INTERNATIONAL SEVEN JOURNAL
OF MULTIDISCIPLINARY
ISSN: 2764-9547

SUSTAINABLE PRACTICES IN ORGANIC AGRICULTURE: REDUCING ENVIRONMENTAL IMPACT AND IMPROVING EFFICIENCY

DOI: 10.56238/isevmjv2n3-012
Receiving the originals: 05/05/2023
Acceptance for publication: 05/05/2023

Antonio Mauricio Baldin

ABSTRACT

Organic agriculture provides an ecologically sound alternative to conventional farming by emphasizing biodiversity, soil health, and reduced chemical input. This article explores key sustainable practices that help minimize environmental impact and enhance efficiency in organic systems. Crop rotation improves soil fertility and disrupts pest cycles, particularly through the use of nitrogen-fixing legumes. Composting transforms organic waste into valuable humus, boosting soil structure, water retention, and microbial activity. Biological pest control replaces synthetic pesticides with natural predators, preserving ecosystem balance and protecting pollinators. Additional strategies such as agroforestry, efficient water management, and cover cropping further enhance system resilience, nutrient cycling, and erosion control. Collectively, these practices demonstrate that organic farming can maintain productivity while promoting environmental sustainability. As global demand for sustainable food systems increases, science-based organic methods offer a promising path toward resilient and regenerative agriculture.

Keywords: Organic agriculture. Sustainable farming practices. Crop rotation. Composting. Biological pest control.

INTRODUCTION

Organic agriculture has emerged as a viable alternative to conventional farming, aiming to minimize environmental degradation while ensuring food security and promoting biodiversity. Central to its philosophy are sustainable practices that preserve soil health, reduce chemical dependency, and contribute to long-term ecological balance. Among these, crop rotation, composting, and biological pest control stand out as effective strategies for reducing environmental impact and enhancing efficiency in organic farming systems.

Crop rotation is one of the oldest and most effective sustainable practices in organic agriculture. It involves alternating different crops in a given field across different seasons or years, which helps to break pest and disease cycles, improve soil fertility, and prevent the depletion of specific nutrients. Leguminous crops, such as clover or beans, are frequently included in rotations to fix atmospheric nitrogen into the soil, thereby reducing the need for external fertilizers (Lemaire et al., 2015). This practice not only maintains soil productivity but also enhances resilience against climate variability and extreme weather events (Bàrberi, 2002).

Composting, another foundational technique, involves the aerobic decomposition of organic matter—such as crop residues, animal manure, and food waste—into nutrient-rich humus that can be applied to soils. The use of compost improves soil structure, water retention, and microbial activity, all of which are crucial for sustainable soil management. Furthermore, composting reduces the need for synthetic fertilizers and contributes to carbon sequestration, thereby mitigating greenhouse gas emissions (Bernal et al., 2009). The application of mature compost also suppresses soil-borne pathogens and enhances plant health, making it an integral part of holistic soil fertility management (Larney & Angers, 2012).

Biological pest control is a third pillar of sustainability in organic agriculture. This method employs natural predators, parasitoids, and pathogens to control pest populations, thereby avoiding the use of synthetic pesticides. For instance, lady beetles and lacewings are commonly used to manage aphid populations in vegetable crops. Biological control contributes to the preservation of ecological balance and prevents the development of pesticide-resistant pest species. Moreover, it safeguards pollinators and other beneficial insects, which are essential for maintaining agricultural productivity and biodiversity (van Lenteren, 2012). While implementing biological control requires a deep understanding of ecosystem dynamics, it can be highly cost-effective and environmentally benign over the long term.

In addition to core practices like rotation and composting, the incorporation of agroecological principles further enhances the sustainability of organic systems. Agroforestry, for instance, combines trees with crops and/or livestock on the same land, creating synergies that can improve soil quality, enhance biodiversity, and stabilize microclimates. Research shows that agroforestry systems contribute to increased carbon sequestration and can significantly reduce erosion compared to monocultures (Jose, 2009). Moreover, trees in agroforestry systems can serve as windbreaks, provide shade, and support the habitats of pollinators and pest-controlling species, thus playing a multifaceted role in sustainable land use (Nair, 2011).

Water management is another critical aspect of sustainable organic agriculture. Drip irrigation, rainwater harvesting, and mulching are techniques commonly used to optimize water use efficiency and prevent water waste. These practices are especially vital in regions facing water scarcity due to climate change or overexploitation of water resources. A study by Pereira et al. (2002) highlights that proper irrigation management not only conserves water but also improves crop yield and quality. Organic systems often benefit from improved soil organic matter content due to composting and cover cropping, which enhances the soil's water-holding capacity and reduces runoff (Lotter et al., 2003).

Moreover, the adoption of cover crops plays a crucial role in enhancing soil fertility and controlling weeds without the use of synthetic herbicides. Cover crops such as rye, vetch, and clover provide a living mulch that suppresses weed growth, reduces soil erosion, and adds organic matter to the soil. Their decomposition contributes to nutrient cycling, especially nitrogen, which is vital for subsequent crop growth. Studies have shown that cover cropping can increase yields and reduce the need for external inputs over time (Snapp et al., 2005). This practice aligns with the long-term goals of organic farming by promoting sustainability, reducing reliance on external inputs, and maintaining ecological integrity.

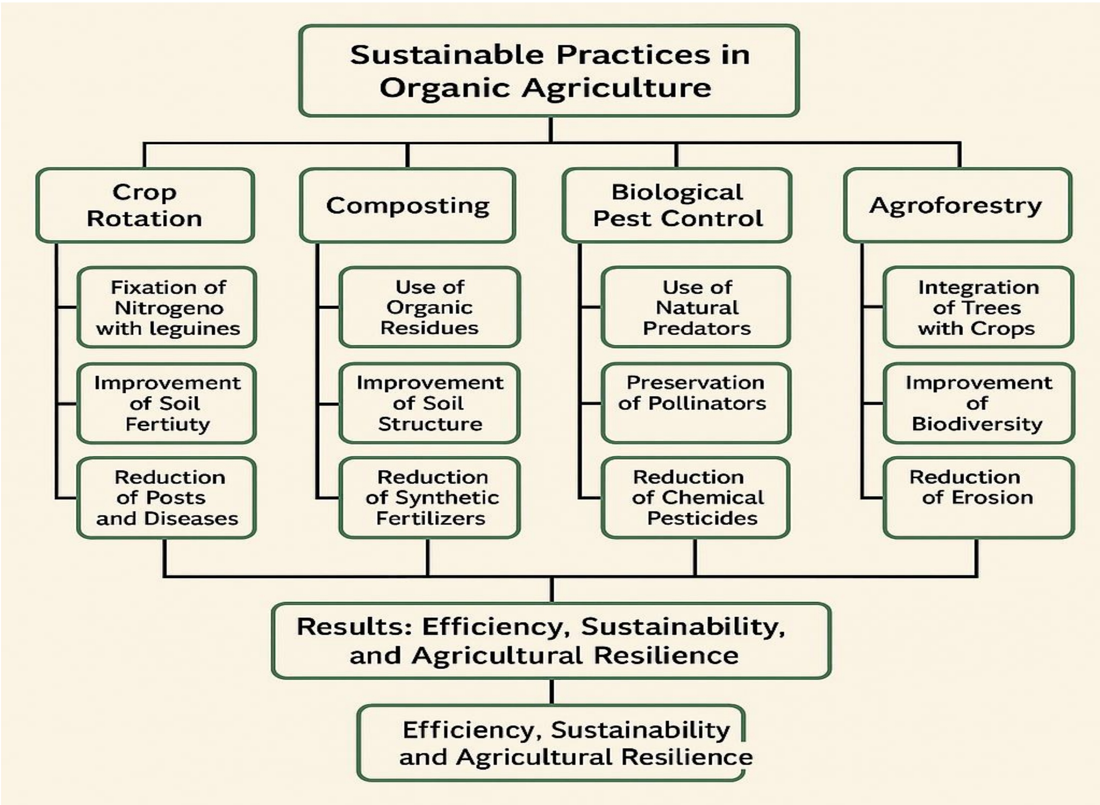
The integration of these practices—crop rotation, composting, biological pest control, agroforestry, efficient water use, and cover cropping—not only reduces the environmental footprint of agricultural activities but also contributes to the economic sustainability of farms. When properly managed, these methods lead to higher yields

INTERNATIONAL SEVEN JOURNAL
OF MULTIDISCIPLINARY
ISSN: 2764-9547

over time, improved crop quality, and reduced input costs. Moreover, they align with consumer preferences for sustainably produced food, potentially offering premium market opportunities for organic producers (Reganold & Wachter, 2016).

The flowchart illustrates the main sustainable practices in organic agriculture and their environmental benefits. It highlights four core strategies: crop rotation, composting, biological pest control, and agroforestry. Crop rotation enhances soil fertility and disrupts pest cycles, especially through the inclusion of nitrogen-fixing legumes. Composting transforms organic waste into nutrient-rich humus, improving soil structure and reducing reliance on synthetic fertilizers. Biological pest control replaces chemical pesticides with natural predators, preserving ecological balance and protecting pollinators. Agroforestry integrates trees with crops to boost biodiversity and reduce erosion. Together, these practices contribute to greater efficiency, sustainability, and resilience in organic farming systems.

Figure 1. Sustainable Practices in Organic Agriculture and Their Environmental Benefits.



Source: Created by author.

In conclusion, sustainable practices in organic agriculture are essential for reducing environmental impact and improving the efficiency and resilience of food production systems. By emphasizing natural cycles and ecological principles, practices such as crop rotation, composting, and biological pest control contribute to healthier soils, reduced pollution, and enhanced biodiversity. As global demand for sustainable food systems continues to grow, organic agriculture—supported by scientifically informed practices—offers a promising path toward a more balanced and enduring agricultural future.

REFERENCES

1. Antonio, S. L. (2025). Technological innovations and geomechanical challenges in Midland Basin drilling. *Brazilian Journal of Development, 11*(3), e78097. https://doi.org/10.34117/bjdv11n3-005

2. Bàrberi, P. (2002). Weed management in organic agriculture: Are we addressing the right issues? *Weed Research, 42*(3), 177–193. https://doi.org/10.1046/j.1365-3180.2002.00277.x

3. Bernal, M. P., Alburquerque, J. A., & Moral, R. (2009). Composting of animal manures and chemical criteria for compost maturity assessment: A review. *Bioresource Technology, 100*(22), 5444–5453. https://doi.org/10.1016/j.biortech.2008.11.027

4. Chazzaoui, T. A. M. (2025). The impact of Brexit on international logistics: Challenges and opportunities for businesses. *Brazilian Journal of Development, 11*(5), e79899. https://doi.org/10.34117/bjdv11n5-066

5. Delci, C. A. M. (2025). The effectiveness of Last Planner System (LPS) in infrastructure project management. *Revista Sistemática, 15*(2), 133–139. https://doi.org/10.56238/rcsv15n2-009

6. Filho, W. L. R. (2025a). The role of AI in enhancing identity and access management systems. *International Seven Journal of Multidisciplinary, 1*(2). https://doi.org/10.56238/isevmjv1n2-011

7. Filho, W. L. R. (2025b). The role of Zero Trust Architecture in modern cybersecurity: Integration with IAM and emerging technologies. *Brazilian Journal of Development, 11*(1), e76836. https://doi.org/10.34117/bjdv11n1-060

8. Freitas, G. B., Rabelo, E. M., & Pessoa, E. G. (2023). Projeto modular com reaproveitamento de container marítimo. *Brazilian Journal of Development, 9*(10), 28303–28339. https://doi.org/10.34117/bjdv9n10-057

9. Garcia, A. G. (2025). The impact of sustainable practices on employee well-being and organizational success. *Brazilian Journal of Development, 11*(3), e78599. https://doi.org/10.34117/bjdv11n3-054

10. Gotardi Pessoa, E. (2022a). Análise de custo de pavimentos permeáveis em bloco de concreto utilizando BIM (Building Information Modeling). *Revistaft, 26*(111), 86. https://doi.org/10.5281/zenodo.10022486

11. Gotardi Pessoa, E. (2022b). Análise comparativa entre resultados teóricos da deflexão de uma laje plana com carga distribuída pelo método de equação diferencial de Lagrange por série de Fourier dupla e modelagem numérica pelo

software SAP2000. *Revistaft, 26*(111), 43. https://doi.org/10.5281/zenodo.10019943

12. Gotardi Pessoa, E., Benittez, G. S. P., Oliveira, N. P., & Leite, V. B. F. (2022). Análise comparativa entre resultados experimentais e teóricos de uma estaca com carga horizontal aplicada no topo. *Revistaft, 27*(119), 67. https://doi.org/10.5281/zenodo.7626667

13. Gotardi Pessoa, E. (2024). Pavimentos permeáveis: Uma solução sustentável. *Revista Sistemática, 14*(3), 594–599. https://doi.org/10.56238/rcsv14n3-012

14. Gotardi Pessoa, E. (2025a). Analysis of the performance of helical piles under various load and geometry conditions. *ITEGAM-JETIA, 11*(53), 135–140. https://doi.org/10.5935/jetia.v11i53.1887

15. Gotardi Pessoa, E. (2025b). Optimizing helical pile foundations: A comprehensive study on displaced soil volume and group behavior. *Brazilian Journal of Development, 11*(4), e79278. https://doi.org/10.34117/bjdv11n4-047

16. Gotardi Pessoa, E. (2025c). Sustainable solutions for urban infrastructure: The environmental and economic benefits of using recycled construction and demolition waste in permeable pavements. *ITEGAM-JETIA, 11*(53), 131–134. https://doi.org/10.5935/jetia.v11i53.1886

17. Gotardi Pessoa, E. (2025d). Utilizing recycled construction and demolition waste in permeable pavements for sustainable urban infrastructure. *Brazilian Journal of Development, 11*(4), e79277. https://doi.org/10.34117/bjdv11n4-046

18. Gotardi Pessoa, E., Feitosa, L. M., Padua, V. P., & Pereira, A. G. (2023a). Estudo dos recalques primários em um aterro executado sobre a argila mole do Sarapuí. *Brazilian Journal of Development, 9*(10), 28352–28375. https://doi.org/10.34117/bjdv9n10-059

19. Gotardi Pessoa, E., Feitosa, L. M., Pereira, A. G., & Padua, V. P. (2023b). Efeitos de espécies de alna eficiência de coagulação, Al residual e propriedade dos flocos no tratamento de águas superficiais. *Brazilian Journal of Health Review, 6*(5), 24814–24826. https://doi.org/10.34119/bjhrv6n5-523

20. Jose, S. (2009). Agroforestry for ecosystem services and environmental benefits: An overview. *Agroforestry Systems, 76*(1), 1–10. https://doi.org/10.1007/s10457-009-9229-7

21. Larney, F. J., & Angers, D. A. (2012). The role of organic amendments in soil reclamation: A review. *Canadian Journal of Soil Science, 92*(1), 19–38. https://doi.org/10.4141/cjss2010-064

22. Lemaire, G., Franzluebbers, A., Carvalho, P. C. F., & Dedieu, B. (2015). Integrated crop–livestock systems: Strategies to achieve synergy between agricultural

production and environmental quality. *Agriculture, Ecosystems & Environment, 190*, 4–8. https://doi.org/10.1016/j.agee.2014.08.009

23. Lotter, D. W., Seidel, R., & Liebhardt, W. (2003). The performance of organic and conventional cropping systems in an extreme climate year. *American Journal of Alternative Agriculture, 18*(3), 146–154. https://doi.org/10.1079/AJAA200345

24. Moreira, C. A. (2025). Digital monitoring of heavy equipment: Advancing cost optimization and operational efficiency. *Brazilian Journal of Development, 11*(2), e77294. https://doi.org/10.34117/bjdv11n2-011

25. Nair, P. K. R. (2011). Agroforestry systems and environmental quality: Introduction. *Journal of Environmental Quality, 40*(3), 784–790. https://doi.org/10.2134/jeq2011.0001

26. Oliveira, C. E. C. de. (2025). Gentrification, urban revitalization, and social equity: Challenges and solutions. *Brazilian Journal of Development, 11*(2), e77293. https://doi.org/10.34117/bjdv11n2-010

27. Pereira, L. S., Oweis, T., & Zairi, A. (2002). Irrigation management under water scarcity. *Agricultural Water Management, 57*(3), 175–206. https://doi.org/10.1016/S0378-3774(02)00075-6

28. Reganold, J. P., & Wachter, J. M. (2016). Organic agriculture in the twenty-first century. *Nature Plants, 2*, Article 15221. https://doi.org/10.1038/nplants.2015.221

29. Rodrigues, I. (2025). Operations management in multicultural environments: Challenges and solutions in transnational mergers and acquisitions. *Brazilian Journal of Development, 11*(5), e80138. https://doi.org/10.34117/bjdv11n5-103

30. Santos, H., & Pessoa, E. G. (2024). Impacts of digitalization on the efficiency and quality of public services: A comprehensive analysis. *Lumen et Virtus, 15*(40), 4409–4414. https://doi.org/10.56238/levv15n40-024

31. Silva, J. F. (2024a). Enhancing cybersecurity: A comprehensive approach to addressing the growing threat of cybercrime. *Revista Sistemática, 14*(5), 1199–1203. https://doi.org/10.56238/rcsv14n5-009

32. Silva, J. F. (2024b). Sensory-focused footwear design: Merging art and well-being for individuals with autism. *International Seven Journal of Multidisciplinary, 1*(1). https://doi.org/10.56238/isevmjv1n1-016

33. Silva, J. F. (2025). Desafios e barreiras jurídicas para o acesso à inclusão de crianças autistas em ambientes educacionais e comerciais. *Brazilian Journal of Development, 11*(5), e79489. https://doi.org/10.34117/bjdv11n5-011

34. Snapp, S. S., Swinton, S. M., Labarta, R., Mutch, D., Black, J. R., Leep, R.,

Nyiraneza, J., & O'Neil, K. (2005). Evaluating cover crops for benefits, costs and performance within cropping system niches. *Agronomy Journal, 97*(1), 322–332. https://doi.org/10.2134/agronj2005.0322

35. Testoni, F. O. (2025). Niche accounting firms and the Brazilian immigrant community in the U.S.: A study of cultural specialization and inclusive growth. *Brazilian Journal of Development, 11*(5), e79627. https://doi.org/10.34117/bjdv11n5-034

36. Turatti, R. C. (2025). Application of artificial intelligence in forecasting consumer behavior and trends in e-commerce. *Brazilian Journal of Development, 11*(3), e78442. https://doi.org/10.34117/bjdv11n3-039

37. van Lenteren, J. C. (2012). The state of commercial augmentative biological control: Plenty of natural enemies, but a frustrating lack of uptake. *BioControl, 57*(1), 1–20. https://doi.org/10.1007/s10526-011-9395-1