



**Food Security and Biotechnology in Africa**



This project is financed by the European Union  
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# **MODULE 2**

## **BIOTECHNOLOGY:**

### **History, State of the art, Future**

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## Disclaimer

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## General objective

The main objective is to offer a broad view of biotechnology, integrating historical, global current and future applications in such a way that its applications in Africa and expected developments could be discussed based on sound knowledge...

## Specific objectives

At completion learner should be able to:

- demonstrate knowledge of essential facts of the history of biotechnology and description of key scientific events in the development of biotechnology
- demonstrate knowledge of the definitions and principles of ancient, classical, and modern biotechnologies.
- describe the theory, practice and potential of current and future biotechnology.
- describe and begin to evaluate aspects of current and future research and applications in biotechnology.

- Unit 1 Introduction to biotechnology, history and concepts definition
- **Unit 2: The Green Revolution: impacts, limits, and the path ahead**
- Unit 3: Agricultural biotechnology: the state-of-the-art
- Unit 4: Future trends and perspectives of agricultural biotechnology
- Unit 5: Food security and Biotechnology in Africa: options and opportunities

**UNIT 2:**  
**The Green Revolution: Impacts,  
Limits, and the Path Ahead  
(04 Hours)**

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This unit is a retrospective study of the Green Revolution (GR) considered as one of the most ground breaking technological renovation of agricultural practices that began in Mexico in the 1940s.

GR impacts at socioeconomic and environmental levels are presented; and its achievement and limits in terms of agricultural productivity improvement is analysed in term of food security.

From the lessons learned and the strategic insights in Latin America, Asia and Africa, the sustainability of technology introduction is discussed.

- 1. History of the GR: Growth and Political aspects**
- 2. The GR and Food Security : production increases and effects on hunger**
- 3. Socioeconomic and environmental impacts of GR**
- 4. Lessons learned from the GR**



This section examines the rationale behind the GR from the historical and political background that led to its development.

Through specific cases analyses (countries from Latin America, Asia and Africa), an account is given about the precise political circumstances that affected positively or negatively the GR adoption and success (state in agriculture, public research & extension systems, influence of international and national institutions and actors)



## GREEN REVOLUTION In Mexico (Latin America)

Cf Documents on GR in Mexico

<http://rockarch.org/workshops/educators/leivarich.pdf>

<http://www.profmex.org/mexicoandtheworld/volume4/3summer99/99Boardman.pdf>

<https://link.springer.com/article/10.1007/BF01557305>





## GREEN REVOLUTION In India (South Asia)

Cf Documents on GR in India

[http://www.apaari.org/wp-content/uploads/2009/05/ss\\_2004\\_03.pdf](http://www.apaari.org/wp-content/uploads/2009/05/ss_2004_03.pdf)

[https://mpr.aub.uni-muenchen.de/10838/2/MPRA\\_paper\\_10838.pdf](https://mpr.aub.uni-muenchen.de/10838/2/MPRA_paper_10838.pdf)

[http://ageconsearch.umn.edu/bitstream/149547/1/Rada\\_India%20Ag%20TFP%20AAEA%20Submission\\_2013.pdf](http://ageconsearch.umn.edu/bitstream/149547/1/Rada_India%20Ag%20TFP%20AAEA%20Submission_2013.pdf)



## Historical & Political Background

**The CGIAR : the international consortium of the key driving forces behind the Green Revolution**

**In 1970**, foundation officials proposed a worldwide network of agricultural research centers under a permanent secretariat. This was further supported and developed by the World Bank; on 19 May 1971, the Consultative Group on International Agricultural Research (**CGIAR**) was established, co-sponsored by the FAO, IFAD and UNDP. CGIAR, has added many research centers throughout the world...

## Historical & Political Background

### **GR in Latin America & Asia /Key notes**

The roots of the first Green Revolution can be traced to a 1943 agricultural development project in Mexico aimed at increasing the yield of beans and corn to address widespread poverty and hunger that was threatening the political stability of the country...

The project was implemented by the government of Mexico but was initiated and funded by the Rockefeller Foundation...

## Historical & Political Background

### **GR in Latin America & Asia /Key notes**

Key project interventions focused on training local plant breeders and scientists on new techniques in plant breeding and farming systems where the use of inorganic fertilizers and modern seed varieties was central....

Rockefeller's agricultural project in Mexico was so successful that it was replicated in other parts of Latin America in the late 1940s, and in India and Southeast Asia in the 1950s..

## Historical & Political Background

### GR in Latin America & Asia /Key notes

A substantial body of literature considers the Green Revolution as having been an important political intervention led by the United States to arrest the spread of Communist insurgency across Latin America and Asia after World War II.







## GREEN REVOLUTION In AFRICA





## Historical & Political Background

- ***Does Africa miss the 1<sup>st</sup> GR ?***
- ***Examples CGIAR research centers in Africa***
- ***Successful Story***

Cf Documents on GR in Africa

<https://www.afdb.org/fileadmin/uploads/afdb/Documents/Knowledge/Africa%27s%20Missed%20Agricultural%20Revolution%20A%20Quantitative%20Study%20of%20the%20Policy%20Options.pdf>

[http://repository.uneca.org/bitstream/handle/10855/3810/bib-29687\\_1.pdf?sequence=1](http://repository.uneca.org/bitstream/handle/10855/3810/bib-29687_1.pdf?sequence=1)

<http://www.cosv.org/download/centrodocumentazione/greenrevolution.pdf>

<http://dspace.africaportal.org/jspui/bitstream/123456789/33046/1/Waiting-for-a-Green-Revolution-.pdf?1>

## Production increases

## Effects on food security

### *Read the documents*

*“Ever-Green Revolution and Sustainable Food Security” and “Towards a truly green revolution for food security”*

[http://nabc.cals.cornell.edu/Publications/Reports/nabc\\_16/16\\_2\\_4\\_Swaminathan.pdf](http://nabc.cals.cornell.edu/Publications/Reports/nabc_16/16_2_4_Swaminathan.pdf)

[http://www.un.org/en/development/desa/policy/wess/wess\\_current/2011wess\\_chapter3.pdf](http://www.un.org/en/development/desa/policy/wess/wess_current/2011wess_chapter3.pdf)

## Socioeconomic & Environmental Impacts of GR

### Socioeconomic impacts

### Environmental impacts

**Biodiversity**

**Pesticides/Health**

### *Read the documents*

<http://digitalcommons.unl.edu/cgi/viewcontent.cgi?article=1027&context=envstudtheses>

[https://www.researchgate.net/publication/46444932\\_Some\\_socio-economic\\_consequences\\_of\\_the\\_Green\\_Revolution](https://www.researchgate.net/publication/46444932_Some_socio-economic_consequences_of_the_Green_Revolution)

This section sum up the GR positive and negative impacts and examine implications for future technology transfer especially in Africa.

Narratives on the underlying causes for the failure of the GR in Africa are pointed out like: technology imported without enabling policies, institutions and infrastructure investments; low demand and marginal production environments, “orphan” staple food crops with little research backlog (e.g. cassava), etc.

## Food Production

The green revolution was a technology package comprising material components of improved high-yielding varieties (HYVs) of two staple cereals (rice and wheat), irrigation or controlled water supply and improved moisture utilization, fertilizers and pesticides and associated management skills.

The utilization of this technology package on suitable land in suitable socio-economic enabling environments resulted in greatly increased yields and incomes for many farmers in Asia, Latin America and in some developing countries elsewhere...

## Food Production

The GR technologies were not without their problems: the need for a significant use of agrochemical-based pest and weed control in some crops has raised environmental concerns as well as concern about human health.

As irrigation areas expanded, water management required skills that were not always there; and there were new scientific challenges to be tackled.

Although HYVs often replaced older landraces, it is less certain that the world has actually suffered significant genetic erosion

## Food Consumption

Real food prices in Asia have steadily declined through the application of yield-increasing, cost-reducing technologies built around improved seed-fertilizer-weed control components.

⇒ **Lower real food prices may benefit the poor relatively more than the rich, since the poor spend a larger proportion of their available income on food.**

Consumption levels may have increased for farmers, but the costs of inputs may have offset some of the yield gains and it is not clear that the yield increases would have translated into improvements in nutrition...

## Food Consumption

Consumption levels of the urban poor and landless may not have increased due to a decrease in real wages and reduced purchasing power; in addition, there may have been a reduction in intake of pulses, vegetables and meat due to price increases in these foods, which may in some cases be linked to the Green Revolution...

## Socioeconomic

The Green Revolution may have increased inequalities in communities due to increased mechanization and decreased labor opportunities for the poor ...

Food-insecure people neither consistently produce enough food for themselves nor have the purchasing power to buy food from other producers. During times of famine, food may simply not be available at any price...



## Environment

The Green Revolution is widely criticized for causing environmental damage. Excessive and inappropriate use of fertilizers and pesticides has polluted waterways, poisoned agricultural workers, and killed beneficial insects and other wildlife...

Often ignored, however, is the positive impact of higher yields in saving huge areas of forest and other environmentally fragile lands that would otherwise have been needed for farming.

## Politic

The lessons from the green revolution taught that scientific advances alone cannot solve the food security problems of developing countries.

Political leaders must create suitable socio-economic and institutional enabling environments, while access to credit and markets should play a key role in improving productivity...

## Politic

Sustainable progress nearly always involves broad popular participation, allowing people themselves to select from among the new tools and to blend these with the technological, social, cultural and economic settings which were created by their traditional systems...

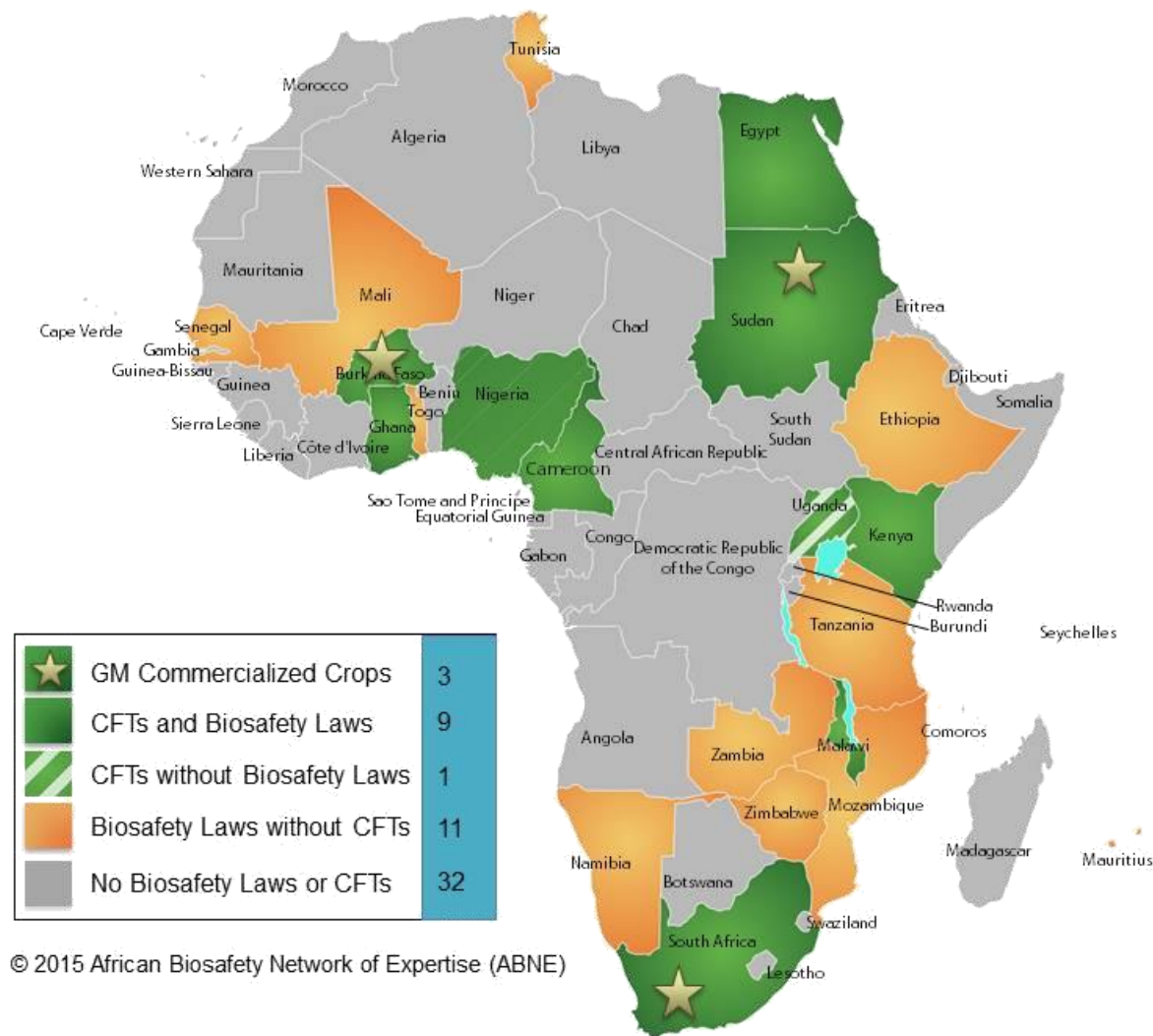
Those countries that have achieved greater national and household food security, also for the poor, have a track record of strong political emphasis on agriculture...

## **GM Crops in the New GR for Africa...**

A careful review of the developments in agriculture in Africa shows that the biotechnology agenda, specifically the push for genetically modified (GM) seeds and crops, actually preceded the orchestrated call for a New Green Revolution for the continent.

**ELENITA C. DAÑO**

## GM Crops the New GR for Africa ?



# Lessons learned from “BT Cotton in Burkina Faso” ?



**Read document : Six Years of Successful Bt Cotton Cultivation in Burkina Faso**

<http://africenter.isaaa.org/wp-content/uploads/2015/03/Burkina-Faso-Bt-cotton-progress-2013.pdf>

**Read document : “Burkina Faso’s Bt cotton Reversal”**

[http://www.ensser.org/fileadmin/user\\_upload/Mex16.DOWD-URIBE.Burkina.Faso.GM.Crops.FINAL.Version.2.pdf](http://www.ensser.org/fileadmin/user_upload/Mex16.DOWD-URIBE.Burkina.Faso.GM.Crops.FINAL.Version.2.pdf)