International Journal of Advance and Applied Research (IJAAR)
Peer Reviewed Bi-Monthly

ISSN – 2347-7075
Impact Factor – 7.328
Vol.8 No.6 July – Aug 2021

ORGANIC FARMING: CONCEPT, PRINCIPALS AND FUTURE PROSPECTS

Dara Suneeta

Assistant Professor, Department of Botany,
Government Degree College, Thorrur,
Mahabubabad (District) Telangana, India

ABSTRACT:

Maintaining soil health, biodiversity, ecological balance, and long-term farm productivity while reducing reliance on artificial fertilizers, pesticides, and other external chemical inputs is the goal of organic farming, an ecological approach to agricultural production. Organic farming, in contrast to conventional agriculture, places a strong emphasis on biological processes, crop rotation, diversification, recycling of organic resources, integrated nutrient management, and ecological pest control. From a production system that was primarily concerned with avoiding synthetic inputs, the idea has developed into a more comprehensive sustainability-oriented strategy that connects soil, plants, animals, people, and environmental resources. More biodiversity, enhanced soil biological activity, higher soil organic carbon, and a decreased reliance on artificial pesticides and mineral fertilizers are just a few of the significant environmental advantages that scientific research suggests organic farming can offer.

Keywords: Organic Farming, Soil, Chemical, Production, Agriculture.

INTRODUCTION:

Organic farming represents a holistic approach to agriculture that prioritizes environmental health, biodiversity, and the well-being of farming communities. This method eschews synthetic pesticides and fertilizers in favor of natural processes and inputs, promoting ecological balance and soil fertility. As concerns about the sustainability of conventional farming intensify, organic farming has emerged as a viable alternative, drawing interest from policymakers, researchers, and consumers (Badgley *et al*., 2007). Although the idea of organic farming is not new, its importance has increased in light of contemporary agricultural issues such soil degradation, water scarcity, biodiversity loss, and climate change. Organic farming provides a route to sustainable agriculture that can satisfy the demands of current and future generations by utilizing both traditional knowledge and cutting-edge scientific discoveries. Organic farming is characterized by its commitment to natural cycles and processes. These include soil health, animal welfare, biodiversity, sustainability, and the use of natural inputs. A key component of organic farming is promoting a range of species to improve ecosystem stability, such as crop diversification and preserving habitats for beneficial organisms. Natural inputs, such as organic fertilizers, compost, and biological pest control, are utilized while prohibiting synthetic chemicals and genetically modified organisms (GMOs). Humane conditions, organic feed, and avoiding growth hormones and antibiotics are all important aspects of animal welfare in organic farming. The key to preserving soil health is improving soil fertility and structure through techniques including crop rotation, no-till farming, green manures, and composting. Organic farming has grown significantly in the last few years. Globally, organic agriculture land and market share have been rising, according to the Food and Agriculture Organization (FAO). Growing consumer demand for organic goods, heightened knowledge of environmental issues, and supportive government legislation in numerous nations are the main drivers of this expansion. Additionally, organic farming is essential for rural development and food security. Organic agriculture can enhance the livelihoods of small-scale farmers and support resilient food systems by encouraging sustainable farming methods. Furthermore, organic farming is frequently connected to regional and local food systems, promoting community growth and lowering reliance on international supply chains. By examining its tenets, methods, and results, this article seeks to offer a thorough analysis of organic farming (Bourn and Prescott, 2002). From an agricultural perspective point of view, we need to produce more food in the proper locations at affordable prices, ensuring livelihoods to farmers. The more considerable challenge ahead of us is that to assess the potential contribution of different types of farming systems to sustainable food security. Organic farming as alternative farming systems try to mimic ecological processes while minimizing external inputs are often suggested as more sustainable forms of food production.

CONCEPT OF ORGANIC FARMING:

Organic farming can be understood as a production system that manages agricultural ecosystems through biological and ecological processes. Instead of treating soil primarily as a physical medium for plant growth, organic farming considers soil as a living system containing microorganisms, organic matter, plant roots and numerous biological interactions. The central objective is to maintain a productive relationship among soil, plants, animals and the surrounding environment. Organic farming generally avoids or restricts synthetic fertilizers, synthetic pesticides, genetically modified organisms and other prohibited inputs according to applicable organic standards. However, the precise definition and permitted practices differ among national certification systems. Seufert *et al.* (2017) demonstrated that organic regulations in different countries have substantial similarities but also differences in how organic production is defined and controlled. Their analysis of eight organic regulations showed that many regulations emphasize the distinction between permitted natural and prohibited synthetic inputs, whereas broader ecological objectives are not always equally represented. Consequently, organic farming should be distinguished from simply "chemical-free farming." A scientifically meaningful organic system involves ecological planning, nutrient recycling, crop diversification, biological pest management and conservation of natural resources. Organic production therefore represents a system-based approach rather than merely an input-substitution strategy.

PRINCIPLES OF ORGANIC FARMING:

The principles of organic agriculture provide a framework for designing and managing sustainable farming systems. Migliorini *et al.* (2017) compared organic agriculture regulations and agro-ecological principles and emphasized four broad IFOAM principles: health, ecology, fairness and care. Organic farming therefore involves more than restricting external inputs; it aims to maintain ecological processes and promote sustainable relationships among people, animals and natural resources.

Principle of Health: The interdependence of soil, plants, animals, people, and the environment is acknowledged by the health principle. Resilient agricultural ecosystems and robust crops are built on healthy soil. Therefore, improving soil organic matter, microbial activity, nutrient cycling, and biological diversity are the goals of organic farming. The idea covers human health, food quality, and animal welfare in addition to crop yield. Important elements of this philosophy include avoiding or minimizing exposure to needless synthetic pesticides and managing agricultural inputs responsibly.

Principle of Ecology: Organic agriculture is strongly based on ecological processes. Nutrient cycling, biological nitrogen fixation, decomposition, natural pest regulation, pollination and soil biological activity are encouraged rather than replaced by external chemical inputs. Crop rotation, mixed cropping, cover crops, agroforestry, biological control and organic amendments are examples of practices that strengthen ecological interactions. Migliorini *et al.* (2017) noted that organic agriculture and agroecology share important principles involving biodiversity, soil management, nutrient recycling and biological interactions.

Principle of Fairness: Relationships between farmers, laborers, consumers, animals, and natural resources are all related to fairness. In an ideal world, organic farming would promote equitable economic relations, prudent resource management, and suitable animal care. This idea also acknowledges the significance of preserving agricultural systems that offer farmers sustainable livelihoods and respectable working conditions for farm laborers.

Principle of Care: The principle of care emphasizes precaution and responsibility toward present and future generations. Agricultural decisions should consider long-term ecological consequences rather than focusing exclusively on immediate production. This principle is particularly relevant under climate change because farming systems must be resilient to uncertain weather patterns, water shortages, extreme temperatures and emerging pest and disease pressures.

MAJOR PRACTICES OF ORGANIC FARMING:

Crop Rotation: Crop rotation is one of the most important practices in organic farming. Growing different crops sequentially can break pest and disease cycles, improve nutrient use and diversify soil biological communities. Leguminous crops can contribute nitrogen through biological fixation, while deep-rooted crops can improve nutrient recycling. Ponisio *et al.* (2015), based on a meta-analysis of 115 studies containing more than 1,000 observations, found that organic yields were on average about 19.2% lower than conventional yields. Importantly, diversification practices reduced the yield gap substantially: multi-cropping reduced the gap to approximately 9%, while crop rotations reduced it to approximately 8%. This finding demonstrates that organic farming performance is strongly influenced by management quality rather than by the organic production label alone.

Organic Manures and Compost: Farmyard manure, compost, vermicompost, crop residues and other organic materials are important sources of nutrients in organic agriculture. These materials supply nutrients gradually and contribute organic carbon to soil. Proper composting can also reduce the risk of pathogens and weed seeds while producing a relatively stable organic amendment. Integration of crop and livestock enterprises can further improve nutrient recycling by returning animal manure to cropland.

Green Manuring and Cover Crops: Green manuring involves growing plants primarily for incorporation into soil. Leguminous green manures can increase nitrogen availability, while cover crops protect soil from erosion, suppress weeds and provide habitat for beneficial organisms. Cover crops can also improve soil structure and contribute organic residues. Their effectiveness depends on appropriate species selection, biomass production, timing of incorporation and local climatic conditions.

Biological Pest Management: Organic farming places considerable emphasis on biological and ecological approaches to pest management. Beneficial insects, parasitoids, predators, microbial biopesticides, botanical pesticides, trap crops and habitat management can reduce pest populations. Organic farming can support biodiversity and natural pest regulation because reduced use of broad-spectrum pesticides allows greater survival of beneficial organisms. Tuck et al. (2014) analysed 184 observations from 94 studies and found that organic farming increased species richness by approximately 30% on average compared with conventional farming. The effect varied among taxonomic groups, crops and landscape conditions.

Soil Conservation: Reduced soil disturbance, residue retention, crop diversification and organic amendments are important for maintaining soil structure. Soil conservation is particularly important in regions affected by erosion, declining soil organic matter and declining water-holding capacity.

Gattinger *et al.* (2012) analysed data from 74 studies comparing organic and non-organic farming systems. Their meta-analysis found higher soil organic carbon concentrations and stocks under organic management, although the magnitude of the benefit depended on external carbon inputs and crop rotations.

Integrated Livestock Management: Livestock can be integrated into organic systems to improve nutrient cycling. Crop residues can provide feed, while manure can return nutrients to cropland. Grazing can also contribute to vegetation management when properly controlled. However, livestock integration must be carefully managed because excessive stocking rates can cause nutrient accumulation, soil compaction and environmental pollution.

ORGANIC FARMING AND SOIL HEALTH:

Soil health is one of the strongest arguments supporting organic farming. Organic management generally emphasizes organic matter inputs, reduced dependence on synthetic fertilizers and diversified crop rotations. Lori *et al.* (2017) conducted a meta-analysis involving 56 studies and 149 pairwise comparisons. They reported that organic systems generally had greater microbial biomass and microbial activity than conventional systems, with several indicators showing increases ranging from approximately 32% to 84%. Soil microorganisms play essential roles in decomposition, nutrient mineralization, nitrogen cycling and disease suppression. Consequently, increased microbial activity may contribute to the long-term functioning of agricultural soils. Krauss *et al.* (2020) further demonstrated that long-term organic management involving reduced tillage and solid manures can improve soil quality. Their 15-year synthesis emphasized the importance of combining organic management practices rather than relying on a single intervention. However, organic amendments must be applied according to nutrient requirements. Excessive manure application can result in nutrient losses and environmental pollution. Thus, organic farming requires scientific nutrient budgeting rather than unrestricted application of organic inputs. When comparing organic farming to conventional systems, Tuck *et al.* (2014) discovered an average increase in species richness of almost 30%. The beneficial impact was especially significant in areas that were heavily farmed. However, land-use requirements must be taken into account in addition to the benefits of biodiversity. Some environmental gains may be countered by increased land conversion if lower yields necessitate much more acreage to produce the same amount of food. Therefore, rather of concentrating only on individual farms, landscape-level planning is necessary for biodiversity protection.

ORGANIC FARMING AND CROP PRODUCTIVITY:

Crop productivity remains one of the most debated aspects of organic agriculture. Seufert et al. (2012) conducted a global meta-analysis and reported that organic yields were generally lower than conventional yields, but the difference depended strongly on crop type and management conditions. Yield reductions ranged from approximately 5% under favourable conditions to approximately 34% under some conventional organic comparisons. Reganold *et al.* (2016) similarly concluded that organic farming often produces lower yields but can perform favourably in environmental impact, profitability and other sustainability indicators. The yield gap is therefore not a fixed characteristic of organic agriculture. Improved crop varieties, better nutrient management, irrigation, biological pest management, improved weed control and diversified rotations can reduce yield limitations. Particularly compelling evidence that diversification can close the organic yield gap comes from Ponisio *et al.* (2015). According to their findings, management innovation is a key strategy for raising organic output.

ENVIRONMENTAL BENEFITS AND CLIMATE CHANGE:

There are various ways that organic farming might help mitigate climate change. The energy needed for fertilizer production can be decreased by using less synthetic nitrogen fertilizers. When organic matter inputs and proper rotations are maintained, organic systems can also raise soil carbon reserves. Nutrient management, soil carbon sequestration, farm diversity, and enhanced soil fertility were noted by Scialabba *et al.* (2010) as key ways that organic farming could help mitigate and adapt to climate change. Skinner *et al.* (2014) conducted a global meta-analysis of greenhouse-gas fluxes from agricultural soils. Based on 12 studies with annual measurements, area-scaled nitrous oxide emissions were approximately 492 ± 160 kg CO_2 equivalent ha^{-1} $year^{-1}$ lower in organic systems. However, yield-scaled emissions were higher under organic management by approximately 41 ± 34 kg CO_2 equivalent per tonne of dry matter.

FUTURE PROSPECTS OF ORGANIC FARMING:

Precision Organic Farming: Precision agriculture technologies such as GPS, remote sensing, drones, soil sensors and geographic information systems can be integrated into organic farming. These tools can help identify nutrient deficiencies, monitor crop stress and improve irrigation efficiency.

Improved Biological Inputs: Future research will likely expand the development of microbial biofertilizers, biopesticides, plant-growth-promoting microorganisms and biological disease-control agents. Improved formulation and shelf life will increase their practical usefulness.

Advanced Breeding: Breeding programs can develop crop varieties specifically suited to organic production. Such varieties should possess strong competitive ability against weeds, efficient nutrient uptake, disease resistance and tolerance to environmental stress.

Circular Nutrient Management: Recycling crop residues, livestock manure, food-processing by-products and other organic resources can reduce dependence on external fertilizers. However, nutrient recycling must be supported by appropriate testing and nutrient budgeting.

Climate-Resilient Organic Agriculture: Climate fluctuation must be taken into consideration while designing future biological systems. Resilience can be increased by agroforestry, diverse rotations, soil organic matter management, drought-tolerant cultivars, and water harvesting. According to Muller *et al.* (2017), rather than depending on a single farming approach, sustainable food systems will need a combination of production modifications, less food waste, better livestock-feed management, and more effective use of natural resources.

CONCLUSION:

Organic farming is an ecological production system based on soil health, biodiversity, nutrient recycling, biological processes and responsible resource management. Its principles of health, ecology, fairness and care provide a broad framework for developing agricultural systems that consider environmental and social objectives alongside food production. Scientific evidence indicates that organic farming can enhance soil biological activity, soil carbon, biodiversity and several ecosystem services. At the same time, organic agriculture faces important challenges, particularly lower average yields, nutrient-management limitations, weed and pest pressure, labour requirements, certification costs and market constraints. The future of organic farming will depend on improving productivity while preserving its ecological foundation. Crop diversification, improved varieties, biological inputs, precision agriculture, digital technologies, integrated crop–livestock systems, improved nutrient recycling and climate-resilient practices can substantially strengthen organic production.

REFERENCES:

1. Badgley, C., Moghtader, J., Quintero, E., Zakem, E., Chappell, M. J., Aviles-Vazquez, K., ... & Perfecto, I. (2007). Organic agriculture and the global food supply. *Renewable agriculture and food systems*, *22*(2), 86-108.
2. Bourn, D., & Prescott, J. (2002). A comparison of the nutritional value, sensory qualities, and food safety of organically and conventionally produced foods. *Critical reviews in food science and nutrition*, *42*(1), 1-34.
3. Gattinger, A., Muller, A., Haeni, M., Skinner, C., Fliessbach, A., Buchmann, N., ... & Niggli, U. (2012). Enhanced top soil carbon stocks under organic farming. *Proceedings of the National Academy of Sciences*, *109*(44), 18226-18231.

4. Migliorini, P., & Wezel, A. (2017). Converging and diverging principles and practices of organic agriculture regulations and agroecology. A review. *Agronomy for sustainable development*, *37*(6), 63.
5. Muller, A., Schader, C., El-Hage Scialabba, N., Brüggemann, J., Isensee, A., Erb, K. H., ... & Niggli, U. (2017). Strategies for feeding the world more sustainably with organic agriculture. *Nature communications*, *8*(1), 1290.
6. Ponisio, L. C., M'gonigle, L. K., Mace, K. C., Palomino, J., De Valpine, P., & Kremen, C. (2015). Diversification practices reduce organic to conventional yield gap. *Proceedings of the Royal Society B: Biological Sciences*, *282*(1799), 20141396.
7. Reganold, J. P., & Wachter, J. M. (2016). Organic agriculture in the twenty-first century. *Nature plants*, *2*(2), 15221.
8. Rigby, D., & Cáceres, D. (2001). Organic farming and the sustainability of agricultural systems. *Agricultural systems*, *68*(1), 21-40.
9. Scialabba, N. E. H., & Müller-Lindenlauf, M. (2010). Organic agriculture and climate change. *Renewable agriculture and food systems*, *25*(2), 158-169.
10. Seufert, V., Ramankutty, N., & Foley, J. A. (2012). Comparing the yields of organic and conventional agriculture. *Nature*, *485*(7397), 229-232.
11. Skinner, C., Gattinger, A., Muller, A., Mäder, P., Fliebach, A., Stolze, M., ... & Niggli, U. (2014). Greenhouse gas fluxes from agricultural soils under organic and non-organic management-A global meta-analysis. *Science of the total environment*, *468*, 553-563.
12. Tuck, S. L., Winqvist, C., Mota, F., Ahnström, J., Turnbull, L. A., & Bengtsson, J. (2014). Land-use intensity and the effects of organic farming on biodiversity: a hierarchical meta-analysis. *Journal of applied ecology*, *51*(3), 746-755.