

Agricultural Biotechnology and Developing Countries: Prospects, Challenges, and Impact

G. Acquah^{1*} • G. Ude² • K. Matand³ • N.J. Tonukari⁴

¹ Department of Agriculture and Natural Resources, Langston University, Langston, OK 73050, USA

² Department of Natural Science, Bowie State University, 14000 Jericho Park Road, Bowie, Maryland, USA

³ Center for Biotechnology Research and Education, Langston University, Langston, OK 73050, USA

⁴ Department of Biochemistry, Delta State University, Abraka, Delta State, Nigeria

*Corresponding author: gacquah@lunet.edu

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ABSTRACT

Agbiotech has the potential to be used to address hunger and food security needs of developing countries. To achieve this, several challenges will have to be addressed chief of which are inadequate scientific capacity for biotechnology, unfavorable government policies, lack of biosafety regulations, capacity to effectively manage intellectual property, and lack of financial resources. Developing countries vary in the degree to which the challenges exist in the nation. Some countries such as China, India, South Africa, and Brazil have well established agbiotech infrastructure and are already commercializing certain products. Contrary to the fact that agbiotech is not as advanced in most developing countries, some of those countries are among the leaders in the adoption of GM crops for commercial production, the leaders being Argentina, Brazil, South Africa and China. Most developing countries use second generation biotechnology, that is, primarily tissue culture. A relatively few number of countries have high scientific capacity to conduct research and development using third generation biotechnology involving transgenesis. The decision to adopt agbiotech should be made by each nation according to its needs, and not imposed or obstructed by external interests.

1. INTRODUCTION

Agriculture is the mainstay of the economies of most low-income developing countries. It contributes between 20 and 25% of the gross domestic product (GDP) and the majority of export earnings of these countries (Ketema et al. 2003). In Africa, the contribution of agriculture to the GDP is estimated at 40%, with an estimated 70 to 75% of the population living in rural areas and depending entirely on income from agriculture and agribusiness (Machuka 2003, UNECA 2002). Food is a basic human need, and access to food a basic human right issue (Ketema et al. 2003). The world population is rapidly increasing. In China, it is projected that the population will reach 1.6 billion in 2030, with a conservative estimate of 60% increase in demand for food (Zhang 2000). The projection for Africa is a rise to 1.7 billion by 2050 with a corresponding rise in food import from 50-70 million tons per year (Pinstrup-Andersen and Pandya-Loch 1999).

The main concern is not the projected increase in population but rather that an estimated 8-11 billion people would reside in developing countries and require a doubling in food production in these regions to sustain the population (IFPRI 1997). Further, an estimated 800 million of the current 4.6 billion people residing in developing countries are food-insecure, the distribution of affected people according to regions being 48% in Asia, 31% in Africa, and 17% in Latin America (Pensley 2000). Also, an estimated 820 million people are classified as undernourished, of which 25% are children (IFPRI 1997). Of the 1.1 billion people who live on less than one US dollar per day, 430 million are in South Asia, 325 million in Sub-Saharan Africa, 260 million in East Asia and the Pacific, and 55 million in Latin America (von Braun et al. 2005).

It is clear from the foregoing that every effort should be made to develop and implement effective strategies for increasing agricultural productivity in developing countries, to avert the dire consequences that could occur sooner or later. The experiences of the Green Revolution of the 1960s indicate that biological technology (i.e., improved cultivars), coupled with the use of intensive production technologies (e.g., irrigation and agrochemicals), can dramatically increase crop productivity. Dr. Norman Borlaug, Nobel laureate and the architect of the Green Revolution is also an advocate for the use of intensive production technologies in developing countries. He observed that in 1960 US producers of the 17 most important food, feed, and fiber crops harvested a total of 252 million tons of products as compared to 700 million tons in 1999 (Wall Street Journal 2000). The remarkable fact is that the 1999 harvest was obtained from 10 million fewer acres of land, something he attributed to the efficient production technology of today. He also pointed out that, if it were not for modern technology, it would have required 460 million acres to achieve the level of 1999 production, using 1960 technology.

Agricultural biotechnology (agbiotech) is one such modern technology that should be considered in addressing the problems of yield constraints and low nutritional quality of food products in developing countries. It comprises tools for accomplishing a wide variety of genetic manipulations, some of which transcend the capabilities of traditional plant breeding (Acquah 2004). Some of the most important food crops of

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