

Evaluation of the Scope of Adopting Agricultural Biotechnology in Developing Countries

Bhargavi Pasupuleti

B. Tech Biotechnology, Vignan Foundation for Science Technology and Research, Vadlamudi, India
Author Email: bhargavisrinivas281@gmail.com

Abstract

Agricultural biotechnology plays an important role in enhancing the productivity of crops and to improving the quality of crops in developing countries. Farmers across many countries such as India, China and other Asian countries South and Central America, and Africa have already started adapting agricultural biotechnology and are getting several benefits from this. The timescale of improvement of the crop quality can be enhanced by Molecular breeding and furthermore has the ability to enable productive use of diversity of gene sources. The adoption of biotechnology has made little impact on the growth of crops as there exist multiple challenges that need to be addressed and resolved accordingly. Application of technology based solutions to decrease the yield gaps are required to be resolved. The findings of the research shows that through private-public partnerships new opportunities can be developed to generate new methods and procedures to adopt agricultural biotechnology in an effective way. In addition, the researcher has utilized a secondary qualitative data collection method for gathering data from prior articles and journals regarding the subject of this research study. However, the result of this study indicated that through the inclusion of financial support an agriculture field can easily improve their production rate through the usage of biotechnology. Nevertheless, knowledge regarding usage of biotechnology can aid the agricultural field to improve the production rate of the foods while maintaining the biomass of the foods.

Keywords

Agricultural Biotechnology, Agriculture, Bio-Crops.

INTRODUCTION

The perspective of the world's food security is distinguished through the sudden growth in the requirement of food in developing countries and difficulties on the supply side. These challenges are slow productivity growth in agriculture, climate changes causing uncertain growth and quality of the crops and insufficient natural resources. As the demand for goods increases, the world needs to meet the demands as well as consider other measures. This includes decreasing post-harvest wastes and losses in the supply chain. Food production can be enhanced through the extension of agriculture frontiers and intensification. Since natural resources such as water and land are limited and already hacked in many regions the required demand can only be fulfilled through agricultural intensification. In order to examine the scope of agricultural biotechnology in developing countries, the paper attempts to analyse the present challenges and the impact of biotechnology in agriculture.

Impact of adopting Biotechnology in agriculture

In recent times, with the world becoming so technologically advanced, the adoption of agricultural biotechnology is an integral step to meet the demands of the growing population. Decades of research has demonstrated that the application of agricultural biotechnology is both beneficial and safe for economic and environmental sustainability. As per the view of Gatica-Arias (2020), the application of biotechnology has assisted to make *insect pest*

control, weed management easier while protecting the crops and vegetables against any disease.

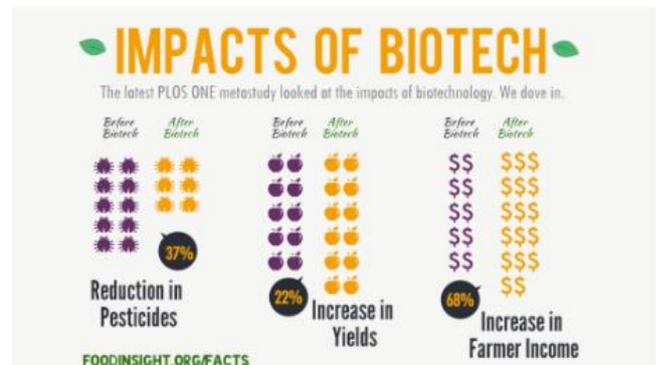


Figure 1. Impact of Biotechnology in Agriculture[1]

As it can be observed that through the use of genetically modified insect-resistant cotton, opposition to the farmers has lessened the use of chemical and systemic pesticides. These chemical pesticides are responsible for polluting water and in general, the environment. On the other hand, according to Adenle *et al.* (2019), in terms of managing the weed control, herbicide-tolerant crops such as cotton, soya beans have the ability to lessen the risk of herbicides. These reduced-risk herbicides then can be broken down in an easier way into the soil and do not affect much on any organism or humans. These herbicide-tolerant crops are well suited to low tillage agriculture systems that assist in preserving the topsoil from erosion[1].

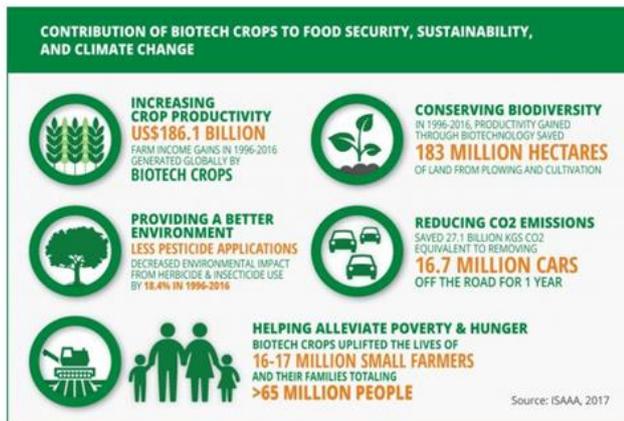


Figure 2. Impact of Bio-Crop in food security, climate change and sustainability[15]

Agricultural biotechnology further plays a key role in safeguarding from numerous diseases. According to Zilberman *et al.* (2018) a papaya virus, known as ringspot virus, was about to destroy the papaya industry of Hawaii. It is through genetic engineering that this fruit was made resistant to this disease and ultimately saves the American industry of papaya. This way several research and experiments have been conducted through other crops and plants such as tomatoes, potatoes and squash in a similar way in order to make these crops disease resistant that otherwise would be quite challenging to manage[15].

The level of beta carotene further can be increased through agricultural biotechnology as these bio-crops help in decreasing the deficiency of vitamin A. Moreover, it can improve the oil composition in corn and soybean. As stated by Kikulwe and Asindu (2020), researchers are now experimenting the adoption of agricultural biodiversity in order to improve the quality and the crops that are able to grow in salty fields. These innovations are necessary to develop for withstanding the effects of climate change[8].

Current challenges of agricultural biotechnology in developing countries

Absence of efficient leadership

The agricultural biotechnologies in several developing countries are facing many challenges due the lack of efficient leadership in science and technology. This is essential to set proper goals and plan and execute investment strategies and policies. One example of such a crisis can be seen in Africa as the controversy regarding the Genetically Modified food is expected to cause confusion and anxiety among the policy makers and to the public as the politicians and researchers are not able to articulate their thoughts and interest in agricultural biotechnology development. As per the view of Kranthi and Stone (2020), in the developing countries there exists an inconsistency in political pronouncement in genetically engineered crops[9].

Lack of funding to develop research on agricultural biotechnology

Biotechnology advancement requires high financial resources that fall short in several countries. According to Brookes and Barfoot (2020), even though many developmental countries like South and Central America the government authorised have invested low budget on research and development of biotechnology. Although countries such as Paraguay, India and South Africa depend on public expenditure for agricultural research and development, it is evident that the quality of most research institutions in these countries is declining. Conversely, as stated by Schiemann *et al.* (2019), governmental authorities and the donor agencies have the tendency to invest on a large number of research institutes rather than contributing financial resources to build quality ones[2][12].

Absence of research infrastructure and strategies

Major number of developing countries is struggling to set proper research areas of advanced agricultural biotechnology as it is necessary to first plan and then invest according to the goals of the research. As per the words of Glover *et al.* (2019), the absence of recognized national goals and pulse, it becomes a quite challenging to make proper and long policies. Several developments share a common flaw that is investing financial resources and spreading human resources in diverse research and development of agricultural biodiversity. Although several countries have identified their research priority, the institutions of these countries are conducting research in isolation and operating with scientifically weak research agencies[5].

MATERIALS AND METHODS

Data collection and data analysis are integral to develop a research in order to estimate the research funding. Generally there exist two kinds of data collection methods that include primary and secondary data collection. On the other hand, there are usually two kinds of data that are used to conduct research; these are qualitative and quantitative data. Primary data collection refers to the process of gathering data from a phenomenon through conducting surveys and interviews. On the other hand, secondary data collection means gathering data from the publisher journals, articles and online portal. Quantitative data is used in order to provide a certain quality or range to assist the researchers to quantify a problem. Conversely, qualitative data is non-numerical in nature and this data can be observed and recorded. In the present research secondary qualitative data has been chosen to develop the research. This data collection analysis method is chosen as it can assist the researcher to examine the impact and the present challenges of the adoption of agricultural biotechnology in developing countries [7]. The chosen method is suitable; the published research articles and journals prove a detailed analysis of the impact and the future of agricultural biotechnology.

RESULT AND DISCUSSION

Presently several organizations are utilizing biometric technology in the agriculture process to enhance the production process of the food products. In addition, as described in this study, biotechnology feeds the world through generating higher crop yields through inputting several inputs and lowering the volumes of agricultural chemicals. On the other hand, as stated by Spielman *et al.* (2019), the inclusion of this technology can also aid the agricultural process to enhance the volume of products into the environment through the usage of biotech crops that require fewer application of chemical and pesticides that can aid the farmers to deduct the tilling of farmland [6][13]. In addition, the incorporation of agricultural biotechnology can also aid the agricultural process to develop biomass for foods, genetic modification and molecular tools that can improve the supply of the product to enhance the production rate of the agricultural industry.

Private companies developed, researched and marketed biotechnology products. This trend is considered to be a departure from technologies of the green revolution as seen in the 1950s and 1960s. However, the monopolistic market has been a cause for concern for the marketers [14]. There have been concerns regarding biosafety and environmental regulatory issues. There has been provenance of risk factors concerning genetically modified organisms. However, there has been no evidence so far regarding any harmful effect of genetically modified organisms on humans or the environment. However, there has been an existence of stringent biosafety regulations [11]. It is necessary to take informed biosafety decisions for proper risk assessment of the genetically modified seed. Consumer acceptability of the genetically modified crop is important to consider for supporting the current biotechnology products. It is important to have physical infrastructure, education and macroeconomic policy for better availability of biotechnology aspects. A comprehensive biotechnology policy is needed for addressing bottlenecks and constraints in the production of biotechnology seeds. Moreover, there is a need to have adapted and appropriate germplasm to insert for the purpose of better gene construct. It is necessary to have increased information and knowledge flow for integration of better technological aspects. Sufficient knowledge and information is required for the purpose of exploiting the potential of technologies. In accordance with the words of Mathias *et al.* (2019), the incorporation of biotechnology requires huge resources that can be implicated through raising funds. However, as presented in several prior articles, in the agricultural field *lack of financial support* has always created several difficulties that have resisted the expansion of agriculture fields. On the other hand, it has been also detected that lack of knowledge and leadership skills are always a major issue that may impose several difficulties on the development of agricultural fields. In this scenario, the government needs to take some initial steps to enhance the knowledge of farmers so they can utilize the knowledge to

maximize the efficiency of biotechnology in the agriculture field. As per the words of Gjonça and Yiannaka (2018), presently several organizations are utilizing the biotechnology in their organization for developing the production of agriculture. Nevertheless, through the application of biotechnology to a broad spectrum in the field, the organizations can easily improve the productivity of the agriculture field while improving the food quality and quantity of the products[4][10].

CONCLUSION

In conclusion, the present study shows that there exist numerous challenges that occur during the adoption of agricultural biotechnology, this includes lack of research focus and infrastructure, low investment on research studies, and lack of effective leadership. The above study provides few recommendations that can be applied to overcome these challenges. The impact of agricultural biotechnology is huge as this technology has the ability to make bio crops that are disease-resistant. On the other hand, agricultural biotechnology can reduce water and land pollution by suggesting suitable bio-insecticides that are not harmful for humans and any organism. It is observed that public-private partnership is required to invest enough funds that are essential to build research institutions and conduct research experiments.

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