

AGRICULTURAL BIOTECHNOLOGY: A VERITABLE TOOL FOR ECONOMIC DIVERSIFICATION IN NIGERIA



INTRODUCTION TO AGRICULTURAL BIOTECHNOLOGY IN NIGERIA

The drastic fall of oil prices in the international market has spurred the Federal Government to diversify the Nigerian economy into other sources of revenue generation, specifically agriculture. A key means of improving the agricultural sector is by the deployment of biotechnology, because it serves as a tool for sustainable development of the agricultural sector and has the potential to boost food security within Nigeria.

According to Article 2 of the United Nations Convention on Biological Diversity, Biotechnology is the use of living systems and organisms to develop or make products, or technological application that uses biological systems, living organisms, or derivatives thereof, to make or modify products or processes for specific use. Biotechnology is not a new era of scientific endeavor as microorganisms have been used to produce food such as beer, vinegar,

yoghurt and cheese for over 8 millennia. Simply put, Biotechnology is the use of living cells or microorganisms (e.g. bacteria) in the industry and technology to manufacture food, drugs, chemicals, etc.

Agricultural biotechnology is the use of a range of tools, including traditional breeding techniques to alter living organisms or parts of organisms to make or modify products, improve plants or animals or develop microorganisms for specific agricultural uses. The undesirable characteristics of the conventional agriculture like susceptibility to diseases and low productivity are bred out. Biotechnology has especially been beneficial in improving agricultural productivity and increasing the resistance of plants to diseases. Biotechnology is considered a powerful tool that can enhance agriculture.



In many industrialized countries, biotechnology has significantly contributed to the progress in agriculture, while in developing countries, such as Nigeria, biotechnology seeks to achieve crucial productivity and sustainability targets to increase food production with added nutritional value and decreased negative impact on the environment. However, large-scale use of biotechnology has its own constraints; they include limited skilled human resources and lack of material and financial resources among others. The emergence of biotechnology in the last few decades has opened new doors for increased productivity not only for agriculture but also in medicine and industry. It is of particular relevance to developing countries that are confronted with an ever-increasing population, food shortage, and scarcity of economic resources.

Applied to the Nigerian economy, agricultural biotechnology offers technological opportunities capable of addressing the constant demand for food and reducing other vulnerabilities in the agricultural sector. Biotechnology can be applied to produce highly efficient agricultural, pharmaceutical and forestry crops to counter problems associated with unemployment and population growth.

It becomes very pertinent in this era of dwindling oil prices and mass unemployment that Nigeria incorporates biotechnology into its agricultural programme as the present administration seeks to improve the economy by diversifying to agriculture. In order to achieve sustainable agriculture, it has become pertinent to adopt appropriate technologies (Biotechnology) that would cater for the

existing agricultural challenges, such as climate change, erosion and leaching of farm lands, arid and unfertile lands among others

Biotechnology like other advanced technologies has potential for misuse. The emergence of modern biotechnology and its adverse impacts on the conservation and sustainable utilization of biodiversity on human health necessitated the development of a biosafety management system. Therefore, it became crucial to adopt a legal and regulatory framework for the use of modern biotechnology for increased productivity in the agricultural sector that would lead to improved socio-economic development of Nigerian farmers and enhanced national economic prosperity. It will also attract foreign investments and earnings from a safe modern biotechnology sector, leading to environmental sustainability, jobs or wealth creation and the availability of raw materials for industrial growth, particularly in the Nigerian textile sector.

Legal and Institutional Framework for Biotechnology in Nigeria

The resort to biotechnology and the capacity of the country's existing laws to accurately regulate biotechnology has become crucial in the light of Nigeria's search for secure and advanced ways to meet various economic needs, including food insufficiency.

In 1992 during the Earth Summit, the Convention on Biological Diversity (CBD) was adopted and Nigeria signed

it in 1992 and ratified it in 1994. The CBD mandated parties to negotiate and develop a Protocol on Biosafety. Subsequently the Cartagena Protocol on Biosafety was negotiated, adopted in 2000 and came into force on the 11th of September 2003. The objective of the Protocol is to contribute to ensuring an adequate level of protection in the field of safe transfer, handling and use of Living Modified Organisms (LMOs) resulting from modern biotechnology that may have adverse impact on the conservation and sustainable use of biological diversity, taking into account risks to human health, and specifically focusing on trans-boundary movements of LMOs.

Nigeria's national biosafety evolution started with National Biosafety Guidelines developed in 1994 under the then Federal Ministry of Agriculture and subsequently a second National Biosafety Guidelines in 2001, under the Federal Ministry of Environment, following the Cartagena Protocol on Biosafety of 2000. The Conference of Parties to the Convention on Biological Diversity, serving as Meeting of Parties (COP-MOP) to the Cartagena Protocol on Biosafety, in 2010, adopted a new Protocol known as the Nagoya-Kuala Lumpur Supplementary Protocol on Liability and Redress, which Nigeria signed in 2012. The objective of the Supplementary Protocol is to contribute to the conservation of and sustainable use of biological diversity, by providing international rules and procedures in the field of liability and redress relating to living modified organisms.

In compliance with international requirements, a Biosafety Bill, (National Biosafety Management Agency Bill) was developed to address the concerns associated with modern biotechnology and to domesticate both the Cartagena Protocol on Biosafety and the Nagoya-Kuala Lumpur Protocol on Liability and Redress. The Bill, which was passed by the 6th Parliament on 1st June 2011, became time barred and was re-presented to the 7th National Assembly, passed in 2015 and was signed into law on the 20th of April, 2015 under the administration of President Goodluck Jonathan. The passage of the National Biosafety Agency Bill into an Act was a milestone in the domestication of modern biotechnology in Nigeria and a giant stride that allowed the country to join the league of countries advanced in the use of this cutting-edge technology as another window to boost economic development in Nigeria. The National Biosafety Act is crucial in the management of modern biotechnology in the country and signing the bill into law allows the domestication of the technology in Nigeria which enables the nation to utilize cutting edge technology to create more employment, boost food production, alleviate hunger and ultimately enhance economic development.

The Act established a biosafety regulatory agency, the National Biosafety Management Agency (NBMA), to ensure safe application of this new technology advancement in the nation. The Act established the NBMA charged with the responsibility of providing regulatory framework, institutional and administrative mechanism for safety measures in the application of modern bio-technology in Nigeria with the view to preventing any adverse effect on human health, animals, plants and environment. So, in actual sense the NBMA is the safety valve that the Federal Government has adopted to ensure that the practice of modern biotechnology in Nigeria is safe and secure.

Furthermore, in recognition of the importance of biotechnology to national development, the Federal Executive Council on 23rd of April 2001 approved the National Biotechnology Policy, which led to the establishment of the National Biotechnology Development Agency (NABDA) in November 2001. The Agency was established under the aegis of the Federal Ministry of Science and Technology to implement the policy that is aimed at promoting, coordinating, and setting research and development priority in biotechnology for Nigeria. Based on this premise, the programmes of the agency are structured in line with the international standards, bearing in mind the development of local technological contents.

There are a few noteworthy provisions of the National Biosafety Management Agency Act. Sections 22 to 35 of the National Biosafety Management Agency Act, provides for the legal procedures required for any person, body or institution to partake in agricultural biotechnology in Nigeria.

Section 22 of the Act, provides that the approval or permit of the Agency is required and must be obtained for a person, institution, or body to import, export, transit or carry out the contained use, confined field trial, multi-locational trial or commercial release of a genetically modified organism in Nigeria. In 2017, 90 tonnes of Genetically Modified (GM) maize for feed meal processing, valued at about \$10 million was impounded and repatriated back to Australia for illegal importation by the NBMA in collaboration with the Nigerian Custom Service (NCS). The GM maize was ordered back because no permit was obtained from the NBMA prior to importation. However, giving an update on the incident during a media interaction shortly after the incident, the Director-General of NBMA, Dr Rufus Ebegeba, said the importer of the GM maize had since applied and secured approval for permit from the agency for the importation of the maize. Furthermore section 23 of the NBMA Act provides that the person, body or institution seeking the approval of the Agency must apply to the Director-General of the Agency not less than 270 days to the date of import,

export, transit or the commencement of such activity. Application for permit or approval may only be granted upon completion of safety risk assessment to determine if there is no substantial risk and that the genetically modified organism can be eaten by humans or animals, as provided for in Section 24 of the Act. The section further provides that any person seeking approval of the Agency must ensure that the application addresses the socio-economic considerations set out in the Third Schedule to the Act. The Agency shall then consider such analysis in the risk or benefit assessment to determine whether it is to be approved or denied. The National Agency for Food and Drug Administration and Control shall then certify the review of the food safety assessment and the determination that the food is safe for human consumption.

Section 28 of the Act provides the procedure for granting approval. With respect to any decision taken under section 23 of this Act, the Agency shall take into consideration, the relevant comments, inputs or concerns of the public received under the provisions of this Act. The Agency shall notify the applicant in writing and the Biosafety Clearing House of the decision and information, facts and analysis supporting the decision. A notification shall be made by the Agency to the public of any genetically modified organism for which approval or permit has been granted for import, contained use, confined field trials, multi-locational trials or commercial release and provide the information, facts and analysis supporting the decision.

Furthermore, the agency may specify the steps to be taken in the implementation of the risk management plan where there are potential risks to human health, animal, plant and the environment. The Agency is empowered under the Act to impose any additional measure for risk management and shall do all such other things and take such other steps as the Agency may consider necessary and expedient for carrying into effect its decision.

Prospects for Agricultural Biotechnology Development in Nigeria (Positive and Negative impacts on the Agricultural sector and the Nigerian economy)

Biotechnology has prospects to remedy the problem of food shortage as research in this field aims to develop plant varieties that provide reliable high yield, at the same or lower costs by breeding in qualities such as resistance to diseases, pest and stress factors which will contribute gainfully to food production while maintaining a healthy environment by reducing the amount of fertilizer, pesticides, herbicides used in farming. These clearly show that biotechnology seeks to improve agricultural practices by increasing productivity in a cost-effective manner as well as bridging other gaps which pose serious challenges to Agriculture. Application of Biotechnology in the Nigerian agricultural sector will lead to capacity building, create numerous jobs, reduce poverty and also put an end to malnutrition. It has been reported that the United Nations Economic and Social Commission in conjunction with International Labour Organization (ILO) sought to identify the best approach for regional capacity building in new technology to improve employment rate, sustainable development and poverty alleviation in developing nations and came to a conclusion that identifying new technologies, adopting, regulating and implementing them will serve the purpose for national economic and social development.

It is worthy of note that 2017 marked an eventful year for the nation's nascent biotechnology development, following the passage of the Biosafety Bill into law in 2015. One of the significant achievement was the endorsement of the *Bacillus thuringiensis* (Bt) Cotton by the Minister of Agriculture, Chief Audu Ogbeh, when he visited the Bt. Cotton trial site at the National Biotechnology Development Agency (NABDA) complex in Abuja. Prior to that, the NABDA had been having a tough time getting policy makers to



support the commercialization of GM crops. The government through the NBMA also gave the International Institute for Tropical Agriculture (IITA) approval to conduct confined field trials (CFT) of genetically engineered cassava to prolong the root storage, this being the most nagging challenge of cassava breeders. The trials, which would be carried out by IITA in collaboration with several universities in Switzerland and Germany, would test cassava bred to resist deterioration using a gene-silencing technology.

The significance of biotechnology is multifarious and they include production of high quality plants; production of highly improved nutritional plants; reduction in intensity of the use of energy and materials; elimination of major diseases traits and consequent increased productivity of plants and animals; facilitating the use of renewable energy resources; and modification of Genetic make-up of organisms by either insertion of new useful genes or removal of unwanted ones thereby boosting their value.

In summary, Agricultural Biotechnology provides so much facilities and opportunities for the improvement of product quality, nutritional plants and other economic benefits. The application of genetic engineering (GE) to food production is intended to enhance the useful and desirable characteristics of the organisms and to eliminate the undesirable ones. There is no doubt that GE has the highest profile among the new technologies in agriculture today. Transgenic crops like maize, rice, wheat, soybean and cotton are among the top priorities for the agricultural biotechnology industries. The overall aim of the food industry with respect to GE will be to improve the quantity and to increase the quality and properties of existing food products, to produce new products and, of course, to improve financial returns.

While Agricultural Biotechnology holds enormous promise for significantly increasing food production and relieving already strained land and water resources, it also presents numerous challenges and negative effects which hinder its development throughout the food chain. These include:

Lack of effective leadership: The lack of effective leadership in science and technology and the absence of clear priorities, policies and investment strategies in Research and Development (R and D) pose great challenge to agricultural biotechnology development in Nigeria. The controversy about Genetically Modified (GM) food aid in Africa for example, will continue to confuse policy makers and cause public anxiety if scientists and politicians do not provide leadership to articulate their aspirations and interests in biotechnological development. The public is often left confused about contradictory positions and

policies on the role of the technology in agriculture. Sometimes, international political system influence political leaders' decision to reject proposals on biotechnology development.

Poor funding of Agricultural Biotechnology research and development (R&D): Biotechnology developments need high inputs of finance which are in short supply in most developing nations especially Nigeria. Even where the economy of the nation is somewhat stable, the budgetary allocation to science and technology and biotechnology R and D in particular is not encouraging. Much of the agricultural biotechnology today depends on public sector investments in agricultural research and extension, but over the years, budgets for research and the quality of national research institutions have declined in many developing countries.

Notwithstanding the foregoing, the Federal Government in an attempt to alleviate funding issues for farmers and prospective farmers launched several programmes and schemes such as the Growth Enhancement Support Scheme (GESS), Commercial Agriculture and Credit Scheme (CACS), Anchor Borrowers Programme, and the Nigeria Incentive-based Risk-sharing System for Agricultural Lending (NIRSAL). The GESS was launched with a view to aid the resource constrained farmer, through the provision of incentives to encourage the critical actors in the fertilizer value chain to work together to improve productivity, household food security and the overall income of the farmer. Since its inception in 2009, the Central Bank of Nigeria has provided the total sum of N501 Billion to the CACS. Although the efforts of the Federal Government are a step in the right direction, the entire value chain is still highly underdeveloped and poorly financed

Public safety: In the 1970s when genetic engineering experiments with micro-organisms were first being developed, many molecular biologists believed that the process was unsafe and that manipulated micro-organisms should be strictly contained and prevented from release to the environment. It was believed that such released micro-organisms could upset the balance of nature or that foreign DNA in the new micro-organism could alter its metabolic activity in unpredictable and undesirable ways. It is also feared that various technologies being in-built into the new agricultural biotechnology products will in future make seeds unviable. It has equally been observed that while the public has readily accepted medical products produced from GMOs, they are much less willing to accept such procedures with food. Genetic engineering is still largely perceived as unnatural and unnecessary in food production. The safety of the human food supply is based

on the concept that there should be a reasonable certainty that no harm will result from its consumption. Foods or food ingredients derived from GMOs must be considered to be as safe as, or safer than, their traditional counterparts before they can be recommended as safe.

Conclusion

Agricultural Biotechnology if effectively implemented can be instrumental in the achievement of food security and economic diversification in Nigeria. It will drive poverty alleviation and the desired economic development in Nigeria. Furthermore, as part of government's efforts to diversify the economy to agriculture, the proposed sum of N118.98 billion was allocated to the Agricultural sector under the 2018 Budget of the Federal Government. This amount allocated to the sector is however an improvement from the N103.79 billion allotted to the sector in the Nigerian 2017 budget, thereby recording an increase of about N15.19 billion. This proves that efforts are underway by the Federal Government to develop a sustainable agricultural sector.

However, in order to achieve the desired level of growth and development in the agricultural sector, it has become critical to ensure that the following measures are considered and applied appropriately:

Adequate legislative and regulatory measures: A major issue that will affect successful applications of biotechnology to agriculture is the regulatory climate governing the release of new products. A safe and efficient regulatory process capable of ensuring public health and environmental safety, is in itself a comparative advantage in biotechnology. Government regulations will represent a critical determinant on the time and costs in bringing a product to market. Regulatory agencies and structures can act as 'gate-keepers' for the development and availability of new agricultural biotechnology products. For instance, adequate intellectual property management is one of the major issues that will affect the application of biotechnology in agriculture. The advantages of the availability of intellectual property protection are that it encourages the development of local research capability and greater investments in biotechnology.

Establishment of Public Confidence: Public confidence in modern agricultural biotechnology is one of the factors that will greatly influence the extent to which countries of

developing societies invest in and benefit from genetic engineering to increase food production. Public understanding of these new technologies could well hasten public acceptance and confidence. The public should be adequately sensitized on the benefits of modern agricultural biotechnology to gain their confidence and to ensure the growth of agricultural biotechnology products and processes.

Human resource development and training: The key elements of any national strategy to foster the development and safe application of agricultural biotechnology are the building and mobilization as well as the efficient utilization of scientific expertise through training and the establishment or acquisition of physical infrastructure (laboratories and related equipment) for R and D. The enhancement of capacities to engage in the analysis and making of policies on agricultural biotechnology should therefore be treated as a priority. Training in risk management and assessment procedures will also be crucial to the building of national capacity for agricultural biotechnology R and D.

Public-private sector collaboration: The major change in the funding of agricultural research in the country in the past decade has been the increased role of the private sector, largely in modern biotechnology. There is therefore a need for greater public-private sector collaboration in relation to agricultural biotechnology and its application to problems in the country. This will require: continued public sector investments from domestic and external resources, public-private sector partnership, innovative funding mechanisms on the part of international development agencies, and involvement of both local private sector companies and transnational companies. This is a policy in the right direction and has laid a proper foundation for an industrial, diversified and self-sustaining economy. It is a step towards a sustainable path and to a future in which wholesale importation and consumption of foreign technology is reduced. With the passing into law of this Order, and the already existing provisions in the Companies and allied matters Act 1999, Nigerian Oil and Gas Industry Content Development Act of 2010 regulating the expatriate quota process, a key to its effectiveness and sustenance will be the need to properly monitor and execute the letter and spirit behind the Order.