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Alternative Agricultural Approaches for the South – All the Same or Clear Distinctions?

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Abstract

This study's objective is to assess eight alternative farming approaches (FA) with the potential to assist smallholder farmers in the Tropics and Subtropics to address the multitude of crises they encounter, and to compare them with mainstream agriculture. We suggest that a universal solution is not applicable to the diverse systems and future challenges, necessitating essential trade-offs. Most of these farming approaches emphasize certain agroecological practices (AEPs). The extent and intensity of applying these AEPs often remain unclear, while certification is an exception (organic farming). All the FAs are culturally differently embedded *with limited practical significance. Since AEPs usually yield best results when combined, focusing on such combinations is crucial.* Information about chemical inputs is frequently opaque and undefined. The diverse approaches are subject to ongoing debates, exhibiting various interpretations, yet also displaying intersections that can confuse smallholder farmers. In conclusion, we suggest that policies should promote the modular implementation of key AEPs. The modular approach should be driven by research, education, and training, with support through incentives such as subsidies.

Keywords: Agri-food systems, alternative agricultural approaches, agroecology, climate-smart agriculture, conservation agriculture, evergreen agriculture, food security, mainstream agriculture, organic farming, regenerative agriculture, syntropic agriculture

Introduction

Partly in response to the green revolution and other issues, agroecology has emerged as a science discipline, a practice, and a movement (Wezel et al., 2009). Its practices have gained significance amidst ongoing crises. Presently, new farming approaches are emerging with promising potential to address these challenges, often drawing inspiration from agroecological practices (AEP). However, agroecology, by not explicitly excluding certain practices, may not always address all environmental concerns, and the selective application of only some practices can limit its ecological impact. Thus, this article analyses various FA that incorporate agroecological practices, assessing their unique features in comparison to mainstream agriculture, and ultimately provides policy recommendations to promote sustainable farming practices among smallholder farms.

Assessment

The selected FA are often highlighted for their potential to reduce negative environmental impacts. To identify how far these FA integrate agroecological and other practices, peer-reviewed and non-peer-reviewed literature are reviewed using Google Scholar for scientific publications, supplemented by relevant stakeholders' online resources.

Each AEP is associated with a specific environmental asset, such as biodiversity (BD), soil fertility (SF), climate change (CC), and greenhouse gas emissions (GHE) (Table 1, 2). The assessment of FA is qualitative, categorised as "Yes/No", "No information", "Not explicit", “Promoted”, or qualitative descriptions.

AEP, which positively impact environmental assets, have been identified and recommended as crucial elements of a harmonized farming system (see Table 1). A second group of key practices (others) encompasses farming inputs that do not clearly align with supporting environmental assets, requiring further classifications to assess their specific performance within each farming approach (Table 2). Notably, tillage practices are excluded from the assessment due to the extensive diversity in each FA itself. Finally, we also assess socio-cultural characteristics which inform about the ethical concerns of each FA (Table 3).

Selected farming approaches (FA)

Agroecology (AE): Agroecology is a broader approach to agriculture. Rooted in ecological sciences and social movements, it aims for sustainable management of whole agroeco- and food systems while including social, cultural but also political aspects such as food sovereignty. Agroecology emphasizes the need of creating resilient farming systems by mimicking natural ecosystems. Agroecological practices can exclude synthetic inputs, depending on the specific approach and context. AE does not rely on a specific certification process or set of standards allowing a certain flexibility/adaptability to local conditions (HLPE, 2019).

Climate-Smart Agriculture (CSA): CSA aims to boost agricultural productivity, bolster resilience, and mitigate greenhouse gas emissions (FAO, 2021). It employs a range of methods tailored to specific regional needs. Significant concerns have been raised regarding the absence of well-defined environmental / social boundaries (Climate Smart Agriculture CONCERNS, 2014).

Conservation Agriculture (CA): CA is discussed as an agricultural practice under the umbrella of sustainable intensification, climate change relevance and as a form of Climate Smart Agriculture. CA is based on three main principles: minimal soil disturbance, permanent soil cover, crop rotation and crop diversification (Andersson & D'Souza, 2014). But there is not a single definition, however diverse understandings, what practice at least is relevant and what is more facultative. The approach is controversial (Giller et al., 2009; Guto et al., 2011a).

Evergreen Agriculture (EA): EA refers to a spatially managed agroforestry system that combines tree intercropping with annual crops. The primary goal of this system is to enhance soil cover, extend growing seasons, bolster farm resilience, and increase overall productivity, among other benefits (Garrity et al., 2010). Promoting the utilization of nitrogen-fixing tree species and incorporating complementary practices (such as CA or OF), is strongly encouraged (Garrity et al., 2010; Hadgu, Mowo, Garrity, & Sileshi, 2011).

Organic farming (OF): OF adheres to ethical principles, encompassing Health, Ecology, Fairness, and Care (IFOAM Principles). OF practices comply with mandatory and optional rules that extensively reference AEP. OF holds international accreditation through a comprehensive control and certification system. It is legally recognised, covering all aspects from input application and processing to market presence in over 110 countries worldwide. Depending on the application of IFOAM's or governmental-legal definitions, the extent of implemented AEP varies.

Traditional agriculture (TA): TA refers to extensive systems, which are constantly disappearing. They do not have access to modern technologies and sophisticated inputs like mineral fertilizers and do not have access to any national or international markets, and therefore are different to organic farming. However, they use all local resources and are knowledgeable about a broad range of crops for food, pest and disease management and medicine, and other purposes (Singh & Singh, 2017). These farming systems are more and more disappearing.

Regenerative Agriculture (RA): RA is an environmentally focused system, that emphasises soil issues (such as humus build-up, carbon sequestration etc.) and tackling the loss of biodiversity while still lacking a comprehensive and consistent scientific definition (Giller, Hijbeek, Andersson, & Sumberg, 2021; Tittonell et al., 2022). Divergences in the perception of RA however arise in the opinion on socio-economic aspects and the use of non-organic inputs (Schreefel, Schulte, de Boer, Schrijver, & van Zanten, 2020).

Syntropic Agriculture (SA): SA is a spatially and temporally managed agroforestry system that incorporates a socio-ecological innovation in agriculture (Andrade, Pasini, & Scarano, 2020). SA focuses on syntropy as energy accumulation principle preventing senescence, layered designs and soil coverage (stratification), natural succession imitating natural species-rich ecosystems, and high pruning intensity with mulching to create artificial disturbance and accelerate soil conservation and succession processes (Andrade & Pasini, 2022).

Mainstream agriculture (MA): In various regions of Africa, smallholder farmers have largely adopted maize-dominated cropping systems, occasionally incorporating other cereals, grain legumes, and root crops.

The use of mineral fertilizer and lime is scarce or non-existent, while the nutrient concentration in animal dung is minimal. Although agroforestry initiatives and cover crops are present, their prevalence is limited. Soil erosion of such systems is high.

Results and discussions: All FAs focus on selected AEPs - except AE and OF are more comprehensive approaches advocating for the implementation of whole systems - however how far those are consequently applied often remains open. Several FA lack sufficient information regarding the relevance of various AEP (CA, EA, OF, MA), specified recommendations (MA), and controversies (Table 1, 2). This limitation complicates the differentiation between FAs. In addition, it leaves the proper application of AEP a matter of good practice and farmers' management rather than providing substantial guidance. Additionally, depending on the definitions applied, RA appears to completely incorporate other FA (CA, EA). OF stands as an exception, benefiting from a precisely defined set of practices through a regulated control and certification system mandated by law, including mandatory and minimum recommended practices. On the other hand, even though organic farming has well-defined practices through its regulated system, it does not always guarantee the proper application of all AEP. Regarding economic practices, OF stands out as the only system that commands a price premium, while subsidies are not commonly provided in Africa. OF is the sole certified system, whereas for other FA, only regional certification systems, if they exist at all, are in place. Governmental support in the form of subsidies is scarce, and the market rarely offers price premiums for non-organic farming products. Regarding socio-cultural practices, many FAs do not address such practices or are not explicit (e.g., CA, RA, CSA) (Table 3).

Table 1. Status of agroecological practices in selected farming approaches

Agroecological practices	Impact on …	Agro-ecology [1]	Con-servation Ag [2,3]	Ever-green Ag	Traditional Ag [4,5]	Organic Farming [6]	Regen-erative Ag [7,8,9,10]	Syntropic Ag [11]	Climate-Smart Ag [12]	Main-stream Ag
Forage legumes	BD, CC, SF, GHE	Not explicit	No	Not explicit	No	Yes	Not explicit	Not explicit	Not explicit	No
Agroforestry / Alley cropping	BD, CC, SF, GHE	Yes	Yes	Yes	Not explicit	Yes [13] / No [14]	Yes	Yes	Yes	No
Crop rotation	BD, CC, SF, GHE	Yes	Not explicit	Not explicit	Not explicit	Yes	Yes	Ecosystem rotation	Yes	No
Composting	BD, CC, SF, GHE	Yes	Yes	Not explicit	Not explicit	Yes	Not explicit	No	Not explicit	Not explicit
Soil cover via mulch	SF, GHE	Yes	Yes	Yes	Not explicit	Yes	Yes	Yes	Not explicit	No

Source: For references, please ask the authors.

Table 2. Status of farming inputs in selected farming approaches

Farming Inputs	Impact on …	Agro-ecology	Conser-vation Ag	Evergreen Ag	Traditional Ag [15]	Organic Farming	Regen-erative Ag	Syntropic Ag [16]	Climate-smart Ag [17]	Main-stream Ag
Nonchemical pest / disease management	BD, SF	Not explicit	No	Yes	Not explicit	Yes	Not explicit	Yes	No	No
Urea, DAP	CC, SF, GHE	Not explicit	Yes	Not explicit	No	No	Not explicit	No	Yes	Yes
Superphos/ DAP	SF	Not explicit	Yes	Yes	No	No	Not explicit	No	Yes	Yes
KCL	SF	Not explicit	Yes	Yes	No	No	Not explicit	No	Yes	Yes
Selected mineral fertilizers*	SF	Yes	No	Not explicit	No	Yes	Not explicit	No	Yes	No
Herbicides	BD, SF	Not explicit	Yes	Not explicit	No	No	Not explicit	No	Yes	Yes
Pesticides	BD, SF		Yes	Not explicit	No	No	Not explicit	No	Yes	Yes
Feed input limitation	CC, GHE	Not explicit	No	No	Not explicit	Yes	No	Not explicit	Yes	No

Source: For references, please ask the authors; * e.g., those that are not listed in the table, and are selected due to ecological reasons.

Table 3. Status of socio-cultural practices in selected farming approaches

Socio-cultural practices	Agro-ecology	Conservation agriculture[18, 19]	Evergreen Agriculture[20, 21]	Traditional Agriculture	Organic Farming[22]	Regen-erative Ag	Syntropic Ag	Climate-smart Ag	Main-stream Ag
Cultural values	Yes	No	Yes	Yes	IFOAM Principles	Not explicit	Not explicit	No	Not explicit
Gender mainstreaming	Yes	No	No	No	Not explicit	No	No	Yes	No
Local / Traditional knowledge	Yes	Not explicit[18, 19]	Yes[20, 21]	Yes	Yes	Not explicit	Yes	Not explicit	Yes
Human-nature perception	Not explicit	No	Yes	Yes	Yes	Not explicit	Yes	No	Not explicit
Community well-being	Yes	No	Yes	Yes	Yes	Not explicit	Yes	Not explicit	Not explicit
Food sovereignty	Yes	No	Yes	Yes	Yes[22]	Yes	Yes	Yes	Yes

Source: For references, please ask the authors.

Conclusions and Outlook: The multitude of farming approaches may not provide practical guidance for farmers; instead, it could further convolute discussions about agroecological practices (AEP) (Altieri & Nicholls, 2012). Farmers prioritize practical actions over the terminology of FAs, often encountering undefined or disputed definitions. Clear FA definitions are essential to prevent confusion. Apart from OF, which is also challenged in terms of practical application, the other FAs are not widely adopted. It is crucial to emphasize that farmers who abstain from using mineral fertilizers or pesticides should not automatically be classified as organic farmers. The fragmented implementation of AEP in most FAs highlights significant obstacles, including labour demands, a lack of knowledge at various educational levels, insufficient access to appropriate inputs, the absence of recognition through higher product prices, and a dearth of incentives such as subsidies. FAs need better descriptions specifically on farm inputs to prevent counterproductive effects on environmental assets while simultaneously ensuring efficient support for sustainable production in terms of soil fertility, yield, and product quality. AEPs are only successful in certain combinations. Otherwise, they fail in terms of ecosystem service delivery incl. soil fertility, crop yield and product quality. To reduce dependence on inorganic fertilizers and address the widespread issues of low humus content, soil degradation, and low pH levels, the recirculation of off-farm organic matter is crucial, alongside the intensification of on-farm organic matter production, regardless of any specific FA. Advocating a modular approach to AEP, policies should endorse certain AEP as a core package for smallholder farms, backed by incentives such as subsidies. Educational and research programs will guarantee the accurate adoption of AEP, irrespective of the FA they encompass.

For references, please ask the authors.

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[1] (HLPE, 2019)
[2] (Dumanski, Peiretti, Benites, McGarry, & Pieri, 2006)
[3] (Dent & Boincean, 2021)
[4] (Singh & Singh, 2017)
[5] (Altieri & Nicholls, 2017)
[6] (Migliorini & Wezel, 2017)
[7] (Newton, Civita, Frankel-Goldwater, Bartel, & Johns, 2020)
[8] (Giller et al., 2021)
[9] (Elevitch, Mazaroli, & Ragone, 2018)
[10] (Al-Kaisi & Lal, 2020)
[11] (Andrade et al., 2020)
[12] (Tripathi et al., 2022)
[13] (Pantera, Mosquera-Losada, Herzog, & Den Herder, 2021)
[14] (Elevitch et al., 2018)
[15] (Singh & Singh, 2017)
[16] (Andrade et al., 2020)
[17] (Arakelyan, Moran, & Wreford, 2017)
[18] (Hermans, Whitfield, Dougill, & Thierfelder, 2020)
[19] (Lahmar, Bationo, Lamso, Guéro, & Tittonell, 2012)
[20] (Mulugeta, 2014)
[21] (Mowo, Dobie, Hadgu, & Kalinganire, 2010)
[22] (Bachmann, Cruzada, & Wright, 2009)