The potential of organic agriculture, soil structure and farmers income for inclusive agriculture sustainability: a review

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Abstract. Sustainable agriculture integrates three main objectives - environmental health, economic profitability, and social-economic justice. Organic farming is an alternative to sustainable agriculture that is more inclusive and has become a widespread phenomenon. Globally, the amount of land cultivated with some form of organic agriculture continues to grow. The sustainability of organic farming cannot be separated from the economic dimension, other than the environmental and social dimensions. Organic farming is not only limited to eliminating the use of synthetic inputs that can cause land degradation due to damage to soil structure, but also the sustainable use of natural resources, healthy food production and saving energy. The potential of organic farming in improving soil fertility is improving the physical and chemical properties of soil with the use of organic materials, and good management of organic farming can increase soil fertility. Economic aspects can be sustainable if agricultural production is able to meet the needs and provide sufficient income for farmers. Economic motivation now controls the direction of developing organic agriculture. Organic Agriculture can ensure stable and sustainable alternative livelihoods, especially in situations where land is available and offers opportunities for improvement, this is supported by the awareness of the dangers posed by the use of synthetic chemicals in agriculture making organic farming attract attention both at the level producers and consumers alike. Most consumers will choose food that is safe for health and environmentally friendly, thus encouraging increased demand for organic products as one of the inclusive agriculture properties.

1. Introduction

Sustainable agriculture integrates three main objectives - environmental health, economic profitability, and social-economic justice. The aim of sustainable agriculture is to meet the food and textile needs of the community without reducing the ability of future generations to meet their own needs. Sustainable
agriculture practitioners seek to integrate three main objectives into their work: a healthy environment, economic profitability, and socio-economic justice. Everyone involved in the food system - growers, food processors, distributors, retailers, consumers, and waste managers, can play a role in ensuring a sustainable farming system.

Increasing the world's population is inevitable, there are limitations to natural resources, while human needs continue to grow. Based on United Nations data in 2017, the global population is projected to reach 8.6 billion in 2030 and swell to 9.8 billion expected in 2050, this increase in population will increase demand for food and feed which will put pressure on agriculture so that direct response is needed by intensifying agriculture [1] as a major capital for developing countries development [2]. The expansion and intensification of global agriculture present a clear need to develop ways of production that can supply sufficient food for growing populations with more efficient use of resources [3]. Agriculture needs the support of a healthy environment, but currently, environmental damage cannot be avoided due to human activities, so nature conservation efforts are needed. Conservation is an important factor in an environmentally sound farming system; conservation of renewable resources means that these resources must be able to function [4]. Environmental sustainability and technical effectiveness in restoring degraded soils and increasing yields with the addition of organic and clay-based materials have been demonstrated by several researchers. Hopes for the future mainly lie in the ability of science and technology to increase agricultural productivity through intensive and sustainable agricultural practices [5] improving land tenure institutions pattern [6], positively affect farmers income [7] and in turn, help poverty alleviation [8] as inclusive agriculture properties.

One alternative agriculture that is environmentally friendly is organic farming. The first time organic farming was implemented in 1940 by Lord Northbourne in his book "Look to the Land" [9]. Northbourne not only uses the term organic in the use of organic material for fertilizer to land, but also for the concept of design and management of agriculture as a household system, integration of land, plants, animals, and society [10]. Organic farming is a widespread phenomenon. Globally, the amount of land cultivated with some form of organic agriculture continues to grow. [11] observed that the growth of organic agriculture in Romania, from the perspective of producers, the main reason explains the expansion of organic agriculture: "Government policies to limit or prohibit the use of technology that can increase pollution. In addition, the possibility of higher financial returns makes organic farming potentially an attractive choice for farmers in the mass market. Especially for small farmers who cannot benefit from the economical scale effects of technologically advanced agricultural production, organic food production seems to be an attractive market [12], shows that the organic farming market in Romania has expanded in the last period. The main reason is consumer concern for healthy eating [13,14].

Organic agriculture is the answer to the green revolution that was promoted in the 1960s. Green revolution in the context of increasing food production has led to reduced soil fertility and environmental damage due to the use of chemical fertilizers and chemical pesticides that do not consider the balance of the ecosystem. Intensive land exploitation is ongoing, and many years have resulted in a decrease in physical and chemical soil fertility. A different thing was stated by Seufert that organic farming is often considered to be related to smaller agriculture. Organic farming may be smaller in size because of the demands of organic farming management, or the market for organic products is still little associated with premium prices. A study from the UK shows that organic farming is more often carried out in areas that are less suitable for intensive cultivation, characterized by height and slope where there is integration such as crops and livestock [15].

The sustainability of organic agriculture cannot be separated from the economic dimension, other than the environmental and social dimensions. Organic farming is not only limited to eliminating the use of synthetic inputs, but also the sustainable use of natural resources, the production of healthy food and saving energy. Economic aspects can be sustainable if agricultural production is able to meet the needs and provide sufficient income for farmers. But as it grows, economic motivation becomes the direction of the development of organic agriculture. Awareness of the dangers posed by the use of
synthetic chemicals in agriculture makes organic farming attractive, both at the producer and consumer levels. Most consumers will choose food that is safe for health and environmentally friendly so that it encourages the increasing demand for organic products. Healthy lifestyles that are familiar with the environment have become a new trend and left behind old patterns of life that use non-natural chemicals, such as fertilizers, synthetic chemical pesticides, and growth hormones in agricultural production. This healthy lifestyle has been internationally institutionalized, which requires a guarantee that agricultural products must be of safe consumption (food safety attributes), high nutritional content (nutritional attributes), and environmentally friendly (eco-labeling attributes). This healthy and highly nutritious food can be produced by organic farming methods [16] in order to avoid the complaints of local people as consumers [17] from an economic perspective [18].

At present, along with the increase in living standards, welfare and education levels as well as public awareness about the dangers posed by the use of synthetic chemicals in agriculture, causing increasing demands for quality and safe food products such as organic agricultural products is increasing. Jelocnik et al. (2015) state that in Europe and throughout the world, agriculture and the food industry are facing a new trend in developing green alternatives [14]. The agricultural sector emerged as a result of public concern about health and the environment due to agricultural intensification technology, and the use of chemicals in the agricultural production process and the food processing industry. The demand for organic products is driven by the belief that organic products are healthier, tastier, and more environmentally friendly than conventional products. At present, there is not enough evidence to show the superiority of organic products in health. Comparative research is needed, especially bioassays in livestock and analysis of functional components of food because the comparison of the taste of organic products and non-organic products is often inconclusive. The purpose of writing this paper is to illustrate the importance of organic agriculture in the future sustainability of agriculture from ecological, economic, and social aspects, that the provision of organic material in the soil provides opportunities to improve soil structure and certainly has an impact on increasing farmers' incomes.

2. Organic agriculture, farmers income for inclusive agriculture

The potential of organic farming in improving soil fertility and soil management [19] is also very interesting to study, improvement of physical, and chemical properties of soil with the use of organic materials, and good management of organic farming can increase soil fertility, this is in line with Celestina research in 2018, that soil organic matter affects the physical, chemical, and biological soil properties and thus these factors affect crop yields [20]. Changes in organic matter from manure, compost, and crop residues are often used in crop production systems to restore degradation and improve physical and chemical soil constraints.

Fertile and healthy soil is a major factor in the success of farming. Intensive use of land over many years for cultivation has reduced soil chemical and biological fertility. The indications are to reduce soil organic matter content so that the activity and biodiversity and microbiological balance in the soil are low [21]. The balance between physical, chemical, and biological in the soil is very important for the continuity of production, soil health, and other ecosystem functions [16,22]. If not, the imbalance can lead to new problems such as the increase or dominance of a pathogen that causes plant diseases. The following is a picture showing agricultural practices that can increase soil fertility.
Based on the picture above, it appears that the importance of agricultural practices that can store nutrients in the soil, namely by crop rotation, the presence of crop cover. Then the importance of returning biomass from unused crop residues, adding organic fertilizer (compost fertilizer, manure, avoiding fire or heating around the plant), doing pasture management so that the above activities can reduce the level of biodegradation and mineralization (without processing soil and water management) and a decrease in erosion rates. Increasing the stock of SOC (Soil Organic Carbon) is not simple, but it is more difficult to increase input C in some places if limited access to necessary resources such as fertilizer or water.

Soil erosion is a complex geomorphic process, which not only leads to soil loss but also has a strong influence on the dynamics of SOC. Mineralization and absorption of SOC at erosion sites along transport routes and at depositional sites are strongly associated with changes in soil biogeochemical properties, such as aggregate damage and formation, redistribution of SOCs, burials in eroded SOCs and shifts in the composition of microbial communities. In this review, we provide an in-depth discussion of the conceptual relationship between biological soil properties, and mineralization and absorption of SOC in eroded agricultural landscapes, and highlight the importance of changes caused by erosion in the composition of microbial community dynamics in SOC [23].

Also, Suleman's research also carried out the recycling of residues. Residue recycling is one of the sustainable alternatives for improving soil structure and increasing nutrient stocks. However, information about the magnitude and duration of disturbance caused by plant and industrial waste in soil structure and microbial community functions is still scarce. The decision-making process for the use of organic fertilizers applies to smallholder crop production globally, where these small farmers cannot buy enough fertilizer to be used at high prices to maximize returns per hectare [24]. Therefore organic farming offers promising alternative management of nematodes, where nematodes are microorganisms that are needed by plants in the soil. His findings show the potential of organic agriculture in suppressing PPN (Plant Parasitisid Nematoda) at the farm level. Policy development and extension services can also consider organic agriculture as an alternative method of managing soil nematodes in agriculture in Africa [25].

A similar situation is experienced by small farmers in Africa who generally do not have the financial means to buy fertilizer sufficient for application at an optimal economic or cost level to maximize net returns per ha to the soil. The study was carried out for peanuts (Phaseolus vulgaris L.), soybeans (Glycine max L.), and peanuts (Arachis hypogaea L.) fertilizer by combining plants with nutrients needed so farmers will be more efficient. The results show an average increase of 92%, 111%, and 92% for N applied to peanuts, and P applied to soybeans and peanuts at 15 kg per ha, respectively, with a lower yield response for P applied to peanuts and K is applied to soybeans and peanuts. Average yields peaked at 1.81, 1.92, and 1.71 Mg per ha for beans, soybeans, and peanuts [26].

Subsequent research was conducted by Smith et al. by assessing the impact of production from the conversion of 100% to organic agriculture in England and Wales using a large-scale linear programming model [3]. This model covers a variety of typical agricultural structures that improved in
all available land areas to maximize food production. Soil impacts and rainfall, nitrogen (N) supply/uptake, and animal feed demand are taken into account. The results of this study indicate the impact of conversion to organic agriculture on food production in England and Wales will be severe. Losses will be greater for some commodities (e.g., cereals, vegetable oils, monogastric livestock) than others (e.g., vegetables and milk). The relative similarity of organic vegetable yields with conventional makes this the most likely planting sector to sustain the widespread adoption of organic practices. The results also suggest that certain organic practices can be extended in some non-organic systems to increase the efficient use of resources without jeopardizing production. This could include the use of introducing livestock to the vegetable system field. A combination of adjustments will be needed, including some certification constraints, new solutions to agronomic constraints, significant reductions in food waste, and perhaps the most challenging of all is significant changes in the national diet to reduce the need for a large increase in imports by replacing lost production resulting from large-scale organic production [3].

Soil organic matter influences the physical, chemical, and biological properties of the soil and is, therefore, agronomically important because these factors affect crop yields. Modifications of organic matter such as manure, compost, and plant residues are often used in crop production systems as an alternative to inorganic fertilizers to restore degraded soil and correct physical chemical constraints. Yield response to the application of changes in organic matter can be made because of the improvement of soil constraints, plant nutrients contained in these changes [20]. Evidence for significant environmental improvements through conversion to very large organic agriculture - almost eliminated pesticides and nutrient pollution that substantially reduces the loss of biodiversity, wind and water erosion, and the use of fossil fuels and the potential for heating conventional farmhouse farms are all reduced in organic agriculture compared with comparable conventional farming systems [14].

3. Potential of organic agriculture: increase farmer's income

There have been many studies that support organic agriculture can increase farmers' incomes. Research conducted by Qiao states that organic farming can provide higher income for farmers for small-scale agriculture compared to conventional agriculture regardless of profitability calculations made based on the area of land or household. Although organic rice yields are lower than conventional rice yields (the price of organic rice is higher than conventional rice) due to an increase in overall household income in the region, food security is not a problem; and most organic and conventional farmers can sell a portion of their rice on the market. Total variable costs without land rent do not show a significant difference on the scale of the land scale between the three groups (p > 0.05), but the cost of renting additional agricultural land by medium farmers and small scale organic farmers is significantly higher than conventional farmers who have no incentive to lease land for production [27].

A study of typology for small farmers in Kenya relates to organic and conventional agriculture. Understanding smallholder diversity is key to developing interventions, strategies, and policies aimed at addressing the challenges faced by farmers and shaping the future of farmers in agriculture in Kenya, Africa, and other countries. In this study, Kamau et al. (2018) developed a typology for smallholder agriculture in Kenya using survey data from 488 agricultural households in Kajiado and Muranga Districts [12]. The results of this study indicate that overall, organic farming practices are associated with higher agricultural incomes, legal land ownership, older household heads, larger household sizes, stronger social networks, higher access to information, a more diverse diet, and a higher level of gender justice. Conversely, farmers who are poorer, younger, and less connected are less involved in organic farming. The results of this study can help improve efficiency in implementing pro-poor agricultural interventions, strategies, and policies and then to form appropriate policy instruments. However, this research supports the findings of previous agricultural typology studies conducted in Kenya, as well as in other countries in Sub-Saharan, where the same pattern was observed. This is a cross-sectional study, and the results must be interpreted with caution because they
do not determine the causal relationship between variables. Finally, despite efforts to capture a climate of heterogeneity, this study failed to represent the overall diversity of biophysical conditions in Kenya.

Gomeiro (2017) illustrates that organic food is increasingly attractive to consumers because it is considered healthier than food produced by conventional agriculture and more environmentally sustainable [28]. This paper provides an overview of the quality of organic products in terms of nutritional value, the presence of pesticide residues, heavy metals, mycotoxins, and bacterial contamination, and problems with antibiotic use. Compared to conventional products, organic products are richer in some beneficial compounds. This study shows that organic food is much less contaminated by pesticides, and residues with toxicity are much lower than those found in conventional foods. As for heavy metals, mycotoxins, and bacterial contamination, there were no significant differences in organic products compared to conventional products (except for Cd, found to be lower in organic products, which is a positive finding). More effective and detailed guidelines must be designed for the design and reporting of primary studies and meta-analyses. Pesticide residues must be assessed both quantitatively and qualitatively. Of course, organic products cannot be assumed, a priori, safe. Good monitoring needs to be continued. It was concluded that organic farming could provide important benefits for human health and the environment, and promote more compassionate animal care. It is hoped that agricultural policy will pay more attention to organic farming practices, agroecology, and low inputs, and invest in research and innovation.

Furthermore, in L.de.Cock et al. (2016) research states that although national organic product customers are growing fast and active government support for organic agriculture, organic products in Flanders have shown little growth since the late 1990s [10]. Discourse analysis approaches that offer important insights on the causes of limited organic production capacity in Flanders complement each other for more general political institutions or actor-oriented perspectives. The results show that for decades, competition between two mutually exclusive organic agriculture discourses has hampered collaborative efforts to contribute to the growth of the agricultural sector both organically and conventionally in this case the organic farming community, market participants, agricultural and food policymakers. Such collaboration proved necessary to stimulate substantial growth in organic production in an area such as Flanders (Belgium). These results suggest that facilitating the non-competitive acceptance of cross-farm discourse, politics, and food market stakeholders is very important to support the development of organic agriculture. Therefore in this research, the impact of organic agriculture discourse on the development of institutions and practices of organic agriculture in Flanders has been studied. Three analytically distinct organic agricultural discourses and coalition discourses have been found (agroecological oriented discourses, agro-industrial oriented discourses, and market-oriented discourses) and analyze how the relative dominance of discourse and discourse coalition changes in time. Thus, the analysis has revealed that discursive dynamics have played an important role in determining the development of the organic agriculture sector in Belgium.

Furthermore, Qiao et al. (2018) research state that organic farming can sustain rural development and reduce poverty [27]. It is not well studied whether it can be feasible to improve the livelihoods of small farmers in the context of urbanization and demographic change. Household surveys were carried out in 2007 and 2014 in Wanzai, Jiangxi Province, where organic farming began in 2000 to understand this. The results show organic farming does contribute to higher agricultural income for small-scale farmers (<1 ha of land) compared to those who farm conventionally, regardless of whether profitability is measured in land units or per basic household. The annual net income of farmer households increased from 2007 to 2014, but agricultural income from small-scale farmers was only a small part of total household income, and the percentage became less and less over time. For medium-scale organic farmers (> 1 ha of land), the proportion of income from agriculture is higher (56% in 2007 and 77% in 2014), which leads to an average agricultural income of USD16,108 in 2014. Apart from farmers, members of the cooperative perform better economically than those, not in cooperatives. Organic farming can ensure stable and sustainable alternative livelihoods, especially in situations where land is available and offers opportunities for improvement.
In global development policies and discourse, the concept of "inclusive business" has become central to efforts to overcome tensions between farmers and other actors in agricultural business with the idea of integrating small farmers and disadvantaged actors in partnership with agribusiness companies that can produce economic benefits: National, private investors, and local livelihoods. Scientific treatment of these topics tends to be polarized into a win / lose narratives, or point to social contingency and differentiation from local experiences [29]. "Inclusive business" has emerged as a key conceptual framework for efforts to improve compatibility between agribusiness expansion and rural livelihoods [30], and have been actively adopted by leading governments [29], NGOs, donors, and food agribusiness companies [31] so that the potential of organic agriculture can be enjoyed by all farmers and agri-business stakeholders.

4. The future potential of organic agriculture

Agriculture, as the basis of human life, is, therefore, important to adopt management strategies to preserve the support of the system and increase its resilience, that is, its ability to recover from stress. It is also important to reduce the impact of agricultural activities on human resources, environment, and health. Problems caused by intensive agriculture have been widely discussed, including the depletion of soil fertility and soil erosion, widespread use of harmful agrochemicals [32].

Conservation planning plays an important role in facilitating progress towards biodiversity targets by giving practitioners the tools needed to allocate resources and implement actions. However, the usefulness of the growing scientific literature for conservation in the field has been questioned. Given these criticisms, and the lack of progress towards global Biodiversity Targets. Mair et al. (2018) aim to assess the scientific contribution of research to the field of conservation planning and to apply topic modeling to a body of literature consisting of 4471 articles relating to conservation planning published between 2000 and 2016 [33]. Then calculate changes in topic popularity and assess the extent to which various topics are discussed in the same article. The results show that research on species and habitat status is the most prevalent; action planning processes receive far less attention, and implementation least attracts researchers from all. The scientific literature is thus dominated by biological research rather than socio-political and further shows that, in general, the lack of interdisciplinary research is problematic given that ultimately the socio-political context will determine the success of conservation efforts. The number of publications on implementation and monitoring has declined over time, showing a diminishing interest in publishing evidence of the effectiveness of the plan, and that limited efforts have been made to overcome the "implementation crisis." We suggest that filling the research gap, through the integration of social science and placing greater value on the synthesis of evidence, will push scientific research towards greater application and help provide the information needed to achieve global biodiversity targets [33].

Diversity is a key component of an organic system that results from the agroecological design of organic management principles. Although the term and concept of diversity do not appear prominently in the work of organic pioneers such as Albert Howard, Rudolf Steiner, or Eve Balfour as the concept of biodiversity was developed longer than organic agriculture. The diversity movement is a key component of the modern conceptualization of organic agriculture. The commonly used organic definition of agriculture defines it as "a holistic production management system that promotes and enhances the health of agroecosystems, including biodiversity, biological cycles, and soil biological activities [15] to finally enhance production, sustain farmers income [34] and strengthen households food security [35]. Therefore, efforts are needed to increase biodiversities in agriculture, such as intercropping, strip cropping, livestock integration, crop rotation, and others. Besides, there is also a Lifecycle Assessment (LCA) is a set of systematic procedures used to assess environmental impacts associated with all stages of products, systems, processes or services, through production, use, and disposal which can be used to see the extent of environmental impacts in the production process [4]. Finally, it would have significant economic and ecological outcomes in agriculture [36].
5. Conclusion

Organic agriculture has great potential in inclusive, sustainable agriculture in the future by integrating all agribusiness stakeholders in agriculture so that they can benefit each other from upstream to downstream. From the environmental aspect, organic farming is able to create a friendly environment and improve soil structure so that it can guarantee the continuity of production that can meet consumer demand for safe and healthy agricultural products. The social and economic aspects of organic agriculture can increase farmers' income on a broader scale so that it can maintain the stability of the welfare of farmers as inclusive agriculture properties.

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