

Biotechnology and Agroecology: Incompatibles or Complementary?

ISSN: 2578-0336



***Corresponding author:** Yoel Beovides-García, Doctor of Biological Sciences, Titular Researcher from Department of Biotechnology, Research Institute of Tropical Roots and Tuber Crops (INIVIT) Titular Professor associate to the Faculty of Agrarian Sciences, University of Cienfuegos, Cuba

Submission:  April 16, 2024

Published:  May 01, 2024

Volume 12 - Issue 2

How to cite this article: Yoel Beovides-García*. Biotechnology and Agroecology: Incompatibles or Complementary?. EnvironAnalEcoStud.000784.12(2).2024. DOI: [10.31031/EAES.2024.12.000784](https://doi.org/10.31031/EAES.2024.12.000784)

Copyright@ Yoel Beovides-García, This article is distributed under the terms of the Creative Commons Attribution 4.0 International License, which permits unrestricted use and redistribution provided that the original author and source are credited.

Yoel Beovides-García*

Doctor of Biological Sciences, Titular Researcher from Department of Biotechnology, Research Institute of Tropical Roots and Tuber Crops (INIVIT) Titular Professor associate to the Faculty of Agrarian Sciences, University of Cienfuegos, Cuba

The Global Context

Agriculture around the globe is facing great challenges, including serious productivity concerns due to pollution, drought, climate change, and food security problems. Considering the rapidly growing world population and the detrimental impact of the Green Revolution on agricultural systems, we need to develop sustainable ways of food production. The inappropriate use of those industrial agricultural methods resulted in increased water and soil pollution and the destruction of habitats.

Most of rural and agrarian communities in developing nations, depend on farming activities as their main source of livelihood [1]. For that reason, different concepts are managing to develop and improve the sustainability and resilience of the agri-food systems. Humanity needs urgently to develop more sustainable global food systems, and biotechnology and agroecology must be consider as powerful and invaluable tools. It should be given more consideration to them in agroecological transformation to support the large-scale adoption of agroecology as a successful model.

It is a privilege to share my opinion and some ideas about the controversial contribution of biotechnology to agroecology. The main objective is to contribute to the social debate around these important topics, prejudices and an inappropriate interpretations about their possible complementary contributions.

Which is the Main Problem?

The problem is that many prejudices persist and there is ignorance between producers and consumers. But, above all, there is a severe campaign promoted by the mainstream media and companies, which constitute ideological thinking tendencies or centers of power in terms of agriculture, aimed at promoting trends and markets that ignore the true needs in terms of sufficient and nutritious food for the majority. Perhaps, its own condition as a social movement has limited a truly holistic vision of everything it can contribute, from an agroecological approach, to achieving sustainable and healthy agricultural productions.

Many people associate agroecology with organic farming or regenerative agriculture, which frequently excludes the use of biotechnology from the package of effective innovations to achieve agricultural goals by 'sustainable tools'. At the same time, there is a tendency to consider biotechnology as genetic engineering, genome editing, or other techniques (some of which are not related to genetic manipulations, like in vitro tissue culture), or just by the most popular term "GMO" (sometimes a diabolic term), but biotech is a lot more than just GM crops.

On the other hand, biotechnology fulfills the 10 elements of agroecology, as proposed by the United Nations for Food and Agriculture Organization (FAO): biodiversity, co-creation and sharing of knowledge, synergies, efficiency, human and social values, culture

and food traditions, responsible governance, recycling, resilience, and circular economy. A non-exhaustive list of the agroecological principles includes all of them [2]. But, in some cases, the environmental impact of biotechnological applications has been misjudged.

Biotechnology and Agroecology: Concept, Vision and Common Point of Views

Sustainable development has become a worldwide priority. As a scientific and policy approach to transform food systems, agroecology has gained greater recognition, and various studies have been shown its positive contribution to the food security and nutrition [3]. Although the adoption of agroecological practices is voluntary for farmers and other food system actors, agroecology has become in a strong societal movement [2,4] with its associate complexities. Atta-Krah et al. [5] summarized levels, elements, and principles of agroecology. Biotechnology encompasses a broad range of technologies that employ living organisms or parts of them to make diverse products and nowadays, biotechnologies are becoming more important tools in the fourth industrial revolution, especially in the medical, agricultural and industrial fields. Some researches revealed the important role of biotechnology in creating sustainable agriculture [6]. Biofertilizers and biopesticides are examples of utilizing natural resources to enhance soil health, plant health, and crops productivity [7,8] and they are biotech products as bioremediation, biofiltration, biodegradation, among others.

A Truly Holistic Vision to Develop Sustainable Agroecosystems

Who and where was established the concept that biotechnology and agroecology are incompatibles? Unfortunately, many people have not yet understood that any alternative by itself can't solve all problems perfectly, one good example is the organic agriculture. It integrates cultural, biological and mechanical practices which promote biodiversity. However, when you find an organic monoculture for many hectares, biodiversity is not present and agroecology principles were not applied. But, if you plant hectares of *in vitro* plantlets of banana with common beans or peanuts interspersed, biodiversity and agroecology philosophies are present.

I consider that, by promoting sustainable agricultural practices, agroecology highlights local economies, biodiversity and food systems which means shorter supply chains, making food systems more robust and productive. It defends agro-biodiversity contribution at the center of human development and economic prosperity. But biotechnology, by *in vitro* tissue culture makes it possible to obtain high quality planting material for many crops in order to enhance both, local and national food security, and increase biodiversity in agroecosystems. As the world looks to promote sustainable agriculture and fight food insecurity, agroecology (often incorrectly conflated with "organic farming" and "regenerative farming" by some international actors) and agricultural biotechnology (including plant tissue culture and

all bioprocess) continue to be two central topics in developing sustainably agricultural systems. Always you plant good seed, you have more opportunities to obtain good yield, even, if the production conditions are not optimal. The implementation of agroecological practices, using good plantation material (like the produced by *in vitro* tissue culture) the production will be better.

In my modest opinion, it is necessary to have an honest, science-based, and data-driven discussion to reconcile these two approaches to understand how biotechnology can serve as an important tool, which can work together with agroecological practices to promote a truly sustainable agriculture. Transition to agroecology has been depicted as a series of levels, from adoption of farming practices and cropping systems to more complex and comprehensive food system redesign. The goals of agroecology are not at odds biotechnology, but rather can be magnified by biotechnology. These complementary approaches to agriculture must be united in our shared goal of developing more sustainable food systems.

Final Considerations

To face the current uncertainties and vulnerabilities in agriculture demands to the science and society new and appropriate ethical point of views, and more effective practical approaches related to objectives, procedures and scopes for greater impact on agricultural production. An appropriate action is needed, especially to avoid prejudices and accept the opportunities that each technique can offer towards true and lasting sustainability in agriculture. Biotechnology and agroecology coincide in their vision to maintain and increase production and resilience, reduce vulnerability of people and ecosystems. Therefore, agricultural biotechnology is compatible with agroecology, there is no one ideal way to improve the food security or to manage current environmental problems in agro-ecosystems. Moving forward, we cannot meaningfully advance the food production debate without breaking down dogmatic fixations with technologies and production practices. We must refocus on inclusive and holistic solutions that are not rooted in restrictive food and farming ideologies.

References

1. Onyeneke CS, Opata PI, Ume C, Sarpong DB, Egyir IS (2023) Heterogeneity of adaptation strategies to climate shocks: Evidence from the Niger Delta region of Nigeria. *Bio-Based and Applied Economics* 12(1): 17-35.
2. Wezel A, Herren BG, Kerr RB, Barrios E, Gonçalves ALR, et al. (2020) Agroecological principles and elements and their implications for transitioning to sustainable food systems. A review. *Agron Sustain Dev* 40: 40.
3. Bezner Kerr RB, Madsen S, Stüber M, Liebert J, Enloe S, et al. (2021) Can agroecology improve food security and nutrition? A review. *Global Food Security* 29: 100540.
4. Gliessman S, Ferguson BG (2020) Keeping up with the agroecology movement: Priorities for agroecology and sustainable food systems. *Agroecol Sustain Food Syst* 44(1): 1-2.
5. Atta-Krah K, Chotte JL, Gascuel C, Gitz V, Hainzelin E, et al. (2021) Agroecological transformation for sustainable food systems: Insight on France-CGIAR research. Montpellier: Agropolis International, p. 147.

6. Das S, Ray MK, Panday D, Mishra PK (2023) Role of biotechnology in creating sustainable agriculture. *PLoS Sustainability and Transformation* 2(7): e0000069.
7. Santana A, Beovides Y, Simó J, Pérez MC (2021) Effect of a *Pseudomonas fluorescens*-based biofertilizer on sweet potato yield components. *Asian Journal of Applied Sciences* 9(2): 101-113.
8. Beovides Y, Pérez MC, González I, Rayas A, Basail M, et al. (2024) Effects of a new rhizobium-based biofertilizer (Fertiriz) on growth and the yield of cowpea (*Vigna unguiculata* (L.) Walp). *Environmental Analysis & Ecology Studies* 12(1): 1376-1385.