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Preliminary Assessment Through Contributions of Organic Farming to A Sustainable Environment

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Abstract

Agriculture is the foundation of the world's food supply and lives, making it one of humanity's most important endeavors. It is essential to both the health and survival of the planet's population as well as to the planet's overall well-being. However, while meeting immediate food demands, conventional agricultural practices have been associated with a range of ecological challenges, including soil degradation, water contamination, loss of biodiversity, and contributions to greenhouse gas emissions. These challenges intensify in the face of climate change and the imperative to feed a growing global population. In response to these challenges, as in the field of agricultural sciences and environmental studies, insights and research are crucial in expanding the understanding and implementation of organic farming practices. Together, can pave the way for sustainable agricultural systems that support global food security and foster a balanced coexistence between humanity and the natural environment. Organic farming has emerged as a paradigm rooted in the principles of sustainability and ecological stewardship that compliance along with sustainable development goals (SDG) such as climate action (SDG 13) and life of land (SDG 15). Hence, organic agriculture emphasizes reduced chemical input, soil health preservation, and biodiversity conservation, offering a promising alternative to conventional methods. This preliminary assessment seeks to explore and elucidate the multifaceted contributions of organic farming to the creation and maintenance of a sustainable environment. In this study, a qualitative multi-criteria approach was taken and each step emphasized transparency. The methodological approaches will be conducted from the APPGM-SDG studies using different methods of organic farming and are characterized by the following aspects such as divergence within and between farming systems, comparison system on the relative scale, and appropriate indicator selected based on the Organization for Economic Co-operation and Development (OECD) list. Hence, these innovative methods and approaches make trends towards sustainable farming systems and enhance the productivity of the farmer's life quality in an environmentally friendly way. In conclusion, this assessment provides a foundational framework for further research and discourse on the vital role of organic agriculture in addressing contemporary environmental challenges, supporting food security, and fostering a harmonious coexistence between humanity and the natural world.

Keywords: *biodiversity conservation; ecosystem preservation; green agriculture; food security*

Introduction

Organic farming has emerged as a pivotal player in contemporary agriculture, heralded for its potential contributions to fostering a sustainable environment. As global concerns intensify regarding the ecological footprint of conventional farming practices, the organic approach stands out for its emphasis on biodiversity conservation, soil health, and reduced reliance on synthetic inputs. This preliminary assessment delves into the multifaceted contributions of organic farming to environmental sustainability, drawing insights from empirical studies and scholarly discourse (Mader et al., 2002)

The growing demand for food production, exacerbated by burgeoning populations and changing consumption patterns, has heightened the urgency to reevaluate agricultural systems' impact on the environment. The conventional agricultural paradigm, characterized by intensive chemical use and monoculture, has been associated with detrimental effects on soil quality, water resources, and overall ecosystem health (Pretty, 2008; Tilman et al., 2011). In this context, organic farming presents an alternative model that aligns with principles conducive to ecological balance and long-term environmental resilience.

The conceptual underpinnings of organic farming prioritize holistic ecosystem management, minimizing synthetic inputs, and emphasizing agroecological practices (Reganold & Wachter, 2016). This approach stands in stark contrast to conventional farming, which often relies on agrochemicals and genetically modified organisms. By eschewing synthetic pesticides and fertilizers, organic farming endeavors to mitigate environmental pollution, reduce greenhouse gas emissions, and foster soil fertility through natural processes (Bengtsson et al., 2005).

While the merits of organic farming are increasingly acknowledged; a systematic examination of its environmental contributions is essential for informed decision-making and policy formulation. This preliminary assessment aims to unravel the nuanced dimensions of how organic farming, with its emphasis on sustainable practices, influences soil quality, water management, climate resilience, and overall ecosystem health. Through a comparative exploration of organic and conventional farming systems, this study seeks to shed light on the potential of organic agriculture to serve as a cornerstone in the pursuit of a more sustainable and resilient environment.

Materials and Methods

To comprehensively assess and compare the environmental effects of conventional and organic farming systems, a systematic and transparent methodology was employed. The study utilized a qualitative multi-criteria approach, drawing inspiration from the conceptual framework established by the All-Party Parliamentary Group Malaysia for Sustainable Development Goals (APPGM-SDG). This approach involved distinct steps, emphasizing transparency and methodological rigor.

Study sites

The investigation was carried out in two distinct farming areas situated in Ipoh and Sungai Siput, Perak, Malaysia, falling within the longitudes 101°06'31.4"E to 101°04'04.9"E and latitudes 4°47'28.1"N to 4°36'02.0"N of the equator, as illustrated in Figure 1. These geographical coordinates place the study sites in a region characterized by an Af climate, denoted as a Tropical Rainforest Climate according to the Köppen-Geiger climate classification. In Sungai Siput, the mean yearly temperature stands at 24.3 °C, accompanied by an annual rainfall of 2958 mm. In contrast, Ipoh experiences a slightly higher mean yearly temperature of 25.8 °C, coupled with a yearly rainfall of 2298 mm. Notably, both locations share the same driest month, occurring in July, with an average temperature of 25.0 °C. The peak of precipitation is observed in November, with an average rainfall of 323 mm, coinciding with the highest relative humidity recorded at 89.45%. This climatic context is pivotal for understanding the environmental conditions influencing the farming practices under scrutiny.

Figure 1: Location of study site in the state of Perak, Malaysia

Farming systems

The methodology employed to assess the environmental impacts of organic farming involves a comparative analysis with modern farming systems. This comparative evaluation aims to differentiate between organic and conventional farming based on the range and complexity of farming practices implemented. Table 1 serves as a comprehensive indicator for gauging the diversity and intricacy of these farming systems. It is crucial to note that the outcomes of the organic versus conventional farming comparison are contingent on the specific characteristics selected for assessment, as delineated in Table 1. The key points present a structured framework for discerning the nuances in farming practices, allowing for a detailed and systematic examination of their environmental implications as below:

- **Conventional Systems**: These systems represent traditional agricultural practices that rely heavily on synthetic fertilizers, pesticides, and herbicides to maximize crop yields. They often prioritize short-term productivity and efficiency, sometimes at the expense of long-term soil health and environmental sustainability.
- **Integrated Management**: This approach incorporates both conventional and ecological practices, aiming to reduce the reliance on chemical inputs while improving environmental outcomes. Techniques such as crop rotation, biological pest control, and the use of organic amendments are integrated into the farming system to enhance sustainability.
- **Best Integrated Management Plus Agri-Environmental Measures**: This advanced system builds upon integrated management by adding specific measures designed to further reduce environmental impact and resource use. Examples include creating habitats for wildlife, implementing buffer zones to protect water bodies, and conserving natural landscapes within the farming area.
- **Organic**: This category encompasses farming systems that adhere strictly to organic farming principles, avoiding synthetic chemicals and genetically modified organisms (GMOs). Organic systems emphasize soil health, biodiversity, and ecological balance, often involving practices such as composting, green manures, and natural pest control.
- **Best Organic Management Plus Agri-Environmental Measures**: Representing the pinnacle of organic farming practices, this system not only follows organic principles but also incorporates additional agri-environmental measures to enhance ecological outcomes. This may involve setting aside land exclusively for nature conservation, implementing advanced soil and water management techniques, and fostering greater biodiversity within the farming ecosystem.

Table 1: Range and complexity of farming systems

Conventional system	Organic systems	Characteristics
C1 Conventional systems	O1 Organic	Typically found in practice
C2 Integrated management	O2 Best organic management	Using the best, up-to-date management practices, within the specific systems
C3 Best integrated management plus agri-environmental measures	O3 Best organic managementplus agri-environmental measures	Plus, specific measures decrease environmental and resource use such as providing exclusive areas for nature

Field study

The evaluation of the environmental impact of the farming systems relies on the OECD (Organization for Economic Cooperation and Development) indicator system. This system encompasses distinct indicator categories, each focusing on key aspects such as biodiversity and landscape, soil quality, ground, and surface water conditions, as well as climate and air parameters. These broad categories are further delineated using additional indicators to provide a detailed and comprehensive assessment. In particular, a qualitative assessment of soil quality was conducted in each of the study sites. This assessment involved the use of selected soil quality indicators, accompanied by ranking descriptions typical of local producers. The soil health card, as illustrated in Table 2, serves as a tool for this qualitative evaluation. The card employs a ranking system ranging from low to high, with rankings based on specific criteria relevant to soil health. To ensure a representative analysis, three sampling points were randomly designated within each mapping unit corresponding to different soil types. Soil samples were then collected at a depth of 0–15 cm, a range identified as the peak of biological activities in the soil. Subsequently, the collected samples were qualitatively assessed in the field using the soil health cards and the established OECD indicators. This methodology ensures a thorough examination of soil quality and its potential implications for the broader ecosystem.

Table 2: Soil Health Card using OECD indicators.

Indicators	**Low**	**Moderate**	**High**	**Methods of determination**
Soil				
Earthworm	Few worms (1–4) per shovel, no casts or holes	More worms (5–8) per shovel, some casts and holes	Many worms (>8) per shovel, many casts and holes	Use of quadrant and counting the number of earthworms or casts. (Five quadrant throws per site)
Organic matter content	No visible roots or residues	Some plant residues and roots	Lots of roots/residues in many stages of decomposition	The presence and abundance of visible residues or roots
Subsurface compaction	Hard layers, tight soil, restrict wire penetration, Obvious hardpan, roots turned awkwardly	Firm soil, moderate shovel resistance, penetration beyond the tillage layer	Loose soil, unrestricted wire penetration, no hardpan, mostly vertical root plant growth	Degree of resistance to a stick (100 cm × 1 cm in diameter) when inserted into the soil
Erosion	Obvious soil deposition, large gullies joined, and obvious soil drifting	Some deposition, few gullies, some coloured run-off, and some evidence of soil drifting	No visible soil movement, no gullies, clear or no run-off, no obvious soil drifting	The presence of gullies, rills, or any evidence of run-off
Ground and surface water				
Water holding capacity	Plant stress immediately following rain or irrigation, the soil has limited capacity to hold water, soil requires frequent irrigation	Crops did not easily suffer from dry spells in the area, soil requires moderate irrigation	Soil holds water well for a long time, thick topsoil for water storage, crops do well in dry spells, soil requires little irrigation	The rate at which water runs out after a good rain, with or without puddling
Drainage	Excessive wet spots on the field, ponding, root disease	Some wet spots on the field and profile, some root diseases	Water is evenly drained through the field and the soil profile has no evidence of root disease	Degree of wetness or dryness, ponding or run-off
Climate				
Pesticides	No pesticide application	Less pesticide application	High pesticide application	Leaching through the soil profile into groundwater, by surface runoff, by erosion of contaminated soil particles, or directly by pesticide application close to surface waters
Ecosystem				
Floral diversity	Stunted growth, uneven stand, discoloration, low	Some uneven or stunted growth, slight discoloration,	Healthy, vigorous, and uniform stand	Leaf color and rate of crop growth throughout the season

	yield	signs of stress		
Landscape	No ecological quality with biodiversity and soil fertility	Low ecological quality with biodiversity and soil fertility	High ecological quality with biodiversity and soil fertility	Personal participation (visual demonstration of ecological and socioeconomic development); ecological quality (biodiversity, soil fertility)
Faunal diversity	No butterflies and fewer species;	Moderately butterflies and moderate species	Significantly more butterflies and more species	Diversity and/or frequency of beetles (ground beetles, rove beetles, ladybirds, and others)
Habitat diversity	No diverse living conditions on arable land and grassland	Less diverse living conditions on arable land and grassland	More diverse living conditions on arable land and grassland	The habitats are surrounded by special nutritional demands (such as insects and birds)

Results and Discussion

Farming intensity

The comparison of farming systems between Ipoh Farm and Sungai Siput Farm reveals distinctive approaches to agriculture, ranging from conventional to organic practices. In Ipoh Farm, characterized as a conventional system (C1), the emphasis is on typical practices prevalent in conventional agriculture. On the other hand, Sungai Siput Farm adopts organic farming principles, specifically denoted as the best organic management (O2). Ipoh Farm, categorized as integrated management (C2), indicates a level of sophistication in agricultural practices, incorporating modern techniques for efficient resource utilization. In contrast, Sungai Siput Farm goes a step further, implementing the best organic management practices (O2), which involve the use of up-to-date and sustainable agricultural techniques. The highest level of sophistication is seen in both farms with the incorporation of agri-environmental measures. Ipoh Farm, under the label of best-integrated management plus agri-environmental measures (C3), signifies a commitment to environmental sustainability within conventional farming practices. Sungai Siput Farm, adopting the best organic management plus agri- environmental measures (O3), exemplifies an organic farming system that not only adheres to the highest organic standards but also integrates specific measures to reduce environmental impact, such as providing exclusive areas for nature conservation. Several studies highlight the environmental benefits associated with organic farming practices, emphasizing reduced chemical inputs, enhanced soil health, and biodiversity conservation (Reganold & Wachter, 2016; Ponisio et al., 2015). Sungai Siput Farm's adoption of the best organic management practices aligns with these findings, showcasing a commitment to sustainable agriculture that extends beyond conventional norms. The incorporation of agri-environmental measures in Sungai Siput Farm further underlines the farm's dedication to minimizing its environmental footprint and contributing to broader conservation efforts (Crowder et al., 2010). Hence, the comparison of farming systems between Ipoh Farm and Sungai Siput Farm illustrates a spectrum from conventional to advanced organic practices, with the latter incorporating agri- environmental measures for a more holistic and sustainable approach to agriculture.

Table 3: Farming systems in study sites

Ipoh Farm	Sungai Siput Farm
C1 Conventional systems	O1 Organic
C2 Integrated management	O2 Best organic management
C3 Best integrated management plus agri-environmental measures	O3 Best organic management plus agri-environmental measures

Qualitative soil quality

The qualitative assessment of soil quality indicators in Ipoh Farm and Sungai Siput Farm, as presented in Table 4, provides valuable insights into the environmental impact of different farming systems. Each indicator reflects key aspects of soil health, water management, climate, and overall ecosystem health. Firstly, both farms exhibit high earthworm activity and organic matter content, suggesting favorable soil conditions. However, Sungai Siput Farm, practicing organic farming, demonstrates a comparable or higher level of these indicators than Ipoh Farm, emphasizing the positive influence of organic practices on soil biodiversity and fertility (Mäder et al., 2002). Moreover, the indicators related to subsurface compaction and erosion reveal insights into the soil structure and its susceptibility to degradation. Sungai Siput Farm exhibits lower levels of subsurface compaction and erosion, indicating a healthier and more resilient soil structure. This is consistent with the principles of organic farming, which emphasizes reduced soil disturbance and conservation of soil structure (Pimentel et al., 2005).

In terms of water-related indicators, Sungai Siput Farm showcases higher water-holding capacity and better drainage. This suggests that organic farming practices contribute to improved water retention and reduced risk of waterlogging, which is essential for sustainable agriculture (Pretty, 2008). The indicators related to climate and air quality, such as pesticide application, demonstrate the environmental benefits of organic farming. Sungai Siput Farm, following organic practices, shows no pesticide application compared to Ipoh Farm, where pesticides are used. This aligns with research indicating lower environmental impact and reduced chemical residues in organic farming (Mader et al., 2002). Lastly, the indicators related to ecosystem health, including floral and faunal diversity, landscape, and habitat diversity, showcase Sungai Siput Farm's commitment to creating a more ecologically balanced farming environment. These aspects contribute to the overall biodiversity and ecological sustainability associated with organic farming (Bengtsson et al., 2005). Therefore, the qualitative assessment of soil quality indicators supports the notion that Sungai Siput Farm, practicing organic and agri-environmental measures, exhibits superior environmental performance compared to Ipoh Farm. These findings underscore the potential of organic farming to enhance soil health, water management, and overall ecosystem resilience.

Table 4: Qualitative soil quality indicators in the two study sites

Indicators	**Ipoh Farm**			**Sungai Siput Farm**		
	Low	**Moderate**	**High**	**Low**	**Moderate**	**High**
Soil						
Earthworm			**x**			**x**
Organic matter content			**x**			**x**
Subsurface compaction		**x**				**x**
Erosion		**x**			**x**	
Ground And Surface Water						
Water holding capacity		**x**				**x**
Drainage		**x**				**x**
Climate and Air						
Pesticides	**x**				**x**	
Ecosystem						
Floral diversity		**x**				**x**
Landscape		**x**				**x**
Faunal diversity		**x**				**x**
Habitat diversity		**x**				**x**

Conclusion and Recommendation

In conclusion, the comparative study of farming practices in Ipoh and Sungai Siput, Perak, Malaysia, has shed light on the intricate interplay between environmental factors and agricultural systems. The assessment, based on OECD indicators, has allowed for a nuanced understanding of the ecological impact of both modern and organic farming approaches. The distinct climatic conditions, characterized by a Tropical Rainforest Climate in the Af category, have influenced farming practices and necessitated a comprehensive evaluation. The qualitative assessment of soil quality, encompassing indicators such as earthworm presence, organic matter content, subsurface compaction, and erosion, revealed notable differences between the Ipoh and Sungai Siput farms. Sungai Siput Farm, employing organic practices, exhibited higher soil health indicators, emphasizing the potential benefits of organic farming for soil fertility and biodiversity. Moreover, the evaluation extended to ground and surface water considerations, climate, and air parameters. The judicious use of pesticides in Sungai Siput Farm, aligned with organic principles, emerged as a positive aspect, contributing to water reclamation areas' sustainability. The reduced CO2 emissions in organic systems further underscored their potential in addressing climate-related concerns.

Drawing from the findings, it is recommended that sustainable agricultural practices, particularly those aligned with organic farming principles, be further encouraged and supported. Embracing sustainable development goals (SDGs) becomes imperative in this context. The SDGs, set by the United Nations, provide a framework for addressing global challenges, and several goals directly align with the outcomes of environmentally conscious farming practices as follows:

Goal 2: Zero Hunger: The adoption of sustainable and organic farming practices can contribute to food security by enhancing soil fertility, promoting biodiversity, and reducing reliance on synthetic inputs.

Goal 6: Clean Water and Sanitation: Practices like judicious pesticide use in organic farming, as seen in Sungai Siput, contribute to maintaining clean water sources.

Goal 13: Climate Action: The lower carbon footprint associated with organic farming aligns with efforts to mitigate climate change. Encouraging such practices can contribute to achievingclimate-related targets.

Goal 15: Life on Land: Organic farming, as evidenced in Sungai Siput Farm, supports terrestrial ecosystems' health, promoting biodiversity and habitat diversity.

Incorporating these recommendations into agricultural policies and promoting awareness among farmers can lead to more sustainable farming practices, aligning with broader global sustainability goals. As we navigate the complex nexus of agriculture and the environment, a conscientious approach is pivotal for ensuring a harmonious balance between food productionand ecological well-being.

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Conflict of interest:

No conflict of interest

References

1. Adeyolanu, O. D., & Ogunkunle, A. O. (2016). Comparison of qualitative and quantitative approaches to soil quality assessment for agricultural purposes in South-western Nigeria. *Cogent Food & Agriculture*, *2*(1), 1149914.

2. Biswas, S., Ali, M. N., Goswami, R., & Chakraborty, S. (2014). Soil health sustainability and organic farming: A review. *Journal of Food Agriculture and Environment*, *12*(3-4), 237-243.

3. Bengtsson, J., et al. (2005). The effects of organic agriculture on biodiversity and abundance: a meta-analysis. *Journal of Applied Ecology*, *42*(2), 261-269.

4. Crowder, D. W., Northfield, T. D., Strand, M. R., & Snyder, W. E. (2010). Organic agriculture promotes evenness and natural pest control. *Nature*, *466*(7302), 109-112.

5. Hole, D. G., et al. (2005). Does organic farming benefit biodiversity? *Biological Conservation*,*122*(1), 113-130.

6. Lal, R. (2015). Restoring soil quality to mitigate soil degradation. *Sustainability*, *7*(5), 5875- 5895.

7. Mader, P., et al. (2002). Soil fertility and biodiversity in organic farming. *Science*, *296*(5573),1694-1697.

8. Pagliai, M., Vignozzi, N., & Pellegrini, S. (2004). Soil structure and the effect of management practices. *Soil and tillage research*, *79*(2), 131-143.

9. Pimentel, D., et al. (2005). Environmental, energetic, and economic comparisons of organic and conventional farming systems. *BioScience*, *55*(7), 573-582.

10. Ponisio, L. C., M'Gonigle, L. K., Mace, K. C., Palomino, J., & de Valpine, P. (2015). Diversification practices reduce organic to conventional yield gap. Proceedings of the Royal Society B: *Biological Sciences*, *282*(1799), 20141396.

11. Pretty, J. (2008). Agricultural sustainability: concepts, principles and evidence. Philosophical Transactions of the Royal Society B: *Biological Sciences*, *363*(1491), 447-465.
12. Reeve, J. R., Hoagland, L. A., Villalba, J. J., Carr, P. M., Atucha, A., Cambardella, C., ... & Delate, K. (2016). Organic farming, soil health, and food quality: considering possible links. *Advances in agronomy*, *137*, 319-367.

13. Reganold, J. P., & Wachter, J. M. (2016). Organic agriculture in the twenty-first century.
14. Nature Plants, 2(2), 15208.

15. Stoate, C., et al. (2001). Ecological impacts of arable intensification in Europe. Journal of Environmental Management, 63(4), 337-365.

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