CARIBBEAN FOOD CROPS SOCIETY

40

Fortieth

Annual Meeting 2004

Proceedings of the Caribbean Food Crops Society. 40:229-234. 2004

BIOTECHNOLOGY, PROSPECTS FOR DEVELOPMENT IN EMERGING ECONOMIES

Malachy Dottin. Ministry of Agriculture, Grenada

ABSTRACT: Throughout history, innovation has driven progress and helped people address the problem of the age. This progress has not been achieved without pain and controversy, at times war and famine and pestilence thwart our best endeavors. Despite setbacks, people in the world over continue to strive to understand the natural world, to pursue truth and beauty, and to create a better world for themselves and their children. Science has a role to play in all these pursuits. However, the very power of the new discoveries in the biological sciences raises fears that these discoveries will not be used wisely. Many believe that they will accelerate the destruction of the natural environment, damage human health, concentrate too much power in the hands of a few global companies, and widen the gap between the rich and the poor, within and between nations. The task of the scholars of today is to analyze where modern science can lead to technical innovation and how these can be used wisely, to improve agriculture productivity, conserve nature resources, and create wealth especially for poor people in developing countries.

INTRODUCTION

Powerful tools provided by Biotechnology in recent years have had a profound impact on the food and agriculture sector worldwide. Innovation production and processing methods have revolutionized many traditional systems, and the world's capacity to generate food products for its growing population has evolved at an unprecedented rate.

These developments have naturally been accompanied by radical changes in economic forces and social organization as well as in management of the earth's productive resources. Our very relationship with nature has been overturned by technological advances that enable us not only to determine genetic improvement through selective breeding but to modify living organisms and create novel genetic combination in the quest for strongest and more productive plants animals and fish.

Understanding such developments invariably gives rise to controversy, and arguments for and against their implementation tend to be intense and emotionally charged.

Poverty in a time of plenty: A Paradox.

The annual world agriculture growth rate has decreased from *3* percent in the 1960s to *2* percent in the last decade.

- 2020 Worldwide, per capita availability of food is projected to increase around 7 % .
- Developing countries by 9 percent (Pinstrup-Andersen, and Rosegrant 1999).

The paradox is that despite the increasing availability of food,

- 840 million people or *13* percent of the global population, who are food insecure.

- ✓ 4.5 billion inhabitants of the developing countries
- ✓ Asia 48 percent
- ✓ Africa 35 percent
- ✓ Latin America 17 percent
- ✓ Of these 840 million, at least 200 million are malnourished children.

It is also paradoxical that food insecurity is so prevalent at a time when global food prices are generally in decline.

- ➢ World cereal production doubled between 1960.
- ➢ 1990 per capital food production increased 37 percent.
- ➢ Calories supplied increased 35 percent
- ➢ Real food prices fell by almost 50 percent (McCalla, 1998).

The basic cause of the paradox is the intrinsic linkage between poverty and food security. Simply put, people's access to food depends on income.

Poverty is both a rural and an urban phenomenon.

- ➢ Over 1.3 billion people in developing countries are absolutely poor, with incomes of US$1 per day or less per person, while another 2 billion people are only marginally better off (World Bank 1997)
- ➢ It is also interesting to note that malnutrition kills *40, 000* people each day.
- ➢ 125 million children are affected by vitamin A deficiency.

Ensuring their access to sufficient nutritious food at affordable prices is also an impotent component of global food security strategies.

Research needs to respond these challenges, so as to improve the livelihood of the rural poor and ensure the increased availability of nutritious food at affordable prices for the urban poor.

FOOD SECURITY

Food security covers both the availability of food at the household level as well as access in terms of purchasing power (FAO 1996)

- ➢ Not just production, but also access
- ➢ Not just output, but also process
- ➢ Not just technology, but also policy
- ➢ Not just government, but also people participation
- ➢ Not just rural, but also urban
- ➢ Not just amount, but also content.

Food production is necessary but not sufficient condition for food security. Focusing on improving the livelihood of smallholder farmers in developing countries is key to environmental protection, poverty reduction, and food security.

GLOBAL FOOD BASE

Humanity has a narrow food base. Twelve crops account for 95 percent of the plant food base. These are banana /plantain, cassava, corn (maize), groundnut, millets, oil crop, potato, rice, sorghum, soybean, sweet potato, and wheat (Delgado 1999).

There is also an increasing demand for milk and meat in the developing countries, etc. cattle, sheep, goats, pigs and chickens. Fish is also an increasingly important component of the diet in developing countries (FAO 1999).

Globally, meat production increased from 71 million tons in 1961 to 226 billion tons in 1999 (Rosegrant 1999). For developing countries, it increased from 20 million tons to 122 million tons over the same period (Delgado 1999).

BEYOND THE GREEN REVOLUTION

- Increasing productivity of cereals
- Expanding the area of arable land
- Massive increases in fertilizer use

Attention was given to the following issues.

- Research and development
- Technology transfer
- Human resource development
- Appropriate provision of credit supply and distribution of inputs (seed, water, fertilizer, pesticide)
- Appropriate pricing policies for inputs and outputs and infrastructure.

Doubly Green Revolution

- Increasing productivity of the major food crops
- Reducing chemical input of fertilizer and pesticides and replacing these with biologically based products
- Integrating soil, water, and nutrient management
- Improving the productivity of livestock

CHALLENGE OF BIOTECHNOLOGY

Definition

It is any technique that uses living organisms or parts thereof to make or modify a product, improve plants or animal or develop microorganism for specific uses.

There has been substantial development in biotechnology and genetic engineering in the

last 20 years, which offer new prospects for increased agriculture production. However while biotechnology has the potential to produce crops and livestock that are more efficient, more productive easier to produce and use less agrichemical, consumer acceptance of genetically modified foods will continue to be a challenge for global application of the results of biotechnological research.

According to recent statistics, in 1999 the global area under genetically modified crops was 40 million hectares and this is expected to 85 million hectares in 2003 (6 % of the total arable land.) The recent release of genetically modified rice called golden rice, which is rich in vitamin A, and could cure Vitamin A deficiency of 124 million children worldwide underscore the potential of biotechnology for the future.

In Human health

- To understand the genetic basis of diseases
  (Human Genome project) DNA sequencing & RNA data
- Early identification of predisposition to genetic disease (cystic fibrosis and breast caner, leading to earlier detection and better treatments). Method of identifying cervical cancer, DNA vaccines. (Biochips)
- Genetically inherited diseases
- Diabetes
- Influenza
- AIDS patients
- Medical therapies
- Alzheimer's
- To develop improved diagnostics, drugs and vaccines for their treatment

In Agriculture and forestry

- Oral medicine
  - Herbal medicine
    - Taxol is a cancer treatment derived from the bark of a tree.
    - Active components
- It promises new ways to harness and improve ways to diagnose and control the pests and pathogens that damage them.
- Crop Improvement
- Improved diagnosis of pest and diseases
- Tissue culture /Micro propagation techniques
  - Production of healthier plants, allowing for savings in the costs of pant protection treatments
  - Uniformity of phenotypic characteristics in clones produced
  - Uniformity in production
  - Easily reproducible experimental system (hence expected results)
  - Availability of planting material year –round
  - Selection for superior quality
  - Selection for higher production

- Labour is reduced to a minimum between subculture (No weeding, irrigation, spraying, etc while in the lab)
- Reduced time from planting to harvest
- Earlier onset of flowering and fruiting (In Musa, Anthurium, pineapple)

- The construction of transgenic plants with improved yields, disease, pest and stress resistance, and /or nutritional quality
- Characterizing Biodiversity
- Identification of genetic resources containing useful genetic combination

Bioinformatics

Research in molecular biology, genomics, sequencing, functional genomics, and comparative genetic are producing large amounts of new genomic data.

Livestock Improvement

- Improvements in genetic potential
- Reproduction technologies
- Health and management practices
- New Vaccine Delivery Systems

  - ✓ In sub-Saharan Africa, animal losses due to disease are estimated to be US $ 4 billion annually, a quarter of the total value of lives production.
  - ✓ About 73 million people will be added to the world population every year from now until 2020.
  - ✓ Demand for meat in the developing world is projected to double between 1995 and 2020.
  - ✓ World grain production will need to increase by 40% by 2020

    - ❖ Under this scenario, food insecurity and malnutrition will persist in 2020 and beyond.
    - ❖ The need to produce sufficient food for the world's population is urgent, compelling, and complementary to improving human health.

Microorganisms for cleaning the environment

- Bioagents effective in treating waste.
- Biodegradable plastic is seen as one of green industry most promising products.
- Biological effect of decomposition

Disadvantages

- Requirement of specialized and expensive facilities
- Skilled staff required

- Potential loss of propagules by early onset of contamination in vitro
- Precise micropropagation condition and protocols must be developed and strictly adhered to
- Requirement that techniques do not introduce genetic instability
- Relatively high cost due to facility and labour-intensive procedures
  This can be offset by large–scale production, high added value of the plantlets, and automation where possible.

CONCLUSION

The need to produce sufficient food for the world's population is urgent, compelling, and complementary to improving human health.

RECOMMENDATION

Research needs to respond these challenges, to improve the livelihood of the rural poor and ensure the increased availability of nutritious food at affordable prices for the urban poor.