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Organic Farming: A Key to Sustainable Agriculture and Food Security

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Organic farming is a sustainable agricultural practice that avoids the use of synthetic chemicals like fertilizers, pesticides, and GMOs. Instead, it relies on natural resources, crop rotation, and biological methods to improve soil health and biodiversity. This approach emphasizes ecological balance, fairness, and care for the environment. Globally, organic farming is gaining popularity, covering over 95.8 million hectares, driven by consumer demand for healthier and more environmentally friendly food. In India, while representing a smaller portion of the cultivated land, organic farming is growing, particularly in states like Madhya Pradesh, Rajasthan, and the fully organic state of Sikkim. Key aspects of organic farming include using biofertilizers, natural manures, and biological pest control methods to sustainably manage soil and water resources. Despite challenges like higher labor requirements, potentially lower yields, and limited market access, organic farming offers several benefits. These include higher prices for organic products, environmental advantages, and improved food security. It also supports small-scale farmers, reduces reliance on chemicals, and contributes to global biodiversity. Successful case studies, such as eco-friendly rice cultivation in Tamil Nadu, demonstrate the economic and environmental benefits of organic farming. With growing global demand and government support through initiatives like the Paramparagat Krishi Vikas Yojana, organic farming is crucial for achieving sustainable agriculture and ensuring food security for the future.

Introduction

Organic farming is a sustainable approach to agriculture that completely avoids the use of chemical inputs (chemical fertilizer, pesticide, growth regulators, GM crops, etc.) and mainly relies on products originating from plants and animals, different cultural practices (crop rotation, cover cropping, intercropping), and biological methods to promote plant growth and control pests.

Organic farming is a production management system that mainly focuses on enhancing the health of an agroecosystem, which encompasses biological cycles, the activity of organisms in the soil, and the diversity of the surrounding environment. It uses different location-specific agronomic, mechanical, and biological techniques and avoids using all synthetic inputs. The International Federation of Organic Agriculture Movements (IFOAM) defines organic farming as: "A production system that sustains the health of soils, ecosystems, and people. It relies on ecological processes, biodiversity, and cycles adapted to local conditions, rather than the use of inputs with adverse effects." Organic farming combines tradition, innovation, and science to benefit the shared environment and promote

fair relationships and a good quality of life for all involved. The three criteria of organic agriculture are: it should be a. Economically feasible, b. Ecologically sound, and c. Socially acceptable.

Principle of Organic Farming

- Principle of health: Organic Agriculture ought to nurture and enhance the well-being of the soil, plants, people, animals, and the entire planet.
- Principle of ecology: Organic farming needs to nurture and uphold the living ecosystems and their natural cycles, supporting and improving them for sustainability.
- Principle of fairness: The principle highlights the importance of fostering human relationships among all participants in organic farming, whether they are directly or indirectly involved. This includes everyone from farmers to processors and distributors, ensuring that fairness is prioritized at every level.
- Principle of care: Organic agriculture must be approached with responsibility and care to ensure the well-being of both our environment and future generations.

History and Recent Global Scenario

The foundational concepts of organic farming took shape in the early 20th century, thanks to early advocates like Sir Albert Howard, and F.H. King. They emphasized that utilizing plant and animal waste, along with specific farming practices and biological methods, can enhance the agricultural system. The popularity of organic food surged in 1960, largely sparked by Rachel Carson's groundbreaking book, Silent Spring. In this influential work, she highlights the significant environmental harm caused by insecticide use.

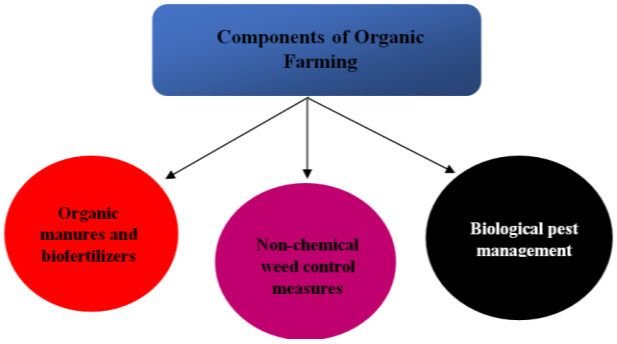
Organic farming is a significant way of life in 187 countries, with around 4.49 million farmers managing at least 95.8 million hectares of agricultural land. As of 2022, global sales of organic food and beverages reached 135 billion euros. Australia leads in organic agricultural land, boasting 35.6 million hectares, followed closely by Argentina, also with 35.5 million hectares, and Spain, which has 23.4 million hectares.

India's organic farming sector is still developing. In 2021, approximately 2,759,660 hectares of land were dedicated to organic agriculture, accounting for just 2% of the country's total net sown area. It consists of 1,160,650 PGS farmers, 1,599,010 NPOP farmers, 1,703 processors, and 745 traders. About half of the area under organic cultivation is concentrated in Madhya Pradesh (0.76 m ha), Rajasthan, and Maharashtra. Sikkim is the only fully organic announced by Prime Minister Modi in January 2016.

Key Components of Organic Farming

- **Biofertilizers:** A biofertilizer is a product that includes live microorganisms. When it's applied to soil, plant surfaces, or seeds, these microbes can establish themselves in the rhizosphere or within the plant itself, promoting growth by improving the availability of nutrients.
- Symbiotic nitrogen fixers- Azolla, Rhizobium, Anabaena, Nostoc
- Free-living nitrogen fixers- Blue Green Algae (BGA), Azotobacter, Klebsiella
- Associative Symbiotic- Azospirilium spp

- Phosphate solubilizing Biofertilizer- Pseudomonas and Bacillus spp (Bacteria), Aspergillus awamori (fungus)
- Phosphate mobilizing Biofertilizer- Vascular Arbuscular Mycorrhiza (VAM)



➢ **Manures:** Manures are natural organic fertilizers made from plant and animal waste used to improve soil fertility.

➢ Bulky organic manure- It is applied in heavy quantities but contains less amounts of nutrients. Ex-FYM, Compost, Green Manure, Vermicompost.

➢ Concentrated organic manure- It is applied in small quantities but contains a high amount of nutrients. Ex- animal origin manure, oilcake

These are some of the manure and their nutrient content

Farmyard Manure (FYM)	0.5% N_2, 0.25% P_2O_5 and 0.4% K
Compost	0.5% N, 0.5% P2O5 and 1% K
Biogas Slurry	1.6-1.8% N, 1-1.2% P2O5, and 1.2-1.8% K
Vermicompost	2-3% N, 0.5-1% P2O5, 1-1.5% K, 0.4%
sunflower cake	7.9% N, 2.2% P2O5, 1.9% K
Groundnut cake	7.3% N, 1.5% P2O5, 1.3% K
cotton seed	6.4% N, 1.8% P2O5, 1.6% K
blood meal	10-12% N, 1-2% P2O5, 0.6-0.8% K
meat meal	10-11% N, 2-2.5% P2O5, 0.7-1% K
Fish meal	4.1% N, 3.9% P2O5, 0.3% K
bone meal	3.5% N, 21% P2O5, 0% K
Guano-dried excreta of sea birds	7-8% N, 11-14% P2O5, 2-3% K
Hoof and horn meal	8-10% N, 3% P2O5, 0% K
night soil	5.5% N, 4% P2O5, 2% K
sheep and goat manure	3% N, 1% P2O5, 2% K
poultry manure	3% N, 2.6% P2O5, 1.4% K
farm compost	0.5% N, 0.15% P2O5, 0.5% K
town compost	1.4% N, 1% P2O5, 1.4% K
sun hemp	2.3% N
Dhaincha	3.5% N

➢ Non-chemical weed control measures: Non-chemical weed control measures rely on physical, mechanical, cultural, and biological techniques to manage and suppress weeds without using herbicides. Botanical herbicides (i.e. essential oils, organic acids, or plant extracts etc.), mycoherbicides (i.e. collego, devine etc.), and bioagents are innovative and eco-friendly tools in weed management, particularly in sustainable and organic farming systems.

➢ **Biological Control:** The utilization of predators, parasites, and pathogens to control insects is known as biological control. This was given by HS Smith in 1919.

1. **Parasitoid:** This unique parasite is mostly similar to the size of the host, kills the host, and depends solely on a single host to fulfill its life cycle.

Target pest	Parasitoid
Gall midge of rice	Platygaster oryzae
Stem borer of rice	Trichogramma japonicum
Top shoot borer and stem borer of Sugarcane and Boll worm cotton	Trichogramma chilonis
Stem borer of maize	Apanteles Flavis

DBM of cabbage	Cottesia Plutella
American and pink bollworm	Bracon debtor
Sugarcane pyrilla / leaf hopper- Pyrilla purpusilla	Epiricania melano-leucea

2. **Predator-** These are bigger than the host, these creatures need multiple hosts to fully complete their life cycle**.**

Target pest	Predator
scale insect, Aphid, mealy bug	Ladybird beetle
Bollworm, white fly, Aphids of cotton	Lacewing

Role of Sustainable Agriculture

- Sustainable farming methods help to preserve habitats, protect watersheds, and improve water quality.
- Sustainable farming methods can help to maintain and surge soil fertility.
- Sustainable agriculture practices can form a more efficient food system that can meet the global food demand.
- Sustainable farming methods can lessen reliance on non-renewable energy sources, reduce chemical usage, and conserve valuable resources.
- Sustainable farming methods can enhance the efficient utilization of non-renewable resources.
- The impact of climate change on crop yields can be mitigated by adopting sustainable farming methods.

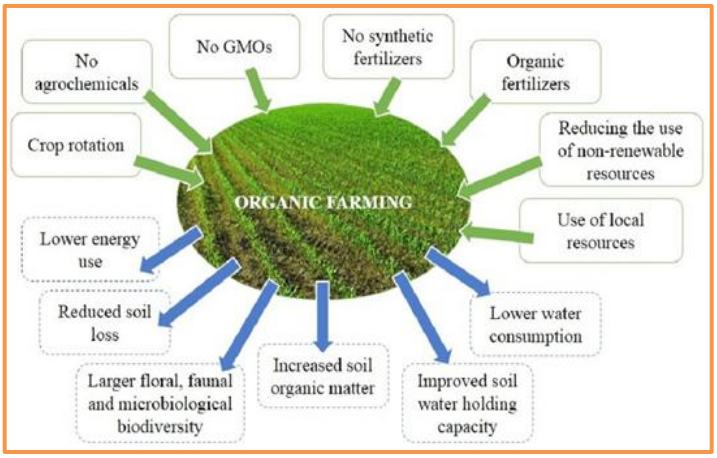
Contribution to Global Food Security

- Improving soil health: Organic farming methods such as cover cropping, composting, and crop rotation enhance soil fertility by boosting nutrient availability and minimizing the chances of soil erosion resulting in greater yield and more resilient plants.
- Increased Biodiversity: Organic farming generally includes a wide range of crops and livestock in agricultural practices, which can enhance biodiversity and lower the chances of crop losses caused by disease and pest infestation.
- Reduced Pesticide Use: Organic farming techniques utilize natural approaches, minimizing the dependence on synthetic pesticides. This contributes to lowering the risk of health issues linked with pesticide exposure, including cancer and neurological disorders.
- Better Water Management: Organic agriculture employs techniques such as cover cropping and mulching to minimize soil erosion and enhance water infiltration, which also helps retain soil moisture and decreases the necessity for irrigation.
- Improved Human Health: By opting for natural foods, individuals can lessen their contact with these dangerous chemicals and enhance their general health and wellness.
- Support for Small: Scale Farmers: Through the utilization of local resources and expertise, organic farmers can cultivate food and various products without depending on costly inputs like synthetic fertilizers and pesticides.
- Better Animal Welfare: Natural farming methods generally emphasize the well-being of animals, encouraging humane practices and minimizing the reliance on antibiotics and other medications. This approach can contribute to a more sustainable and ethical food production system.

Challenges related to organic farming

Organic farming generally requires more manual effort and typically produces fewer crops compared to traditional farming methods. The farmers also face challenges in marketing organic products, financial sustainability, and management of pests and diseases. Along with this most of the farmers may lack the knowledge and skills to manage an organic farm.

Opportunities related to organic farming



The growing demand for organic products presents a significant opportunity in the global organic agriculture market. As consumers become more conscious of their health and the environment, they are more inclined to pay higher prices for organic items. Additionally, the rising popularity of organic farming methods is another opportunity. These methods utilize natural fertilizers and pest management techniques, which enhance soil health and biodiversity. This approach not only leads to healthier food but also supports local ecosystems. Furthermore, organic farming encourages sustainable agricultural practices and minimizes harmful chemicals, benefiting the environment and lowering the carbon footprint.

Global Perspective on organic agriculture

Organic farming is an increasingly important part of sustainable agriculture. It contributes a global revenue of 25 billion dollars per annum and 1.5% of the world's total agricultural land. Liechtenstein boasts over 38% of its agricultural land managed organically. Globally, there are more than 2.8 million organic farmers. India leads the way with the highest number of organic producers at 1.15 million, followed by countries such as Ethiopia, Uganda, Peru, Tanzania, and Turkey.

Government Schemes related to Organic Farming

- Paramparagat Krishi Vikash Yojanas (PKVY): It encourages organic farming through the creation of clusters. Support is offered in establishing these clusters, providing training, obtaining certification, and facilitating marketing efforts. For three years, an assistance amount of 50,000 per hectare is available, with 62% (31,000) allocated specifically as an incentive for organic inputs. It emphasized the positive impact of reducing reliance on chemical fertilizers, promoting compost use, and employing specific organic formulations. These approaches enhance soil health by increasing organic matter content, improving nutrient storage, and fostering beneficial soil biology.
- Mission for Organic Value Chain Development for North Eastern Region: This initiative encourages third-party certification of organic farming in the northeastern region by leveraging the Farmer Producer Organization (FPO) to promote the export of organic products. The farmers receive support of 25000 per hectare for 3 years to help with organic inputs.
- Capital Investment Subsidy Scheme: Under this scheme the state government offers full financial support for establishing mechanized agro waste compost units, with a maximum funding of 190 lakh per unit, utilizing fruit and vegetable waste.
- National Mission on Oilseed and Oil palm (NMOP): Under this program, you can receive financial support of 50% of the costs, a maximum of up to Rs 300 per hectare for various components, including biofertilizer, manure, and more
- National Food Security Mission: In this scheme financial support of 50% is provided on the cost and it is a maximum of up to Rs 300 per hectare for the promotion of Bio fertilizers.
- The Bharatiya Prakrutik Krishi Padhati (BPKP) of PKVY encourages the use of on-farm inputs to promote organic farming.

Success Story

The farmers of Tirunelveli district of Tamil Nadu successfully implemented eco-friendly technologies to grow rice. They adopt this technology for the indigenous rice variety Kitchii Samba. Because of the adoption of this, the cost of cultivation for growing rice is decreased and this organic rice fetches a premium price in the market. A farmer G Braja Sekhar grew a medium-duration Kitchili Samba rice in 1.5 hectares of area. According to him first, he treated the seed with Panchakavya then he incorporated the green manure 3-4 days before ploughing after that they used biogas slurry as irrigation when the seedlings were just established in the main field. 20 days after the transplantation they spray a 3% solution of panchakavya, 30 DAT coconut milk, and buttermilk in equal proportions it is then mixed with water which is ten times the volume of the mixture, and sprayed over the crop. on 40 DAT another round of 3% solution of panchakavya is sprayed over the crop. 45 DAT a dose of bio insect repellent is sprayed on crops. According to him, the cost of cultivation is 14000 rupees and the yield is about 6 tonnes from a 1.6 ha area. He sells the output as organic rice for 30 rupees per kg. So, it is very profitable for him and the whole village is doing the same thing.

Conclusion

The interest in organic farming growing especially in those areas where the farming resources have degraded day by day due to the continuous use of synthetic inputs. The farmers and consumers are also aware of their health and the effect of synthetic input on soil, groundwater, wildlife, and the environment. In developed countries, awareness about environmental quality and health is mostly promoted by environmental groups, Due to this the demand for organic products is growing very rapidly, which creates the opportunity to sell the products at very high prices that enable the organic farmer to expand continuously.

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