Advances in Research

Volume 25, Issue 3, Page 128-136, 2024; Article no.AIR.114013
ISSN: 2348-0394, NLM ID: 101666096

The Role of Organic Farming in Sustainable Agriculture

Janak Raj [a++*], Sarita Jat [a++], Manish Kumar [b++], Reema [a++] and Anuradha Yadav [a++]

[a] Department of Agronomy, SKNAU, Jobner, Rajasthan, 303329, India.
[b] Department of Agronomy, RCA, MPUA&T, Udaipur, Rajasthan, 313001, India.

Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

Article Information

DOI: 10.9734/AIR/2024/v25i31058

Open Peer Review History:
This journal follows the Advanced Open Peer Review policy. Identity of the Reviewers, Editor(s) and additional Reviewers, peer review comments, different versions of the manuscript, comments of the editors, etc are available here: https://www.sdiarticle5.com/review-history/114013

Review Article

Received: 03/01/2024
Accepted: 07/03/2024
Published: 06/04/2024

ABSTRACT

Organic farming, as a sustainable alternative to conventional high-input practices reliant on synthetic fertilizers, fungicides, and pesticides, prioritizes the vitality of soil as a living ecosystem. Embracing practices such as crop rotation, animal manures, crop residues, green manures, and biological pest and disease control, organic agriculture aims to uphold soil health and productivity. By meeting present food demands in an environmentally conscientious manner, organic farming also safeguards the needs of future generations, thereby preserving and nurturing our ecosystem. Modern agriculture has detrimentally impacted the environment, leading to issues such as decreased soil fertility, elevated water hardness, insect resistance development, reduced genetic diversity in plants, heightened levels of toxic residues in the food chain and animal feed, contributing to health problems and environmental degradation. In contrast, organic farming nurtures plants with essential macronutrients and micronutrients while simultaneously enhancing soil physical, chemical, and biological characteristics. Guided by the ethos of sustainability, organic farming prioritizes mitigating health risks linked to synthetic inputs and cultivating a healthier ecosystem. The minimal environmental footprint of organic farming positions it as a practical

[++] Ph.D. Scholar;
**Corresponding author: E-mail: 1997janakraj@gmail.com;*

solution for tackling urgent concerns like soil degradation, water pollution, and global ecological well-being. Essentially, organic farming stands out as a beacon of sustainable agriculture, paving the way to reconcile food production with environmental conservation. Moreover, organic farming's low environmental impact presents an opportunity to rehabilitate and enhance degraded agricultural lands.

Keywords: Organic farming; sustainable agriculture; nutrition; healthy food; eco-friendly environment; organic farming; agricultural lands.

1. INTRODUCTION

“With organic agriculture notably, Asia boasts the highest proportion of organic growers (36%), followed by Africa (29%) and Europe (17%). Considering these advancements in organic farming, this chapter aims to consolidate various topics” [1]. “It delves into the historical evolution of organic farming and scrutinizes the global and Indian landscapes concerning organic agriculture. Drawing from a literature review, primary concerns within organic farming encompass yield decline during farm conversion, strategies for enhancing soil fertility, integration of animals, certification processes, ecological considerations, marketing strategies, and policy support”, as highlighted Das et al. [2]. “Organic farming serves as a holistic approach to production management, fostering and enhancing the health of agro-ecosystems by promoting biodiversity, biological cycles, and soil biological activity. It prioritizes the implementation of management practices over reliance on external inputs, recognizing the need for regionally tailored solutions based on local conditions”, as highlighted by Yadav et al. [3]. “This approach involves the utilization of agronomic, biological, and mechanical processes instead of synthetic materials to fulfill specific functions within the system. Furthermore, numerous non-governmental organizations in India have actively advocated for organic farming by educating farmers about the benefits of sustainable agriculture and providing training on organic farming techniques”, as discussed by Yadav [4]. Despite numerous initiatives, organic farming in India still grapples with several challenges, including inadequate infrastructure, limited market access, and the high cost of organic inputs. Focusing on biofertilizers and vermicomposting, this study delves into various aspects of organic farming in India to gain insights into its advantages, challenges, and future prospects, as discussed by Elayaraja and Vijai [5]. “While there has been a continuum of thought from earlier days to the present, the modern organic movement has undergone significant transformation. It now places environmental sustainability at its core, alongside the founders' concerns for promoting healthy soil, nutritious food, and well-being”, as highlighted by Yadav and Sarkar [6].

2. CONCEPT AND DEFINITION

The concept of organic agriculture is subject to diverse interpretations among individuals. For many, it signifies the utilization of organic manures and natural methods for plant protection, rather than relying on synthetic fertilizers and pesticides. However, the term "organic" holds different meanings depending on the context. In this context, it pertains to holistic farm management, treating the farm as a living organism. Practices such as the use of artificial fertilizers, herbicides, insecticides, fungicides, and animal drenches are eschewed on organic farms, as discussed by Chandra [7]. The term "organic" in relation to farming was initially introduced by Northbourne (1940) in the book “Look to the Land”, where he emphasized the necessity for the farm to possess biological completeness, functioning as a living entity with balanced organic life within itself. Northbourne's concept transcended mere organic inputs like compost, highlighting the importance of managing the farm as an integrated, whole system, as elucidated by Dey et al. [8].

“According to the USDA study team's definition of organic farming, it is a system that aims to minimize or entirely eliminate the use of synthetic inputs such as fertilizers, pesticides, hormones, and feed additives. Instead, it primarily relies on practices such as crop rotations, utilization of crop residues, application of animal manures, incorporation of off-farm organic waste, integration of mineral grade rock additives, and implementation of biological methods for nutrient mobilization and plant protection”, as outlined by Kumar et al. [9]. “Similarly, the FAO defines organic agriculture as a distinctive production management system that fosters and enhances the health of agro-ecosystems, including biodiversity, biological cycles, and soil biological activity. This is achieved through the utilization of on-farm agronomic, biological, and mechanical

methods, while excluding all synthetic off-farm inputs", as suggested by FAO [10].

3. ORGANIC AGRICULTURE IN INDIA

In India, Organic Farming has ancient roots, though its prevalence diminished with the adoption of mineral-based farming and the onset of the Green Revolution in the 1960s, characterized by chemical and technological advancements in agriculture. Undoubtedly, this transition led to significant gains in productivity, addressing food insecurity for India's growing population, as highlighted by Karunakaran [11]. However, it also brought forth adverse ecological consequences, including soil health degradation, the emergence of new pests and diseases, depletion of eco-friendly micro-organisms, and contamination of the food chain with toxic chemicals, posing a threat to the nation's biosphere, as discussed by Tandon [12]. Recognizing the need for a sustainable approach to agricultural production, Organic Farming has emerged as an alternative system, focusing on optimal, balanced, efficient, and scientifically managed land, water, biodiversity, and external inputs, as proposed by Kumara et al. [13].

4. ORGANIC FARMING: PRESENT SCENARIO IN INDIA

In India, the total area under organic certification is 5.71 million hectares which includes 26 per cent cultivable area with 1.49 million hectares and the rest 74 per cent covering about 4.22 million hectares is forest and wild areas for collection of forest produce. "The countries with the largest areas of organic agricultural land recorded in the year 2021 are countries with the most organic agricultural land were Australia (35.7 million hectares), Argentina (4.1 million hectares) and France (2.8 million hectares). India acquired the sixth position with a total organic agriculture area of 2.66 million hectares. There were nearly 1.8 million producers, most of whom were in India. The leading countries by area in Asia were China (2.75 million hectares) and India (over 2.66 million hectares). Many countries reported a significant increase. In absolute terms, the biggest increases were in China, France, and Spain" [14].

4.1 Principles of Organic Farming

4.1.1 Principle of health

Health is defined as the wholeness and integrity of living systems, encompassing soil, plants, animals, humans, and the planet as a unified and indivisible entity. Organic Agriculture is dedicated to sustaining and enhancing the health of ecosystems and organisms at every level, from the microorganisms in the soil to human beings, across all stages of farming, processing, distribution, and consumption. It aims to produce high-quality, nutrient-rich food that contributes to preventive healthcare and overall well-being. To achieve this goal, organic agriculture refrains from the use of fertilizers, pesticides, animal drugs, and food additives that may pose adverse health effects.

4.1.2 Principle of ecology

Organic Agriculture is founded upon the principles of living ecological systems and cycles, aiming to harmonize with, emulate, and sustain them. It emphasizes production based on ecological processes and recycling, recognizing the universality of these cycles while acknowledging their site-specific operation. Organic management practices must be tailored to local conditions, ecology, cultural contexts, and scale. Furthermore, organic agriculture seeks to achieve ecological balance through the deliberate design of farming systems, creation of habitats, and promotion of genetic and agricultural diversity. Stakeholders involved in the production, processing, trading, or consumption of organic products are tasked with safeguarding and enhancing the shared environment, including landscapes, climate, habitats, biodiversity, air, and water resources.

4.1.3 Principle of fairness

Fairness in organic agriculture is characterized by principles of equity, respect, justice, and stewardship toward the shared world, encompassing relations among people and with other living beings. Organic agriculture endeavours to ensure that all individuals involved enjoy a high quality of life while contributing to food sovereignty and poverty reduction. It strives to generate an ample supply of high-quality food and other goods. Additionally, this principle emphasizes providing animals with conditions and opportunities that align with their physiology, natural behaviour, and well-being. Achieving fairness necessitates transparent and equitable systems in production, distribution, and trade.

Fig. 1. Principles of organic farming
(Source: https://statistics.fibl.org/data.html)

4.1.4 The principle of care

Precaution and responsibility serve as paramount considerations in the management, development, and technological choices within organic agriculture. It is imperative that organic agriculture be overseen with caution and responsibility to safeguard the health and well-being of present and future generations, as well as the environment. While scientific knowledge is valuable, it alone is insufficient. Practical experience, accumulated wisdom, and traditional and indigenous knowledge provide valuable insights and solutions that have stood the test of time. Organic agriculture should prioritize the prevention of significant risks by embracing appropriate technologies while rejecting unpredictable ones, such as genetic engineering.

5. COMPONENTS OF ORGANIC FARMING

Crucial elements of organic farming encompass biological nitrogen fixation, crop rotation, crop residues, biopesticides, and biogas slurry, among others. Vermicomposting has risen as a prominent component in organic farming, proving highly effective in bolstering soil fertility and promoting sustainable crop growth, as highlighted by Nambiar et al. [15].

The various components of organic farming are:

1. Crop rotation:

To practice sustainable agriculture, it is essential to implement crop rotation on the same land over a period of two years or more. This practice helps maintain soil fertility and effectively controls insects, weeds, and diseases. For instance, incorporating legumes into the rotation enhances soil fertility.

2. Crop residue:

India holds significant potential for utilizing crop residues and straw from cereals and pulses in nutrient recycling during organic farming. When crop residues are inoculated with fungal species, they enhance the physiochemical properties of the soil and contribute to increased crop yields.

3. Organic manure:

Organic manure, derived from biological sources such as plant, animal, and human residues, plays a crucial role in enhancing crop growth. It directly improves the uptake of humic substances, while indirectly promoting soil productivity by enhancing the availability of major and minor plant nutrients through soil microorganisms, as discussed by Nagavallemma et al. [16].

5.1 Bulky Organic Manure

Bulky organic manure includes compost, FYM and green manure having less nutrients in comparison to concentrated organic manure.

FYM: Farm Yard Manure (FYM) refers to the well decomposed combination of dung, urine, farm litter and leftover materials (roughages or fodder).

Compost: "Substantial amounts of waste material, including vegetable refuse, weeds, stubble, bhusa, sugarcane trash, sewage sludge, animal waste, and human and industrial refuse, can be transformed into compost manure through anaerobic decomposition. Compost serves as a beneficial alternative to farmyard manure (FYM), suitable for application to various soil types and crops", as highlighted by Narayan [17].

Green Manuring: "Green manuring is practice of adding organic matter to the soil by ploughing and adding into the soil undecomposed green plant tissues for improving physical structure and fertility of the soil. The green manure crop (legume crop) supplies organic matter and additional nitrogen. Commonly used green manure crops are such as Sun hemp (*Crotalaria juncea*), Dhaincha (*Sesbania aculeata*), Cowpea, Cluster Bean, Senji (*Melilotus parviflor*, *Vigna sinensis*), Berseem (*Trifolium alexandrium) etc"* Olle [18].

5.2 Concentrated Organic Manure

"Oilcakes, blood meal, fishmeal, meat meal, and horn and hoof meal, categorized as concentrated organic manures, are derived from raw materials of animal or plant origin. These materials contain a higher percentage of vital plant nutrients, including nitrogen, phosphorus, and potash, compared to bulky organic manures", as highlighted by Stockdale et al. [19].

4. Waste:

1. Industrial waste: Industrial by products such as spent wash & coir waste can be used as manure.

2. Municipal and Sewage waste: It is an important component of organic waste.

5. Biofertilizers:

"Biofertilizers are microorganisms with the capacity to enhance soil fertility, such as by fixing atmospheric nitrogen and through the activity of mycorrhizal fungi and phosphate solubilizers. These eco-friendly and sustainable agents contribute to soil fertility by promoting the growth of crop plants and trees, increasing biomass production, and enhancing grain yields", as discussed by Madhavi et al. [20].

Types of Biofertilizers: There are two types of bio-fertilizers.

1. **Symbiotic Nitrogen-fixation:**

Rhizobium: Rhizobium bacteria play a crucial role in fixing atmospheric nitrogen within the roots of leguminous plants, forming tumour-like growths known as root nodules. This widely utilized biofertilizer has the capacity to fix approximately 100-300 kg of nitrogen per hectare in a single crop season.

Fig. 2. Application of organic farming

2. Asymbiotic N-fixation: Blue-green algae, Azolla, Azotobacter, Mycorrhizae, and *Azospirillium* thrive in decomposing soil organic matter and have the ability to fix atmospheric nitrogen in suitable soil mediums.

i) Azotobacter: *Azotobacter* has a beneficial effect on a variety of crops including vegetables, millets, cereals, sugarcane, and cotton. This organism is capable of producing nitrogen as well as compounds with antifungal, antibacterial properties, siderophores, and hormones, as highlighted by Saravana and Jain [21].

ii) Azospirillium: *Azospirillium* has a beneficial effect on crops such as oats, barley, maize, sorghum, forage crops, and pearl millet. This microorganism fixes nitrogen by colonizing root zones.

iii) Blue Green Algae: Blue-green algae play a role in reducing soil alkalinity, making them beneficial for rice cultivation and land bio-reclamation purposes.

iv) Azolla: Small floating fern, Azolla harbours blue-green algae, anabaena, commonly seen in shallow fresh water bodies and in low land fields. They fix nitrogen in association.

v) Mycorrhizae: Mycorrhizae is symbiotic association of fungi with roots of vascular plants. This helps in increasing phosphorous uptake and improve the growth of plants.

6. Bio-pesticide:

Biopesticides, derived from plant sources, consist of compounds such as alkaloids, phenolics, terpenoids, and other secondary chemicals. These substances exhibit biological activity against insects, fungi, and nematodes, impacting their behavior and physiology. Well-known examples of biopesticides include Pyrethrum, Nicotine, Neem, Margosa, and Rotenone, as mentioned by Manida [22].

7. Vermicompost:

Vermicompost is organic manure or compost created through the action of earthworms, which inhabit soil, consume organic matter, and excrete it in a digested form. This nutrient-rich product contains a plethora of macro and micronutrients, vitamins, growth hormones, and immobilized microflora vital for supporting plant growth.

6. OBJECTIVES OF ORGANIC FARMING

The objectives of organic agriculture have been expressed in the standard document of the IFOAM as follows:

(1) Ensure the production of food with high nutritional value in adequate quantities.
(2) Embrace natural systems rather than seeking domination over them.
(3) Foster and enhance biological cycles within farming systems, involving microorganisms, soil flora and fauna, plants, and animals.
(4) Preserve and enhance the long-term fertility of soils.
(5) Utilize renewable resources in locally organized agricultural systems to the extent possible.
(6) Operate within a closed system, maximizing the use of organic matter and nutrient elements.
(7) Provide livestock with conditions conducive to expressing all aspects of their innate behaviour.
(8) Prevent all forms of pollution resulting from agricultural practices.
(9) Preserve the genetic diversity of the agricultural system and its surroundings, including the protection of plant and wildlife habitats.

6.1 Benefits of Organic Farming

The benefits provided by organic farming are:

- Organic farming contributes to environmental health by reducing pollution levels.
- It facilitates sustainable agricultural production, ensuring long-term viability.
- Organic practices enhance soil health, promoting fertility and productivity.
- Products from organic farming typically exhibit superior quality, characterized by larger size, enhanced flavor, and aromatic attributes.
- Organic techniques improve soil water holding capacity, aiding in water conservation.
- Organic farming enhances nutrient availability crucial for plant growth and development, as emphasized by Kumari and Raj [23].
- Organic farm products are renowned for their superior quality attributes, including size, flavour, and aroma.

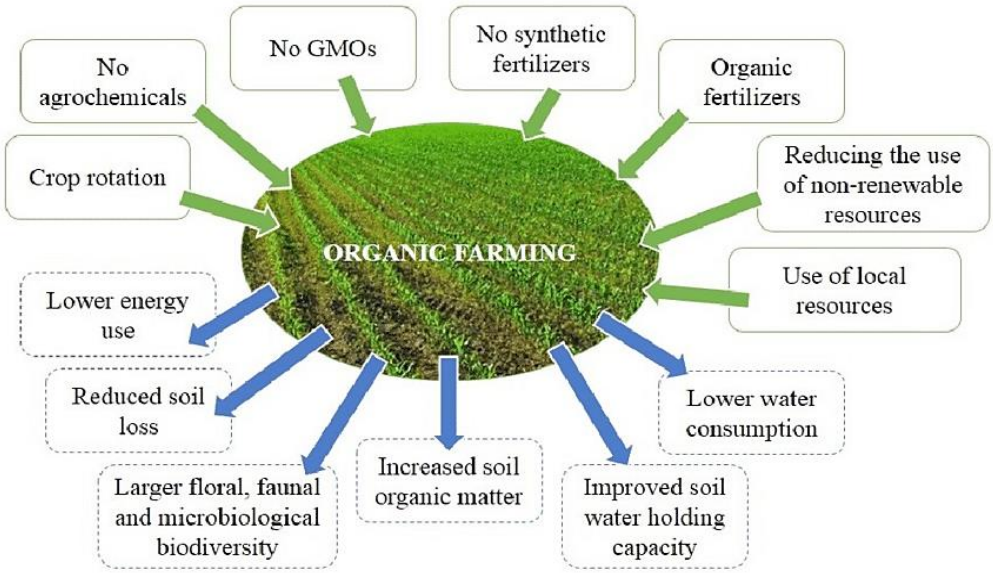

Fig. 3. Objectives of organic farming
(Source: https://statistics.fibl.org/data.html)

- Groundwater in areas under organic farming remains free from toxic chemicals.
- Vermicomposting effectively reduces waste bulk density, as demonstrated by Anwar et al. [24].
- Vermicomposting enriches the soil with auxins, hormone-like substances that stimulate plant growth.
- Organic practices maintain optimal C:N ratios in soil, enhancing fertility and productivity.

7. CONSTRAINTS / LIMITATIONS OF ORGANIC FARMING IN INDIA

(1) Small land holdings prevail, with the average operational size being 1.57 hectares, and this size is gradually diminishing due to population pressure.
(2) Inadequate infrastructure, such as insufficient soil testing laboratories, hampers agricultural development.
(3) Limited technological knowledge and awareness regarding the use of bio-fertilizers, bio-pesticides, bio-control methods, Integrated Pest Management (IPM), and Integrated Nutrient Management (INM) are prevalent.
(4) Transitioning to organic farming typically requires a four-year period for farmers to completely eliminate chemical inputs as nutrients and crop protectants, as noted by Edwards [25].
(5) Limited cooperation among neighbouring farmers regarding the use of fertilizers, pesticides, and weedicides poses challenges.
(6) The decline in the production of high-yielding crops like rice and wheat, which require optimal fertility levels to achieve their potential yields, as observed by Ramesh et al. [26].
(7) Competition for organic materials such as dung-cakes for domestic cooking fuel and bagasse for fuel in sugar factories and villages is evident.
(8) Wheat and rice straws are commonly disposed of through burning rather than being returned to the soil.
(9) Direct application of dung, slurry, pig manure, and other waste materials in the field without composting poses risks to crops and groundwater pollution.
(10) Sewage and sludge contain pathogens, some of which can survive for extended periods, posing risks to human and animal health, as highlighted by Pathania [27].
(11) City garbage often contains undecomposed materials like metal, plastic, glass, stones, and needles, posing numerous challenges.
(12) Availability of biocontrol agents is limited to a few selected insect pests.
(13) The organic certification process is complex and costly.
(14) Organic producers face challenges such as high price expectations, delayed delivery,

quality restrictions, lack of certification, and marketing networks.

(15) Major Indian and multinational companies show little interest in biopesticides, while dealers prioritize chemical pesticides, as noted by Sofia et al. [28].

7.1 Future of Organic Farming in India

India possesses vast arable land, with a net cultivated area totalling 140.1 million hectares, making agriculture a primary economic lifeline, contributing to 20-30% of household incomes, as noted by Pavani et al. [29]. Although traditional farming methods have been prevalent in India, the advent of modern techniques and rapid population growth spurred the widespread adoption of conventional farming to address food shortages. However, the increasing awareness of chemical effects on soil health and concerns about food quality and safety have fuelled a rising demand for organic produce, as highlighted by Cidon et al. [30]. With its rich indigenous farming heritage, skilled traditional farmers, extensive drylands, and abundant rainfall in northeastern hilly regions, India is well-positioned to embrace organic farming, presenting a promising opportunity, as emphasized by Gurjar et al. [31]. India holds the distinction of being the largest global organic producer. Moreover, the introduction of innovative technologies in organic farming, such as 3D printing, utilization of mycorrhizal fungi and nano bio-stimulants, and adoption of agroecological practices, offers promising prospects for further advancements in the organic farming sector, as suggested by Kumar et al. [32].

8. CONCLUSION

Organic agriculture, with its focus on the sustainable utilization of locally available natural resources, constitutes a holistic food production system. To ensure its continued growth and uphold quality standards, it is essential to embrace a comprehensive approach involving collaboration with all stakeholders, adoption of environmentally friendly technologies, establishment of robust marketing infrastructure, and provision of effective financial support. By fostering an environmentally sustainable agricultural system like organic agriculture, we can contribute to maintaining resource balance, preventing resource overexploitation, and conserving soil nutritional quality and biodiversity in the country.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. APEDA. Annual Report, Ministry of Commerce and Industry, GOI, New Delhi. 2014;1-52.
2. Das S, Chatterjee A, Pal TK. Organic farming in India: A vision towards a healthy nation. Food Quality and Safety. 2020; 4:69-76.
3. Yadav SK, Babu S, Yadav MK, Singh K, Yadav GS, Pal S. A review of organic farming for sustainable agriculture in northern India. Inter. J. Agron. 2013;10:1-8.
4. Yadav AK. Organic Agriculture (Concept, Scenario, Principals and Practices), National Centre of Organic Farming Department of Agriculture and Cooperation, Ministry of Agriculture, Govt of India, Ghaziabad, Uttar Pradesh; 2015.
5. Elayaraja M, Vijai C. "Organic farming in India: Benefits and Challenges." European J. Molecular and Clinical Medicine. 2020; 7:3021-3029.
6. Yadav KK, Sarkar S. Biofertilizers impact on soil fertility and crop productivity under sustainable agriculture. Environ. Eco. 2018;37:89-93.
7. Chandra Krishan. “Organic Manures” Regional Director Regional Centre of Organic Farming No. 34, 5th Main Road Hebbal, Banglaore; 2005.
8. Dey S, Achar S, Dey A. Organic farming: Concept, principles, benefits and prospects in India. Agric. Letters. 2021;2:24-26.
9. Kumar A, Prakash CHB, Brar NS, Kumar B. Potential of vermicompost for sustainable crop production and soil health improvement in different cropping systems. Int. J. Curr. Micro. and App. Sci. 2018;7:1042-1055.
10. FAO. Organic Agriculture, Food and Agriculture Organization of the United Nations, Rome, Italy; 2002. Available:https://www.fao.org/3/y4587e/y4587e.pdf
11. Karunakaran N. Status, benefits and future prospects of organic farming in India: A review. J. Manage. Res. and Analysis. 2021;8:103-111.
12. Tandon HLS. Fertilizers and their integration and organics and biofertilizers.

in fertilizers, organic manures, recyclable wastes and biofertilizers, FDCO, New Delhi, India. 1992;32-36.
13. Kumara KTM, Singh DR, Praveen KV. Economic benefits from adoption of organic farming in India. Economic Affairs. 2015;60:569-564.
14. Anonymous. Directorate of Economics and Statistics, Department of Agriculture and Farmer's welfare, Ministry of Agriculture and Farmers welfare Government of India. 2023;463-472.
Available:https://www.apeda.gov.in/apeda website/organic/data.htm
15. Nambiar KKM, Soni PN, Vats MR, Sehgal DK, Mehta DK. AICRP on long term fertilizer experiments. Annual Reports 1987-88 and 1988-89, IARI, New Delhi, India; 1992.
16. Nagavallemma KP, Wani S, Lacroix VV, Padmaja C, Vineela M, Babu Rao, Sahrawat KL. Vermicomposting: Recycling wastes into valuable organic fertilizer. Int. Crops Res. Insti. Semi-Arid Trop. 2004; 20:112-119.
17. Narayan S. “Organic Farming in India: Relevance, Problems and Constraints” Department of Economic Analysis and Research, National Bank for Agriculture and Rural Development, Mumbai. 2005; 113-123.
18. Olle M. Review: Vermicompost, its importance and benefit in agriculture. J. Agric. Sci. 2019;2:93-98.
19. Stockdale EA, Lampkin NH, Hovi M. Agronomic and environmental implications of organic farming systems. Advan. Agron. 2001;70:261-327.
20. Madhavi R, Vijaya GS, Malathi H. A paper on sustainable organic farming in India. Int. J. Modern Agric. 2021;10:1080-1088.
21. Saravana KV, Jain DK. Marketing of organic products and minor forest produce. Ind. J. Agric. Marketing, Conf. Spl. 2003; 17- 27.
22. Manida M. Organic farming current status and opportunities for future development. Agric. Food: E-Newsletter. 2021;3:14-18.
23. Kumari SV, Raj S. "Organic farming: Path for sustainable ecosystem, discussion paper 17, "National Ins. Agric. Ext. Manage. (MANAGE). 2020;95-102.
24. Anwar MDD, Patra S, Chand K, Alpesh AA, Naqvi, Khanuja SPS. Effect of organic manures and inorganic fertilizer on growth, herb and oil yield, nutrient accumulation and basil. Commun. Soil. Sci. Plan. 2005; 36:1737-1746.
25. Edwards CA. The use of earthworms in the break down and management of organic wastes: In: Earthworm Eco. Edwards, C.A. (ed.), CRC Press LLC, Florida. 1998;327-354.
26. Ramesh P, Panwar NR, Singh AB, Ramana S, Yadav, Subba Rao A. Impact of organic manure combinations on the productivity and soil quality in different cropping systems in central Indian. J. Plant. Nutrient. Soil. Sci. 2009;172:577-585.
27. Pathania N. Organic farming: Its objectives, principles, types, techniques, favorable circumstances and downsides. 2020;1:50-55.
28. Sofia PK, Prasad R, Vijay VK. Organic farming tradition reinvented. Ind. J. Trad. Knowledge. 2006;5:139-142.
29. Pavani P, Kumar PAD, Bharath U. Futuristic agriculture (organic farming) in India: A review. Acta Scientific Agric. 2022;6:25-31.
30. Cidón CF, Figueiró PS, Schreiber D. Benefits of organic agriculture under the perspective of the bioeconomy: A systematic review. Sustainability. 2021; 13:1-19.
31. Gurjar S. Organic farming in Sikkim -A sustainable nexus between crop yield and crop productivity. Ind. J. Organic Farming. 2022;1:33-65.
32. Kumar S Diksha, Sindhu SS, Kumar R. Biofertilizers: An ecofriendly technology for nutrient recycling and environmental sustainability. Curr. Res. Micro. Sci. 2022;94-100.

© Copyright (2024): Author(s). The licensee is the journal publisher. This is an Open Access article distributed under the terms of the Creative Commons Attribution License (http://creativecommons.org/licenses/by/4.0), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Peer-review history:
The peer review history for this paper can be accessed here:
https://www.sdiarticle5.com/review-history/114013