found them safe and authorized them suitable for use as food. Ten years later, they will reassess its impact on society. Such should be adopted here with a sincere purpose for enhanced food and nutritional security (www.isaaa.org).

9. Building our trust on proven scientific findings and not on speculations that have no root in science. We can borrow some sense from the ESAFE approach and assess all Biotech products and not just reject or support their rejection without any proven evidence of their adverse effects on human beings.

10. Build trust in our scientists who are part of the development, evaluation, safety assessment, and toxicology and do away with the sponsor of the antics of Biotech that are enslaving us in Africa and cleverly impoverishing us to depend only on them for food, by discouraging seed of high yield potential, crops of pest resistance, high nutrition and climate-smart varieties that can cope with dynamics of weather and climates of our present generation.

11. Health benefits such as Vaccine, drugs, oils, Pets that were developed as products of Biotech are their friends, they live together, play together, feed them with products of Biotech, some give these pets kisses and exchange saliva, some write a will and give their properties to them because of the friendship and loyalty that bound them together, yet they sponsor campaign against biotechnology. You can see the deceits and insincerity of some GMO antics.

12. There is a need for Africa to borrow some sense in all efforts to produce food sustainably and stop importing the same GMO food you refuse to accept, produce, and utilize here. When there is a food shortage, African leaders will be forced to import the only available GMO food for the teeming population to survive, rather than dying in thousands, using FOREX and depleting their foreign reserves. Please tell me where the economic sense is. Free yourself from the economic slavery of the World giants.

13. The need to build trust in our scientists is important. The reason we have decided on the high-powered National Variety Release Committee is to accept and release only GMOs that are developed here in Nigeria, evaluated here in Nigeria, produced here in Nigeria, and undergo strict supervision and Biosafety regulations of Nigeria. Unfortunately, the one who is rich and kind enough to fund research to ensure that Africa is developed, food self-sufficient, and environmentally cleaned of hydrocarbons and other pollutants are being castigated by the ignorant who had been paid to blog about the speculation of Biotech food as being poisonous. Our Nigerian colleagues who work in Biotech Labs abroad, which have been fed GMOs for over 29 years are pitifully laughing at our ignorance.

14. Build trust in Biotechnology to enhance environmentally clean oil-producing and river-riven areas of Africa. In blue Biotech practices, oil spillage, poisonous pollutants, and plastics that are presently reducing the fishing business can be cleaned up using Biodegrading organisms to digest the plastic. Adoption of this technology will reduce billions of Naira being spent annually to clean up the oil-extracting fields effectively, cheaply and affordably.

My concern as a person, an African, and a Scientist

This paper attempted some fact findings exercises to ascertain the world food security vis-a-vis population and adoption or otherwise of Biotechnology practices in food production. The implications for the socio-economic well-being of people across the globe, and the risk of consuming GMO food or food products if any.

Methodology

The brief study by surveying the websites looks into the ten most food-sufficient nations, ten countries with the most food shortage, their population growth, and

population growth rate. The study also selected ten hunger-stricken nations and ten countries of the world where the death rate was associated with hunger. The survey also unfolds the true position of people's speculation that GMO foods were responsible for the increase in cancer diseases across the globe. It is important to declare here that the information obtained in this paper is published information in the public domain that can be verified on the websites for confirmation or re-validation by people with probing minds. The data were directly from the primary sources of the organizations that reported them. My only assignment was to compile, collate, and interpret them dispassionately without bias to enlighten our minds. The countries chosen here naturally pop up by mere use of search engines, not by my volution.

Results and Discussion

The results of this brief search showed the following: The United States of America was the most food-secure, followed by the Netherlands, Japan, Sweden, Canada, Norway, Bulgaria, Ukraine, Russia, and Australia. The ten countries with food shortages include the Democratic Republic of Congo, Nigeria, Sudan, Afghanistan, Ethiopia, Yemen, the Syrian Arab Republic, Bangladesh, Pakistan, and Myanmar in that order. The population of the sample countries varied from 5.49 million (Norway) to 333.3 million (United States of America). The countries selected naturally fell within different regions of the globe, spreading across the continents (Table 1).

The adoption of GMO crops and food products was observed in six out of the ten food-sufficient countries (the United States, Japan, Canada, Norway, Russia, and Australia). Four of the ten food-sufficient countries did not approve the use of GM crops or food products. These countries include the Netherlands, Sweden, Bulgaria, and Ukraine. Similarly, countries with food shortages and the use of GM crops and food products were six out of ten (Nigeria, Sudan, Ethiopia, Bangladesh, Pakistan, and Myanmar). Democratic Republic of Congo, Afghanistan, Yemen, and the Syrian Arab Republic had yet to approve and adopt the use of GM crops (Table 1). Other important observations are as follows:

(1) Six countries with high population density that adopted the use of GM crops and were food-sufficient examples are the USA and Russia

(2) Four of the countries (without the use of GM are food sufficient (Netherlands, Sweden, Bulgaria, and Ukraine), but with a population of less than 50 million people.

(3) Four countries with food shortages and no GM crop approval were the Democratic Republic of Congo, Afghanistan, Yemen and The Syrian Arab Republic.

Table: 1 Ten Most Food sufficient and Most food Shortage Nations of the World, 2023

Rank	Country with Food sufficiency	Population (Million)	Country with a Food shortage	Population
1	United States of America*	333.3	Democratic Republic of Congo	105.63
2	Netherlands	17.65	Nigeria*	299.15
3	Japan*	122.6	Sudan*	49.36
4	Sweden	10.64	Afghanistan	43.37
5	Canada*	39.10	Ethiopia*	129.72
6	Norway*	5.49	Yemen	35.22
7	Bulgaria	6.618	The Syrian Arab Republic	23.79
8	Ukraine	37.91	Bangladesh*	174.70
9	Russia*	144.2	Pakistan*	245.21
10	Australia*	26.67	Myanmar*	54.96

Source: FAO 2010; https://joint-research-centre.ec.europa.eu, 2023)

Table 2 presents the ten most hunger-stricken and ten most food shortage countries in the world. The ten hunger-stricken nations of the world include Sudan, the Central Africa Republic, Niger, Chad, the Democratic Republic of Congo, Ethiopia, Yemen, Haiti, Madagascar and Afghanistan. The top nations with food shortages are Nigeria, Sudan, the Syrian Arab Republic, Bangladesh, Pakistan, and Myanmar. Many of these countries stricken by food shortages in their wisdom therefore adopted and approved the use of GM crops and food. They are Bangladesh, Ethiopia, Myanmar, Nigeria, and Pakistan (Table 3). Others are still watching and trying to find solutions to food shortages in their countries. The European Union members approved GMOs in 2010 to curb hunger and used them for thirteen years and did not report an empirical study, but some members woke up and banned them in 2023, some even went organic. African countries should also use GMO food to stem starvation and death through hunger for just 10 years before reviewing whether to continue the use or otherwise, instead of rejecting it and dying in thousands of ignorance.

Table 2: Top Ten Hunger-Stricken and Ten Most Food-Stricken shortages across the Globe

Ranking	Hunger-stricken nation	Hunger index	Ranking	Ten nations with the most food shortage
1	Sudan	28.8	9	Democratic Republic of Congo
2	Central African Republic	44.0	2	Nigeria
3	Niger	32.6	7	Sudan
4	Chad	37.2	5	Afghanistan
5	Democratic Republic of Congo	37.8	4	Ethiopia
6	Ethiopia	27.6	10	Yemen
7	Yamen	45.1	1	The Syrian Arab Republic
8	Haiti	32.7	6	Bangladesh
9	Madagascar	38.7	3	Pakistan
10	Afghanistan	29.9	8	Myanmar

Source: sources across the web, 2023

Table 3: Countries with GM Crop approvals on the GM Approval Database

1	Argentina	25	Mexico
2	Australia	26	Myanmar
3	Bangladesh	27	New Zealand
4	Bolivia	28	Nigeria
5	Brazil	29	Norway
6	Burkina Faso	30	Pakistan
7	Canada	31	Panama
8	Chile	32	Paraguay
9	China	33	Philippines
10	Colombia	34	Russia
11	Costa Rica	35	Singapore
12	Cuba	36	South Africa
13	Egypt	37	South Korea
14	Eswatini	38	Sudan
15	Ethiopia	39	Switzerland
16	European Union	40	Taiwan
17	Ghana	41	Thailand
18	Honduras	42	Turkey
19	India	42	United States
20	Indonesia	43	Uruguay
21	Iran	44	Vietnam
22	New Zealand	45	Zambia
23	Kenya	46	Spain
24	Malaysia		

Source: ISAAA: https//www.isaaa.or

Tables 4a to 4c highlight the historical population growth of three countries (United States of America, Japan and Nigeria, to critically look at how the population growth of these countries is being managed or controlled. Nigerian population growth increased from 218,541,212 in the year 2022 to 223,804,632 in 2023 and from 223,804,632 to 229, 152,217 in 2024. Although the growth rate in 2022 and 2023 was constant at 2.41, it declined by 2024 from 2.41 to 2.39. May be for reasons of deaths due to bandits, Herdsmen attacks, Boko Haram and natural death. For Japan, it was a planned action to regularly maintain the population growth which was slightly reducing every year, with growth rates of -0.53. -0.53 and -0.54 in 2022, 2023 and 2024 respectively. The population growth and rates were slightly increasing just like Nigeria with growth rates of 0.31, 0.50 and 0.53 for 2022, 2023 and 2024 respectively. The major difference was that America had higher population growth than Nigeria and was in the table of the ten food-secured countries of the world, while Nigeria was ranked second among the ten most food shortages in the world. This calls for a big concern for the government, stakeholders in food production, Agricultural Research scientists and policymakers. Perhaps the reason for the adoption and approval of GM crops is that can boost the production of food and food items. It is also a wake-up call for nations of the world with similar situations. these countries, we can then review the use of GMOs.

Table 4a: Historical Population Growth rate for necessary Food Security Planning

Nigeria

Year	Population	Growth rate (%)
2024	229,152,217	2.39
2023	223,804,632	2.41
2022	218,541,212	2.41

Table 4b: Japan Population Growth rate

Year	Population	Growth rate (%)
2024	122,631,432	-0.54
2023	123,294,513	-0.53
2022	123,951,692	-0.53

Table 4c: United States Population Growth

Year	Population	Growth rate (%)
2024	341,814,420	0.53
2023	339,996,563	0.50
2022	338,289,857	0.31

Source: Extracted from Worldometer: Worldometer www.worldometer.info

Table 5 presents the death rate in the 10 top countries with the highest death rate associated with hunger. These figures represent number of mortalities per year in every 100,000 people. From this report, death rates of between 27.52 and 101.32 were reported confirmed. The lowest death rate from hunger and starvation was 27.52 in Eritrea while the highest was 101.32 in Angola. Others were within this range. The worrisome aspect of these situations with these countries is that they are properly located across the globe favourable agricultural ecology. There may be other factors that might be responsible for the food shortage and hunger-stricken condition of these nations, the adoption of a biotechnology system of food production would have been better than starving people to death. Many of these countries such as the Central African Republic, Sudan, the Democratic Republic of Congo, Benin, share similar latitudes with Nigeria, and Ghana where agricultural production potential is relatively high compared to many parts of the world. It is also important here to state that only three of these ten countries with the highest death rate due to hunger are not in Africa. The rest seven are located on African soils. Maybe, the reason the African Union is seriously encouraging the application of the Biotech method of food production. There was no European country or American country where people were dying of hunger yet they embraced GMOs (Table 3). Rather than rejecting GM food, they embraced it and constantly reviewed it either to retain, modify or ban it (EFSA, 2023). Whenever Africa is food-sufficient like these countries, we can then review the use of GMOs. But let us solve the problem of food shortage and starvation which is fast killing and bringing war into our domain before thinking of any side effects of GMOs that are based on speculations

Table 5: Ten top countries with the highest rates of death due to hunger

S/N	Country	Death rate	Ranking	Policy on GM food
1	Somalia	46.27	5th	Not yet approve
2	Bangladesh	56.36	2nd	Approved
3	Mali	57.15	3rd	Not yet approve
4	Angola	101.32	1st	Not yet approve
5	Cambodia	50.19	4th	Not yet approve
6	Benin	37.71	6th	Not yet approve
7	Bolivia	31.79	7th	Approved
8	Central African Republic	29.51	8th	Not yet approve
9	Madagascar	28.32	9th	Not yet approved
10	Eritrea	27.52	10th	Not yet approved

Source: Action against hunger, 2024: https://www.actionagainsthunger

Table 6 presents the ten highest cancer-rated countries globally. From the table, some facts emerged. There is strong speculation that has not been scientifically substantiated with empirical data especially in and peer-review journal. Hence, table 6 does not directly link with cancer rate to the consumption of GMO foods. For example, five out of the ten countries captured as highest cancer rated nations, adopted GMO food while the other five were not GMO-approved nations. Ireland, Denmark, Belgium, Netherlands, and France have not officially accepted GM foods but were placed as third, fifth, sixth, and ninth in the order of cancer top-rated nations. On the other hand, Australia, New Zealand, the United States, Canada and Norway adopted GM food but were placed first, second, fourth, eighth and tenth on the list respectively.

Table 6: Ten highest Cancer rates and ten lowest cancers by Country

Rank	Country with a High cancer rate	Rank	Country with the lowest cancer rate
1	Australia	1	Sudan*
2	New Zealand	2	South Sudan*
3	Ireland	3	Djibouti
4	United States	4	Timor-Leste
5	Denmark	5	Tajikistan
6	Belgium	6	Republic of Congo
7	The Netherlands	7	Bhutan
8	Canada	8	Nepal
9	France	9	The Republic of Gambia
10	Norway	10	Niger*

*Do not have infrastructure to adequately identify and register cases. Source: Dana-Farber Cancer Institute 2022-2023

If GMO is the only factor responsible for cancer high rate, in Countries such as Ireland, Denmark, and Belgium. The Netherlands (which feeds mainly on organic food) and France should not have appeared on the list of the ten highest countries with cancer cases. These facts should be sufficient enough in the meantime to disabuse the speculation that GM foods are linked with cancer and to

humble the antics of GM food to relax until empirical data in peer-reviewed Journals affirms that. The bloggers of anti-GM should also change the narrative to support GM foods and desist from starving millions of people in already listed countries to death for unsubstantiated information about GM foods at least for posterity. In a similar vein, countries of the world with high rates of food shortage, or better still hunger-stricken or hunger-killing nations should rethink adopting GM food to save the lives that are wasting away for dislike of GM food.

Conclusion

The simple question is that if some people have been consuming GM food for more than 30 years without cancer in advanced countries like the USA, we should agree with me that hunger kills faster than GM food, (if at all) GM is inherently dangerous for human health. The present generation owes the coming generations the planet Earth and an atmosphere that is free of contaminants, where temperature and carbon imbalance is minimized, where aquatic and terrestrial animals are surviving, where vegetation is close to being natural, where genetic erosion is highly reduced, where green gas is almost non-existing, where crop yields per unit area is high, where food and nutrition is more secured, where millions of people will no longer be dying for distaste to GM food and unhealthy policy decision, where everyone is happy and where the game is win-win in nature. The solution is the adoption of GM crops which are higher yielding, disease and pest resistant, drought tolerant, well adapted to various ecologies, climate-smart, free from chemical spraying, possess good shelf life, eco-friendly and nutritionally secured.

Declaration of interest

The authors declare no conflict of interest.

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