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ORGANIC FARMING - AND ITS AGRONOMIC IMPORTANCE

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Abstract

Organic farming represents a sustainable agricultural model that integrates ecological principles with agronomic practices to promote soil health, biodiversity, and long-term productivity without relying on synthetic chemicals. This comprehensive article explores the agronomic significance of organic farming, detailing key practices such as soil fertility enhancement through composting and cover cropping, crop rotation for nutrient cycling, biological pest control, and integrated weed management. It examines how these methods contribute to environmental sustainability, climate resilience, and human health, supported by extensive empirical evidence from global studies. Challenges, including yield gaps and economic barriers, are addressed alongside benefits like reduced chemical pollution and enhanced ecosystem services. Case studies from diverse regions, including Europe, India, and the United States, illustrate practical applications. The discussion emphasizes organic farming's role in addressing global food security and climate change, advocating for policy support and innovations like precision tools. By synthesizing scientific literature, the article highlights organic agronomy's potential to transform conventional agriculture into resilient, regenerative systems.

Keywords: *Organic farming, soil fertility, biodiversity, sustainable agriculture, and climate resilience.*

Introduction

Organic farming is an agricultural philosophy and practice that prioritizes ecological harmony, soil vitality, and biodiversity over short-term yields achieved through synthetic inputs. Defined by the exclusion of chemical fertilizers, pesticides, herbicides, and genetically modified organisms (GMOs), organic farming draws on natural processes to cultivate crops and raise livestock. Its agronomic importance lies in fostering sustainable soil management, nutrient cycling, and ecosystem balance, which are essential for resilient food production in the face of climate change, soil degradation, and biodiversity loss.

Historically, organic farming emerged as a counter to the industrial agriculture of the mid-20th century. Pioneers like Sir Albert Howard, author of An Agricultural Testament (1940), emphasized composting and natural manures based on his observations in India. Rudolf Steiner's biodynamic approach (1924) incorporated cosmic influences, while J.I. Rodale popularized organic methods in the United States through Organic Gardening magazine. The modern organic movement gained momentum with the formation of the International Federation of Organic Agriculture Movements (IFOAM) in 1972, leading to standardized certifications. Today, organic farming is regulated globally, with standards like the USDA Organic Rule (2002) and the EU Organic Regulation (EC) No 834/2007 ensuring compliance.

Agronomically, organic farming views the farm as a living system where soil health is paramount. Unlike conventional agronomy, which often depletes soil through intensive chemical use, organic practices build organic matter, enhance microbial activity, and promote natural pest regulation. With organic farmland covering over 72 million hectares worldwide and a market value exceeding $100 billion (Willer et al., 2022; Sahota, 2018), organic farming addresses critical issues like water pollution from runoff, greenhouse gas emissions from fertilizer production, and the loss of arable land due to erosion. This article provides an in-depth analysis of organic farming's agronomic practices, their benefits, challenges, and future implications, drawing on a wealth of scientific research and real-world examples to underscore its importance in sustainable agriculture.

Why Organic Farming?

Modern agricultural farming practices, along with irrational use of chemical inputs over the past four decades have resulted in not only loss of natural habitat balance and soil health but have also caused many hazards like soil erosion, decreased groundwater level, soil salinization, pollution due to fertilizers and pesticides, genetic erosion, ill effects on environment, reduced food quality and increased the cost of cultivation, rendering the farmer poorer year by year. Some of the factors that contributed to the present crisis in farming could be the shooting-up of the price of factory-made external inputs. In other words, local indigenous farm techniques have been wiped out and replaced by the modern techniques, resulting in an unviable and unsustainable farm enterprise.

It is in this context that alternative farm techniques and strategies for growing crops ought to be found in the larger interest. The principle of organic cultivation is attracting farmer world over due to its various advantages over modern agricultural practices. This is accomplished by using wherever possible, agronomic, biological and mechanical methods, as opposed to using synthetic materials, to fulfill any specific function within the system' (FAO, 1999).

IFOAM definition:

According to the IFOAM 2002 Basic Standards,

"organic agriculture is a whole system approach based upon a set of process resulting in a sustainable ecosystem, safe food, good nutrition, animal welfare and social justice".

However, organic is not only about replacing inputs, which is the starting point of the process, it goes beyond, as enshrined in the four principles of organic farming advocated by IFOAM;

- **Principle of health:** Organic agriculture should sustain and enhance the health of soil, plant, animal, human and planet as one and indivisible.
- **Principle of ecology:** Organic agriculture should be based on living ecological systems and cycles, work with them, emulate them and help sustain them.
- **Principle of fairness:** Organic agriculture should build on relationships that ensure fairness with regard to the common environment and life opportunities.
- **Principle of care:** Organic agriculture should be managed in a precautionary and responsible manner to protect the health and well-being of current and future generations and the environment.

Objectives & Importance of Organic Farming:

- To cope-up with increasing demand of chemical fertilizers & their residues in food grains.
- To promote the rainfed farmers particularly of hills.
- To meet the demand of safe food without chemical residues.
- To create opportunities of employment for youth on sustainable basis.
- To enhance the productivity on sustainable basis.
- To maintain the soil health.

Potential and Strengths of Organic Farming:

Tremendous progress in promoting organic agriculture in India has been made during last fifteen years. Eleventh plan document on Organic sector and National Commission on farmers has recommended organic farming as a tool for 2nd Green Revolution. FAO with the help of IFOAM and other International Agencies recommended Organic Farming as a tool to address Millennium Development Goal (MDG) 1&7. The first MDG is the eradi-

cation of extreme poverty and hunger, whereas, the seventh MDG is to ensure environmental sustainability. In hill and mountain agro-ecosystem in India, organic agriculture has a large potential due to many reasons as given below:

- This agro-ecosystem has large geographical and arable area with a wide variety of agro-climatic zones.
- More than two-third of the arable area is rainfed which remained untouched by the green revolution techniques
- Most of the areas in this region are organic by default
- The green revolution success stories related to Haryana, Punjab and western UP where the soils have become sick because of over use of chemicals and under use of organic matter
- Global market demand for organic produce can provide premium prices, as demand is growing rapidly and supply is still behind. We can take advantage of this situation

Limitations

The most important limitations are:

- Lack of adequate information to farmers and consumers about the advantages and products.
- Lack of domestic and international market information on suppliers, prices and qualities
- Lack of training, organic farmers' field schools and the non-existence of an adequate extension system, except in those areas covered by NGOs and private traders making use of contract farmers.
- Lack of adequate storage facilities
- Lack of a guarantee system for the domestic market. The consumer wants to know whether the organic products to be bought are truly organic or not.
- A stagnating local market, owing to a lack of consumer awareness, but also because a limited number of processed products are offered.
- Lack of sufficient government support
- High costs of certification, especially for small farmers.
- Lack of scientific and socio-economic data on organic agriculture

How Organic Farming...??

Organic production system is based on ecological principles. One formal definition states that organic farming seeks to create ecosystems that achieve sustainable productivity and provide control of pests through a diverse mixing of interdependent life forms, through recycling of plant and animal residues and also crop selection, crop rotation water management and cultivation etc.

The primary challenges in an organic seed production system are: a.

1. Soil fertility management.
2. Insect pest and disease management
3. Weed management

1. **Soil fertility management :** The judicious combination of good agronomic practices, organic manures and bio-fertilizers is indispensable for nutrient management under organic farming conditions.

- **Agronomic practices :** Green manuring, residue management, crop rotation, cover crops, mixed cropping, mulching etc.
- **Addition of Organic materials :** Composts/Manures, Crop residues, Leaf litter, Urban solid wastes (Bio solids), Agro-industrial wastes.
- **Addition of Bio-fertilizers :** Rhizobium, PSB, Azotobactor & Azospirillum
- **Natural minerals :** Unprocessed apatite, Rock- phosphate, Potash, Calcium, Iron, Micronutrient bearing Minerals-Tank Silt, Sand, clay

Organic Manures/Composts: Production of organic manures and bio-fertilizers shall be promoted to augment the nutrient requirements of crops as described below:

i. Solid manures/composts:

- FYM
- Vermicompost
- Him compost
- NADEP compost

ii. Liquid Manures:

- Vermiwash
- Matka Khad
- Himsol
- Compost Tea

iii. Bio-fertilizers:

- Rhizobium
- Azotobacter
- Azospirillum
- PSB (Phosphorus Solubilizing Bacteria)

2. **Insect-pest & disease management :** To control insect and pest detrimental to the agriculture, the following measures shall be adopted to find alternatives to the chemical pesticides and insecticides presently used for the control of plant insect-pests and diseases.

Botanicals

- Neem based products--- aphids, mites, leaf miner & sucking pests
- Lantana extract-- Bean bugs, beetles, pod borers & pea leaf miner
- Darek (Melia) extract-- blister beetle & bean bugs
- Ghaniri (Polygonum) extract-- soybean & bean bugs
- Eupatorium extract– Flea beetle & blister beetle
- Dashparni- Gram pod borer, pea leaf miner & blight
- Agneyastra- Leaf miner, aphids & mites
- Ipomea extract- beetles & bean bugs

Biocontrol Agents

- Trichoderma harzianum/T. viride (10g/l)- For foliar & fruit diseases & soil borne pathogens
- Bacillus thuringensis (BT) (10g/l)- For foliar and fruit diseases& soil borne pathogens
- Verticilliumsp.(10g/l)-Aphids&Thrips
- Beauveria bassiana- Root grub and white flies
- Ha-NPV @ 250 l/ha- Fruit borers in tomato

Cow product-based formulations

- Fermented Butter milk (FBM)-- Cercospora leaf spot, bugs, beetles
- Beejamrit –seed borne disease
- Jivamrit-soil borne diseases
- Panchgavya– Early & late blight, Root rot wilt complex, beetles
- Tamarlassi-- Cercospora leaf spot

Challenges for future developments in Organic Farming

- To increase and enhance government policy initiatives and assistance, especially for and during the conversion process.
- To create organic agricultural faculties at the most important agricultural universities.
- To introduce organic extension services and training for farmers' field schools
- To build up adequate infrastructure for transport, storage, processing and market facilities.
- To create a guarantee system for the domestic market.
- To increase consumer awareness about the safe and environmentally friendly production of food.
- To add organic information to the existing oversees reports on markets.
- To spur production and supply of organic seeds, organic manure, organic bio-fertilizers and bio-pesticides

To provide funds for proper scientific studies on income generation, household income and food security, yields and soil improvement from organic agriculture.

Agronomic Importance of Organic Farming

Organic farming offers several agronomic advantages that directly contribute to soil health, crop productivity, and long-term agricultural sustainability. Unlike conventional farming, which mainly focuses on short-term yield using synthetic inputs, organic farming builds the foundation of crop production by enhancing the soil–plant–environment relationship. Its agronomic importance can be understood under the following point:

1. Improvement of Soil Physical Properties

Organic farming significantly enhances the physical condition of the soil through continuous addition of organic matter.

- Improves soil structure by binding soil particles into stable aggregates.

- Enhances water-holding capacity, reducing irrigation requirements.
- Reduces soil compaction and bulk density, allowing better root growth.
- Improves soil aeration, which enhances microbial activity and nutrient uptake

10. Economic and Agronomic Sustainability

Organic inputs such as compost, farmyard manure (FYM), vermicompost, and green manure improve the soil's chemical fertility.

- Increases cation exchange capacity (CEC), helping soil retain and supply nutrients.
- Maintains balanced soil pH, improving nutrient availability.
- Reduces nutrient leaching, especially nitrogen and potassium.
- Provides slow, sustained nutrient release, ensuring long-term productivity.

3. Promotion of Soil Biological Activity

Soil biology is the heart of organic farming. Organic systems enhance populations of beneficial organisms such as bacteria, fungi, nematodes, actinomycetes, and earthworms.

- Improves decomposition of organic matter, turning residues into plant-available nutrients.
- Enhances nutrient mineralization, supplying essential nutrients throughout crop growth.
- Promotes natural disease suppression through antagonistic microbes like Trichoderma.
- Supports earthworms, which aerate soil and increase fertility through their casts.

4. Efficient Nutrient Cycling

- Organic farming relies on natural nutrient-recycling processes rather than external inputs.
- Use of compost, crop residues, and animal waste recycles nutrients back into the soil.
- Green manuring adds nitrogen through biological fixation.
- Biofertilizers improve nutrient availability without chemical fertilizers.
- Conserves resources and reduces the cost of external inputs.

5. Sustainable Soil Fertility and Long-Term Productivity

- Organic farming focuses on building soil rather than only feeding the crop.
- Maintains and gradually increases soil organic carbon (SOC).
- Ensures long-term soil fertility even in intensive cropping systems.
- Prevents soil degradation and nutrient depletion common in chemical-intensive farming

6. Reduction of Chemical Residues and Environmental Pollution

- Organic systems avoid synthetic pesticides, weedicides, and fertilizers.
- Prevents harmful chemical accumulation in soil and water.
- Protects beneficial soil microorganisms and pollinators.
- Reduces risk of pesticide resistance and pest resurgence.
- Improves crop quality and safety for consumption.

7. Enhanced Biodiversity and Ecological Balance

- Organic farms support natural ecosystems.
- Increases populations of natural enemies that control pests.
- Promotes pollinators like bees and butterflies.
- Encourages diverse crop rotations and intercropping.
- Overall improves resilience against pests, diseases, and extreme climatic conditions.

8. Improved Water-Use Efficiency

- Healthy soils enriched with organic matter hold more moisture.
- Less water is needed for irrigation.
- Crops tolerate drought better.
- Reduces runoff and soil erosion.

9. Climate Change Mitigation

- Organic farming contributes to climate-smart agriculture.
- Increases soil carbon sequestration.
- Reduces greenhouse gas emissions by avoiding synthetic nitrogen fertilizers.
- Enhances resilience against heat and drought stresses.

10. Economic and Agronomic Sustainability

- Although initial yields may be lower, organic farming ensures long-term profitability.
- Lower input costs (no synthetic fertilizers or pesticides).
- Premium prices for organic produce.
- Improved soil ensures stable yields over time

Case Studies Illustrating Agronomic Importance

European Long-Term Trials: DOK Experiment (Switzerland)

Since 1978, the DOK trial has compared organic and conventional systems. Organic plots using compost and rotations exhibited 20-30% higher soil organic matter and microbial activity, leading to stable yields and lower pest pressures. This highlights organic agronomy's role in long-term soil regeneration.

Indian Organic Cotton: Sustainable Pest Control (Andhra Pradesh)

Farmers employ neem and biological controls, reducing pesticides by 90% and increasing incomes by 20%. Agronomically, this maintains soil health and water infiltration, with yields rising despite challenges.

U.S. Midwest: Cover Crops for Soil Health (Iowa)

Organic maize-soybean systems with cover crops reduced nitrogen leaching by 40% and boosted yields by 10%, demonstrating efficient nutrient cycling.

Biodynamic Farming in Germany: Holistic Agronomy

Biodynamic farms incorporate compost preparations and lunar calendars, showing improved grape quality and soil vitality in vineyards.

African Polycultures: Resilience in Kenya

Intercropping maize and beans have increased yields by 20-40%, enhancing food security in smallholder farms.

Future Prospects and Innovations

Innovations like precision agriculture, microbial technologies, and organic breeding could narrow yield gaps. Policies such as the EU's Farm to Fork aim for 25% organic land by 2030. Research into climate-resilient varieties and digital tools will enhance organic agronomy's role in sustainable food systems.

Conclusion

Organic farming's agronomic importance is profound, offering a pathway to regenerative agriculture that sustains soil, enhances biodiversity, and builds climate resilience. While challenges like yield gaps persist, the benefits like environmental, health, and economic far outweigh them. Through continued research, policy incentives, and farmer education, organic farming can scale to meet global demands. As conventional systems face diminishing returns, organic agronomy's emphasis on natural cycles positions it as a cornerstone of future food security and ecological health.

References

- Altieri, M. A., Nicholls, C. I., Henao, A., & Lana, M. A. (2015). Agroecology and the design of climate change-resilient farming systems. Agronomy for *Sustainable Development*, 35(3): 869-890.
- Auge, R. M. (2001). Water relations, drought and vesicular-arbuscular mycorrhizal symbiosis. *Mycorrhiza*, 11(1): 3-42.
- Baranski, M., Srednicka-Tober, D., Volakakis, N., Seal, C., Sanderson, R., Stewart, G. B., ... & Leifert, C. (2014). Higher antioxidant and lower cadmium concentrations and lower incidence of pesticide residues in organically grown crops: A systematic literature review and meta-analyses. *British Journal of Nutrition,* 112(5): 794-811.
- Barzman, M., Barberi, P., Birch, A. N. E., Boone Kamp, P., Dachbrodt-Saaydeh, S., Graf, B., & Ratna Dass, A. (2015). Eight principles of integrated pest management. *Agronomy for Sustainable Development,* 35(4): 1199-1215.
- Bengtsson, J., Ahnstrom, J., & Weibull, A. C. (2005). The effects of organic agriculture on biodiversity and abundance: A meta-analysis. *Journal of Applied Ecology,* 42(2): 261-269.
- Bhardwaj, D., Ansari, M. W., Sahoo, R. K., & Tuteja, N. (2014). Biofertilizers function as key player in sustainable agriculture by improving soil fertility, plant tolerance and crop productivity. *Microbial Cell Factories,* 13(1): 66.
- Bond, W., & Grundy, A. C. (2001). Non-chemical weed management in organic farming systems. *Weed Research,* 41(5): 383-405.
- Celette, F., Gaudin, R., & Gary, C. (2009). Spatial and temporal changes to the water regime of a Mediterranean vineyard due to the adoption of cover cropping. *European Journal of Agronomy,* 31(2): 21-29.
- Cook, S. M., Khan, Z. R., & Pickett, J. A. (2007). The use of push-pull strategies in integrated pest management. *Annual Review of Entomology,* 52: 375-400.
- Darnhofer, I., Schneeberger, W., & Freyer, B. (2010). Converting or not converting to organic farming in Austria: Farmer types and their rationale. *Agriculture and Human Values,* 27(4): 447-462.