



## **Controversies Between Conventional and Organic Agriculture in Democratic Republic of the Congo) (A review)**

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### **ABSTRACT**

**Description of the subject.** This review critically analyses the debates between conventional and organic agriculture in Democratic Republic of the Congo, highlighting key points of divergence and potential pathways towards sustainable production. Rapid population growth, environmental degradation, and persistent food security challenges increasingly strain dominant agricultural systems.

**Literature.** Agriculture directly affects the conservation or depletion of natural resources, which are essential production factors, and their deterioration threatens future productivity and ecosystem resilience. Conventional agriculture, relying heavily on synthetic fertilisers, chemical pesticides, concentrated animal feeds, and intensive veterinary interventions, has been widely adopted to maximise short-term yields. However, evidence demonstrates its negative impacts on soil fertility, water quality, biodiversity, and overall ecosystem health. By contrast, organic and alternative systems, which minimise or exclude synthetic inputs, offer potential for ecological balance and sustainable resource management. Yet, empirical data from African contexts, particularly in the DR Congo, remain limited, making it difficult to evaluate whether organic approaches can achieve comparable yields without resorting to Green Revolution-style interventions.

**Conclusion.** The review consolidates existing literature and identifies knowledge gaps, providing an evidence-based foundation for assessing both systems. It emphasises the importance of locally adapted, resource-conserving practices that integrate ecological, social, and economic considerations, aiming to reconcile productivity with environmental sustainability in Democratic Republic of the Congo and similar agroecological regions.

**Keywords:** Agriculture, degradation of environment, controverses, Democratic Republic of the Congo

### **RESUME**

**Controverses entre agriculture conventionnelle et biologique en République Démocratique du Congo : (une revue de la littérature)**

**Description du sujet.** Cette revue analyse de manière critique, les débats entre l'agriculture conventionnelle et l'agriculture biologique en République Démocratique du Congo, en mettant en lumière les points de divergence clés et les voies potentielles vers une production durable. La croissance démographique rapide, la dégradation de l'environnement et les défis persistants en matière de sécurité alimentaire exercent une pression croissante sur les systèmes agricoles dominants.

**Littérature.** L'agriculture influence directement la conservation ou l'épuisement des ressources naturelles, lesquelles constituent des facteurs de production essentiels ; leur détérioration menace la productivité future et la résilience des écosystèmes. L'agriculture conventionnelle, qui repose largement sur les engrais de synthèse, les pesticides chimiques, les aliments concentrés pour le bétail et les interventions vétérinaires intensives, a été

largement adoptée pour maximiser les rendements à court terme. Cependant, les données probantes démontrent ses impacts négatifs sur la fertilité des sols, la qualité de l'eau, la biodiversité et la santé globale des écosystèmes. À l'inverse, l'agriculture biologique et les systèmes alternatifs, qui minimisent ou excluent les intrants de synthèse, offrent un potentiel d'équilibre écologique et de gestion durable des ressources. Pourtant, les données empiriques issues des contextes africains, particulièrement en RD Congo, restent limitées, ce qui rend difficile l'évaluation de la capacité des approches biologiques à atteindre des rendements comparables sans recourir aux interventions de type « Révolution Verte ».

**Conclusion.** Cette revue consolide la littérature existante et identifie les lacunes dans les connaissances, fournissant ainsi une base factuelle pour l'évaluation des deux systèmes. Elle souligne l'importance de pratiques économes en ressources et adaptées localement, intégrant les dimensions écologiques, sociales et économiques. L'objectif est de concilier la productivité avec la durabilité environnementale en République Démocratique du Congo ainsi que dans d'autres régions agroécologiques similaires.

**Mots-clés :** Agriculture, dégradation de l'environnement, controverses, République Démocratique du Congo.

## 1. INTRODUCTION

Plants are exposed to numerous biotic and abiotic stresses that cause serious metabolic disturbances and very often considerable yield losses (Yarou *et al.*, 2017). The use of pesticides and chemical fertilizers in agriculture has become systematic in Africa to optimize yields of cash and vegetable crops (Ahouangninou *et al.*, 2011). Although their effectiveness is obvious, their negative impact on the environment is increasingly discussed (Azandémè-hounmalon *et al.*, 2022).

Indeed, their excessive use in agriculture is the cause of soil and water pollution, the development of resistance to weeds and insects, and the destruction of many useful organisms (pollinators) (Yarou *et al.*, 2017). According to (Eriguchi *et al.*, 2019), studies show a relationship between exposure to synthetic chemical pesticides and high rates of chronic diseases including cancers, cardiovascular disease, diabetes, neurodegenerative disorders such as Parkinson's. In addition, fields farmed organically support around 30% higher levels of biodiversity than fields farmed conventionally (Hayo *et al.*, 2020).

Furthermore, the ability of organic farming to meet the challenges posed by food security in sub-Saharan Africa remains poorly understood, and quantitative studies on the performance of organic farming are still very rare (Andriamampianina *et al.*, 2018). The low yields of organic farming compared with conventional farming are frequently highlighted.

The Democratic Republic of the Congo is one of the countries in Sub-Saharan Africa where family-type agriculture is predominant for the majority of the population in rural areas. Farmers, mainly because of their low level of education, know little about the real toxicity of the pesticides used and how to use them. They have no technical data sheets linking the pest, its damage, the product to be used, its dose and frequency (Korangi *et al.*, 2021). Faced with the harmful effects of chemical

pesticides, new control approaches that respect the environment and human health are needed (Kouakou & Diakaria, 2022).

In such a context, the use of organic production becomes a guarantee of both environmental and food security (Aihounon *et al.*, 2022), and proves to be a very promising alternative (Kouakou & Diakaria, 2022) for controlling insects harmful to plants thanks to their non-toxic and ecological mode of action (Zaki *et al.*, 2020).

This bibliographical synthesis aimed to show all those involved in the agricultural sector the controversies that exist between organic and conventional agriculture, with a view to proposing the possibility of an agricultural development that conserves natural resources in the Democratic Republic of the Congo (DRC)

This study provides a decision-making framework for the agroecological transition in the DRC, aiming to restore soil health and biodiversity while mitigating pesticide-related health risks. It establishes a scientific baseline to decouple family farming from imported inputs, thereby ensuring autonomous and sustainable food security.

## 2. BIOLOGICAL AND CONVENTIONAL AGRICULTURE IN DRC

### 2.1. Controversies between biological and conventional agriculture

In Africa, biological agriculture covers a wide range of practices, and yields are highly uncertain (Kouakou & Diakaria, 2022). The development of this type of agriculture is a factor in ecological sustainability, since organic farming requires methods that are less aggressive on the environment (Korangi *et al.*, 2021). Other modes of production, such as integrated farming or any other form of low-input agriculture, are also interesting from this point of view (Bon *et al.*, 2019).

The most comprehensive meta-analysis of scientific data concluded that, on a global scale, organic yields are 19 % lower than conventional yields, and only 8 to 9% lower with improved cropping techniques (rotations, leguminous intercropping, recycling of organic matter, natural mineral amendments, etc.) (Aubert *et al.*, 2023). According to Bon *et al.* (2019), report that in some cases, biological agriculture yields are higher than those of conventional agriculture technical itineraries. This finding has already been observed in the scientific literature, shows that organic farming is an agricultural development path not to be ruled out in Africa (Deborah & François, 2016).

Sub-Saharan Africa is characterized by the highest prevalence of food insecurity in the world, while agriculture is the main economic activity in this region (Andriamampianina *et al.*, 2018). Admittedly, biological agriculture is less productive but more remunerative on local markets. Moreover, in view of the negative externalities of industrial agriculture (pollution), climate change and health crises (Temple & Bon, 2020), the global market for biologically grown products is booming. Furthermore, eating bio products is also more expensive because the negative externalities of conventional agriculture (depollution costs, health costs...) are not taken into account in the price the consumer pays. If they were, organic products would be cheaper than conventional ones.

In biological agriculture, energy consumption is much lower per unit of surface area than in conventional farming, but little different per quantity produced (Aubert *et al.*, 2009). Greenhouse gas emissions, particularly nitrous oxide (N<sub>2</sub>O), which has 265 times the warming power of carbon dioxide (CO<sub>2</sub>), are lower in biological than in conventional agriculture (Aubert *et al.*, 2023). Recent studies (Baudry, 2019; Kesse-Guyot, 2022), conclude that the contribution of regular bio consumers to greenhouse gas emissions from their food is 35 % lower than that of conventional consumers.

## **2.2. Controversies over biological agriculture's ability to meet the challenges of sustainable food security**

According to Alavoine-mornas & Madelrieux (2014), Biological Agriculture, relying on regulations based on an obligation of means (mainly including a ban on synthetic products), is considered a model of sustainable agriculture. While this is true, the work that challenges the ability of AB to change the technological paradigm for agriculture is mainly grouped into approaches in terms of "land sparing" (Rundlöf and Smith, 2006; Smith, 2013; Kirchmann *et al.*, 2016). These demands are linked to the quantitative increase in food demands (demographic transitions, food

transitions in emerging or less advanced countries) or to industrial demands.

The first set of results analysed knowledge of the agronomic potential of biological Agriculture in African situations. Generally speaking, scientific work on biological Agriculture yields is rare in Africa (Adebisi *et al.*, 2020). Andriamampianina *et al.* (2018) experimented with an expert elicitation method to generate new information from existing knowledge bases. It displayed that yield differences between conventional and biological farming are not homogeneous across commodities and locations. For fruit and vegetables, for example, De Bon *et al.* (2018) showed that the unfavorable differentials for biological agriculture are much smaller than for cereal production, and can even be reversed in some cases.

Similarly, in areas where conventional farming has destroyed the natural foundations of fertility in the broadest sense, biological agriculture became a means of increasing yields. From a methodological point of view, this raises the question of how to compare crop yields based on indicators of homogeneity of species, varieties and quality, versus yields within associated crops involving different species with products of varying nutritional quality.

A second set of results highlighted the central role of institutions in transforming socio-political paradigms to recognize biological agriculture as the lever for a technological modernization of agriculture that meets the expectations of domestic markets (Andriamampianina *et al.*, 2018). The social and environmental externalities of biological agriculture are also debated. As far as social externalities are concerned, it is common to think that organic farming, by producing quality products at a higher price, would restrict access to them to commercial channels (specific departments, specialized stores) dedicated to high-income social categories (Temple & Bon, 2020).

Moreover, in Africa, certified organic farming concerns a few products traded on international markets (cocoa, coffee, cotton, quinoa, rice, dessert banana, mango, pineapple), and sometimes products destined for national markets (yams, fruit and vegetables) using long distribution channels (François *et al.*, 2005).

The renewed objectives of international organizations to reduce global inequalities (environmental, social) raise the question of how biological agriculture can no longer be just another alternative, but a lever for the global transformation of agriculture. Biological agriculture's ability to respond to the food security and environmental challenges specific to the African continent is a prerequisite for achieving the objectives of the first

axis. Yet this capacity remains little recognized because it is little known (Kahane *et al.*, 2013), given the controversies raised in the introduction to this article.

### 2.3. The poles of organic farming towards sustainable agriculture: our viewpoint

According to the UN, sustainable agriculture “meets the needs of the present without compromising the ability of future generations to satisfy their own needs” Bruntland Report, 1987 (Gionfriddo & Piccaluga, 2025). Biological agriculture focuses on:

(i) Biological agriculture must maintain and improve the health of the soil, plants, animals, human beings and the planet, considering them as a single indivisible unit. In other words, this principle states that the health of individuals and communities cannot be separated from the health of the ecosystem. Indeed, healthy soils produce healthy food, which in turn has a positive influence on the health of animals and humans;

(ii) Biological agriculture must base its production process on ecosystems and their natural cycles. This process must be in harmony with natural cycles for better conservation of natural agricultural resources. In short, biological agricultural practices must be ecological and based on recycling;

(iii) The biological movement must build relationships that ensure equity in the common environment and opportunities for better living conditions. Equity is characterized by respect, justice and responsibility towards the planet, both between human beings and in their relationships with other living beings. Biological agriculture must provide all those involved with a good standard of living and contribute to food security and poverty reduction;

(iv) Finally, biological agriculture must be managed in such a way as to respect the precautionary principle. It must take all necessary precautions to protect the health and well-being of present and future generations, and of the environment. To this end, biological farmers can improve efficiency and increase production, but not at the expense of health and well-being. Similarly, the environmental performance of new technologies needs to be tested and that of current technologies reviewed, especially as our understanding of agriculture and ecosystems is incomplete. That said, this principle stipulates that precaution and responsibility must be major issues in the management, development and choice of technologies in biological agriculture.

Finally, biological agriculture aims to promote farming that is “economically efficient, socially equitable and ecologically sound”.

### 3. CONCLUSION

A comparison between biological and conventional agriculture is inevitable. The dominant models of agricultural production have long been called into question. Conventional agriculture does not fully meet today's needs in terms of environmental protection and “sustainability”. Biological agriculture improves the resilience of farming systems. Its specific techniques can, under certain conditions, increase agricultural productivity, even if yields are on average lower than those of conventional agriculture. It can also be a source of employment for young people in rural areas. Agricultural research must now support its emergence, in a context where very few studies have been carried out on the subject to date. Research could also contribute to the development of appropriate public policies at different levels, so that these new initiatives can develop.

To recognize and develop biological agriculture, national and regional public policies are needed. These policies must involve all public (national, local) and private stakeholders in agricultural production, with the support of international development organizations. Finally, it is essential to link such policies with initiatives taken at the local level, in a process designed both to adapt to local conditions and to enable local players to control the dynamics.

Feeding the planet sustainably with agriculture that is independent of industrial inputs (pesticides, synthetic nitrogen fertilizers) is therefore possible, provided we give greater support to agronomic research, improve agro-ecological techniques and help farmers implement them. Biological agriculture and its variants (biodynamics, permaculture, regenerative biological agriculture) are the only realistic alternatives to conventional agriculture in the current ecological transition. So, is biological agriculture better than conventional agriculture? Yes, it is!

For example, the rules of organic farming are: soil fertility (green manure, compost, rotations...), no synthetic pesticides, limitation of nitrogen inputs per year, organic and integrated pest management, ecological reservoir zone... choice of hardy, resistant, indigenous species, organic seeds, no genetically modified organisms... for animals: less suffering, no stress, organic feed, homeopathy, phytotherapy... If processing: no ionizing radiation... We suggest in-depth surveys using robust methods to refine these studies on conventional and organic farming in DR Congo, with a view to drawing the obvious and reassuring conclusions possible through in situ experiments, both agronomic and sanitary.

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