

Organic Farming: A Sustainable Agricultural Practice

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ABSTRACT

The agriculture sector faces multiple challenges in meeting the growing food demand of an ever-increasing population. Conventional farming is one of the most widely practiced approach due to its affordability and accessibility, but it is associated with various drawbacks. A resilient and sustainable agriculture system is required to face different environmental challenges. Sustainable agriculture includes different eco-friendly farming techniques that boost crop yield and livestock production without having an adverse effect on the environment. Organic farming is one such approach that should be practiced for attaining the goal of sustainable agriculture. In simple words, organic farming can be defined as the production of plants by avoiding the use of harmful synthetic additives (fertilizers, pesticides, antibiotics etc.). Organically cultivated foodstuffs have become increasingly popular due to their numerous health benefits. India has experienced a significant expansion of organic farming and is presently one of the major organic producers in the world. Though there are some difficulties yet to be overcome in order to ensure that organic farming has a beneficial economic and health impact, it can be argued that it has a better prospect in India. This review deliberates the current state of organic farming in India along with its components, advantages, associated constraints and future potential.

Keywords: Agriculture, farming, organic, product, sustainable

1. INTRODUCTION

By 2100, the world's population has been prophesied to touch approximately 11 billion (United Nations, 17 June 2019). As a result, to keep up with the expanding population demand, food production must be increased. Apart from meeting the food needs, the agriculture sector also contributes to the country's economic development. Conventional farming is the most commonly followed practice, but it makes use of synthetic fertilizers for growing crops and pesticides for killing weeds. These synthetic additives are detrimental to soil productivity, pollute the water resources and are harmful to human health.

Different agricultural methods have evolved in the last couple of decades as a result of technological innovations. In order to address the issue of escalating threats like climate change, pollution, and loss of biodiversity, it is critically essential to produce food in a sustainable manner.

The concept of sustainable agriculture gained attraction after the publication of the Brundtland Report (1987) which discusses sustainable development as “development that meets the demands of present generations without jeopardising future generations’ ability to satisfy their own needs”.

Gupta et al. (2021) recognized a total of 30 sustainable agricultural approaches (SAPs) in India. Organic farming is one such vital SAP for addressing India's current agricultural snags. Organic farming makes use of biological fertilizers and pest control, compost, as well environmentally friendly approaches like intercropping, mulching, crop rotations, etc. This system restricts the application of chemical fertilizers, growth regulators, pesticides, herbicides and other chemical inputs. It also discourages and restricts the usage of ionizing radiation, sewage sludge, genetically modified organism and antibiotics. The chief objective of organic farming is to increase the nutrition content, and soil productivity and protect the environment. All these factors will eventually positively regulate the socio-economic condition of our country. Major principles of organic farming defined by the International Federation of Organic Agriculture Movements (IFOAM) are principles of health, care, ecology and fairness (I.F.O.A.M., 2005a). The major components of organic farming include

management of soil, pesticides, weeds and crop, recycling of waste and use of biofertilizers.

The soil fertility is largely maintained by using organic manures, following crop rotation and planting cover crops. Pest diseases and weeds are managed via physical and biological control systems. Organic livestock is reared without the application of antibiotics and growth hormones. They are also given routine immunization, vitamins and minerals supplementation (Roychowdhury et al., 2013; Patil et al., 2014; Das et al., 2020). Organic farming is associated with numerous economic, social and environmental benefits (Figure 1).

The organic food industry's growth in India is being fuelled by a growing market for organic products as well as government policies that encourage exports. India has the maximum number of organic farmers (1st rank globally) and occupies the eighth position in terms of area under organic cultivation (http://apeda.gov.in/apedawebsite/organic/Organic_Products.htm). In 2016, Sikkim was the first state to be declared completely organic.

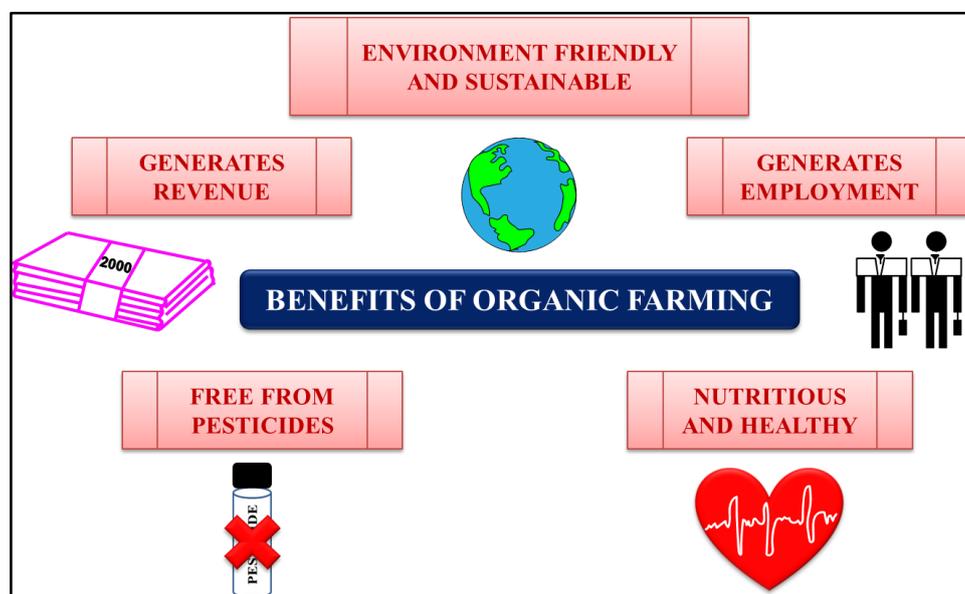


Figure 1: Benefits of organic farming

Other states, like Madhya Pradesh, Maharashtra and Rajasthan are also on the route of being organic. The Indian government has proposed different schemes like Mission Organic Value Chain Development for North Eastern Region (MOVCDNER), National

Food Security Mission (NFSM), Capital Investment Subsidy Scheme under Soil Health Management, Paramparagat Krishi Vikas Yojana (PKVY), National Mission on Oilseeds and Oil Palm, etc. for endorsing organic farming or its components in India. Many government (www.jaivikkheti.in), as well as private organic e-commerce platforms, have also been established. Farmers can sell their organic products directly to both retail and bulk buyers through these portals. The major organic products exported from India are sugar, coffee, oils, tea, dry fruits spices, cereals, etc.

The Agricultural and Processed Food Products Export Development Authority (APEDA) under the Ministry of Commerce & Industries, Government of India has administered National Programme for Organic Production (NPOP). The major responsibilities of this program are the accreditation of different certification bodies, marketing, setting guidelines for the development of organic products, strengthening organic agriculture etc. Organic product certification is very crucial for establishing authenticity. Buyers should seek different logos like FSSAI (Jaivik Bharat), PGS organic India, etc. on organic items for determining their validity. The required logos on the organic product are depicted in Figure 2.



Figure 2: FSSAI (A), Jaivik Bharat (B), NPOP (C) and PGS India Organic (D) logos on organic product. FSSAI, Food Safety and Standards Authority of India; NPOP, National Program for Organic Production; PGS India, Participatory Guarantee System of India

Though the government has taken many initiatives to endorse organic farming, still barely 2% of the total net sown area is under organic cultivation in India. Although there are around two million certified organic farmers recognised in India, still, there are many uncertified farmers whose information is not available (Gupta et al., 2021). Thus, there is a need to raise awareness through the formulation of different policies as well as the organization of different training camps for farmers to support organic farming.

This article attempts to review the principles, components, benefits and challenges associated with organic farming. It also highlights the present Indian scenario in terms of organic farming and future directions in this field.

2. CONCEPT OF SUSTAINABLE DEVELOPMENT

Sustainable development is defined as a development in a direction that the present generation's needs are met without overexploitation of resources so that future generations' needs are not compromised (W.C.E.D., Brundtland Commission Report, 1987). This was further strengthened at the United Nations Conference on Environment and Development which was held in Rio de Janeiro in 1992, and the World Summit on Sustainable Development held in Johannesburg in 2002. The ecological interpretation of sustainability and the emerging conservation concept of ecosystem health have both anthropocentric and ecocentric value dimensions. The objectives of sustainable development are important as those would certainly help to achieve a sustainable biome. The documents of UNCED at Rio+20 clearly indicate the proposal keeping goals for sustainable development which must be applicable in reality, easy to understand and communicate, limited to exercise, inspiring and can be applied universally to all nations, keeping in view their national policies and priorities (Sachs, 2012). Organic farming can be an absolute path to socio-economic and ecologically sustainable development, especially in developing countries (Gilbert et al., 1990).

According to USDA "organic farming is a system which avoids or largely excludes the use of synthetic inputs (such as fertilizers, pesticides, hormones, feed additives, etc.) and to the maximum extent feasible rely upon crop rotations, crop residues, animal manures, off-farm organic waste, mineral grade rock additives and biological system of nutrient mobilization and plant protection". FAO defined organic farming as "Organic agriculture

is a unique production management system which promotes and enhances agro-ecosystem health, including biodiversity, biological cycles and soil biological activity, and this is accomplished by using on-farm agronomic, biological and mechanical methods in exclusion of all synthetic off-farm inputs” (Mohler & Johnson, 2009).

3. PRINCIPLES OF ORGANIC FARMING

The four main principles of organic production given by IFOAM in 2005 (IFOAM, founded in 1972) are:

- The Principle of Health – Organic agriculture should sustain and enhance the health of soil, plant, animal, human and planet as one and indivisible.
- The Principle of Ecology – Organic agriculture should be based on living ecological systems and cycles, work with them, emulate them and help sustain them.
- The Principle of Fairness – Organic agriculture should build on relationships that ensure fairness with regard to the common environment and life opportunities.
- The 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 (I.F.O.A.M., 2005b).

4. OBJECTIVES OF ORGANIC FARMING

These are major objectives of sustainable organic farming:

- A high crop yield
- Synchronization between nature and agriculture system by rejuvenation of soil and e nutrient recycling
- Increasing microflora and microfauna of soil, thus enhancing fertility
- Enhancing soil quality without compromising biological diversity in the ecosystem
- Promoting alternative energy resource usage
- Developing equilibrium between crop farming and animal husbandry
- Keeping animals in an environment which is close to their natural habitat
- Preserving and applying traditional knowledge in farming and management

5. COMPONENTS OF ORGANIC FARMING

Various components of organic farming are meant for better soil structure and its management for good yield, farm waste recycling by composting to produce organic manure, weed management system by non-chemical and non-toxic means and addition of biofertilizers instead of any chemical fertilizers.

5.1. Crop and Soil Management

Soil organic matter is an important factor governing soil fertility, which can be enhanced by good farming methods. Fertile soil should have good water holding capacity, cation exchange and be less prone to soil erosion. The use of green manures is one of the aspects of organic farming which carefully manages soil by enhancing its biological activity. Crop rotation, and inter-cropping are involved in organic farming which help in controlling weeds and also managing chemical and physical properties of soil. Livestock, farm residues or leftover, straw, etc. are used for mixed cropping which keeps a check on the leaching of essential nutrient from surface soil and reduce soil erosion.

5.1.1. Crop rotation and inter-cropping

Organic agriculture is basically dependent on soil biology and soil health. Various organic farming practices which include crop rotation, mixed cropping and inter-cropping are believed to help in increasing soil life by enhancing soil properties and its biological activities. According to Jean-Paul Courtens (a farmer) “rotations balance soil-building crops (soil improvement crops) and cash crops, and can allow for bare fallow periods to break weed cycles and incorporate plant matter into the soil”. So a legume crop can be followed by high nitrogen demanding crop and then by less nutrient requiring crops in subsequent years. This method keeps a check on weed growth and also helps in nutrient recycling in the ecosystem (Mohler & Johnson, 2009).

Further, inter-cropping is a method which is important to balance ecosystem where intensive agriculture program is going on. In this, different crops can be grown in the same field simultaneously with different requirements. Seeds of two different plants can be sown at the same time or may be with a gap of some period.

5.1.2. Crop residues

In developing countries like India, tonnes of crop residues are left every year which are a great source of nutrient recycling in soil. Generally, crop residues are inoculated with fungal hyphae and spores which enhance soil health and help in organic farming. The crop residues include straws, stalks, bristles, cobs of maize and halms of beans, peas, potatoes, etc. Thrashing sheds are also included like oil cakes, rice husks, peanut shell, Indian millet and pearl millet (Mohler & Johnson, 2009).

5.1.3. Organic manure

Organic fertilizers or manures are the keys to sustainable and well-managed soil. They improve the quality of soil without compromising ecosystem health. Different biological sources like plant or animal residues can be used for composting. Organic manure enhances the biological activity in the soil which increases the availability of inorganic nutrients in the soil and increases humus for good crop yield. National Organic Program (NOP) has set standards for the proper usage of organic manure for conventional farming methods. Organic manure is generally categorized into bulky and concentrated organic manures (Santhoshkumar et al., 2017; Migliorini & Wezel, 2017).

Bulky organic manure, which is comprised of well-decomposed animal excreta like dungs, urine and also other farm residues and regarded as Farm Yard Manures. Bulky organic manure also includes compost and most importantly green manures. Compost is humus like material produced from organic waste due to microbial activity in anaerobic conditions. Compost can be made from farm waste and also from household waste. Green manures are actually the crops grown for the benefit of soil. Green manure not only increases the fertility of the soil by addition of surplus inorganic nutrients, organic matter, microbial growth and humus but also prevents soil erosion, leaching of nutrients and controls weed growth. Green manures are generally used for sustainable annual cropping systems. These plants are only grown for the benefit of soil and not for grazing or harvesting purposes. Green manure plants are the part of crop rotation method. Legumes are important green manure as they fix atmospheric nitrogen into the available form of nitrogen in the soil with the help of nitrogen-fixing bacteria present in their root nodules. Some of the legume plants used as green manures are *Sesbania aculeate* (Dhaincha), *Vigna unguiculata* (Cowpea), *Melilotus parviflor* (Senji), *Cyamopsis tetragonoloba* L. Taub. (Cluster Bean), *Crotalaria juncea* (Sun hemp),

Trifolium alexandrinum (Berseem clover), *Sesbania rostrata* (jantar), etc. Although non-legume plants do not fix nitrogen in soil but they can be used as green manure as they prevent leaching of some important soil nutrients and thus are an essential part of green manure. Non-legume plants are generally used to increase biomass in soil for good crop yield. Non-legume plants used as green manure are *Jatropha*, *Fagopyrum esculentum*, *Neem*, *Hibiscus viscosa*, *Vitex negundu*, *Calotropis gigantean*, *Delonix regia*, *Derris indica*, etc. There are two ways of green manuring in India- Green leaf manuring in which green leaves, twigs are collected from the plants grown in fields or wastelands and then mixed in soil. Another way is known as On-farm green manuring which are actually the legume plants growing as green manure in the same field under crop rotation method. Although bulky organic manure has lesser nutrients than concentrated organic manures, but are widely used in developing countries like India.

In case of concentrated organic manure, some of plant and animal material containing higher amount of nutrients can be used as organic manure. Meat and bone meal, blood meal, fish fertilizer, horn fertilizer and hoof meal are readily used to make concentrated organic manures.

5.2. On-farm Waste Recycling

Organic waste recycling is very important for sustainable farming as it suppresses the consumption of expensive and harmful chemical fertilizers. Farm and household wastes, including pruned branches, straw, and discarded parts of fruits and vegetables undergo composting, anaerobic digestion, and thermo-chemical treatments (catalytic, pyrolytic and hydrothermal), which lead to maximum recycling. This leads to a reduction in the usage of conventional chemical fertilizers and other energy sources. Industrial waste, household waste, and wastes from MCD is also an important component of organic waste (Santhoshkumar et al., 2017; Migliorini & Wezel, 2017).

5.3. Weed Management in Sustainable Agriculture

To avoid the use of herbicides and chemicals on farms, alternative and sustainable weed management methods are practiced in organic agriculture. This includes cultural weed management methods like crop rotation, crop and cultivar choice, increasing crop density by higher seeding rates, row spacing for earlier canopy closure, weed control by mechanical and physical methods, tillage, soil heating by solar radiation,

inter-cropping, stale seed bed, mulching, hand weeding, biological weed control and bioherbicides (Tahat et al., 2020).

5.4. Biofertilizers

Excessive use of chemical fertilizer not only deteriorates the quality of soil but its long usage also compromises human health. Long term use of chemicals in soil has a negative impact on microflora and microfauna. So for the overall benefit of the ecosystem, an alternative method is essential. Microbes are an important part of this, as they increase crop yield by increasing the availability of micronutrient in soil and thus increases soil productivity. Some useful strains of microbes like bacteria, fungi, and algae are used as biofertilisers (Santhoshkumar et al., 2017).

5.4.1. Symbiotic nitrogen-fixation

A type of biotic interaction- symbiosis is useful in fixing atmospheric nitrogen into various forms of nitrogen in the soil which is readily available to plants. The symbiotic relationship between legume plants and *Rhizobium* bacteria is very useful for nitrogen fixation in soil. *Rhizobium* bacteria live in the root nodule of leguminous plants which make available atmospheric nitrogen in the soil for the plants.

5.4.2. Asymbiotic nitrogen-fixation

Some organisms like blue-green algae (BGA), Mycorrhizae, bacteria like *Azospirillum* and *Azotobacter*, *Azolla* (a small aquatic plant) can decompose soil organic matter and by chemical reaction converts nitrogen from the atmosphere into available forms like nitrates, nitrites, ammonia, etc. in soil without establishing any symbiotic relationship with other organisms.

5.5. Bio-pesticide

Biopesticides are biological agents producing toxins that are harmful to the pests invading plants. Secondary metabolites like alkaloids, phenolics, terpenoids, etc. are produced as active biopesticides against nematodes, insects, fungi and other pests. Biopesticides check the growth of nematodes, fungi, insects and other pests and kill them. A few examples of biopesticides are Pyrethrum, Nicotine, Neem, Margosa, Rotenone etc. (Santhoshkumar et al., 2017).

5.6. Vermicompost

In vermicomposting, certain earthworm species are used where they are fed organic waste materials and after digestion gives out the granular form (cocoons) known as vermicompost. Vermicomposting requires moderate environmental conditions where microorganisms and earthworms are used. Vermicompost are rich in micronutrients and macronutrients, phytohormones and also contains microflora essential for the growth of plants (Santhoshkumar et al., 2017).

6. RELATIVE ADVANTAGES OF ORGANIC FARMING IN INDIA

NPOP takes care of accreditation for certification bodies, organic production standards, and organic agricultural marketing, among other things. Importing countries acknowledge Indian organic products that have been certified by India's certification bodies (Shukla et al., 2013). In India, there are six accreditation boards recognized by the Ministry of Commerce, namely- APEDA, Coconut Development Board, Tea Board, Directorate of Cashew and Cocoa, Spices Board, and Coffee Board. The accrediting boards authorize certification agencies to certify organic goods in accordance with the established standards. The Government of India also designated accreditation agencies and certification through these boards and agencies is now required, particularly for export markets (Singh et al., 2019; https://apeda.gov.in/apedawebsite/organic/NPOP_certification_bodies.pdf). Singh et al. (2019) highlighted the relative advantages of organic farming in India. India excels at producing high-quality crops such as tea, spices, rice varieties, and medicinal herbs. It has a long history of agricultural practices that may be used to build organic farming methods. Agriculture in various parts of India is not extremely intense in terms of using agrochemicals, especially in mountainous and tribal areas, which makes the transition to organic farming easier. Organic farming practices have proven to provide equivalent or even higher yields on marginal soils than conventional farming (particularly in the humid tropics). In India, labour is relatively inexpensive in comparison to input costs, favouring the transformation to less input-dependent, but more labour intensive production processes, as long as acceptable yields are attained. India's non-governmental organisations (NGO) sector is quite robust and promotes organic farming by providing training, information, extension services, and marketing services to farmers.

7. CURRENT STATUS OF ORGANIC FARMING IN INDIA

In India, organic farming is no more an alien concept. In reality, the earliest scientific approach to organic farming may be traced back to the later Vedic period's Vedas, which emphasized living in peace with mother nature instead of exploiting her. Several organic inputs are also mentioned briefly in our ancient literature such as the Rigveda, Mahabharata, Kautilya's Arthasashthra, Ramayana etc. Organic farming has its origin in ancient agricultural techniques that have evolved over millennia in innumerable villages and farming groups (Singh et al., 2019). Organic agriculture accounts for approximately 1.5 % of global agricultural output. Due to its diverse agro-climatic conditions, India has a lot of potential for producing a wide range of organic products. In some parts of the country, the practice of organic farming is an added bonus. This provides an opportunity for organic producers to tap into a market that is gradually expanding both domestically and internationally (http://apeda.gov.in/apedawebsite/organic/Organic_Products.htm).

As of 2020, India ranks eighth in terms of organic agricultural land and first in terms of the total number of producers, according to APEDA 2020-21. (Willer & Sahota, 2020). As of March 31, 2021, the total area under organic production (as defined by the NPOP) was 4339184.93 hectares. This comprises a cultivable area of 2657889.33 hectares and a wild harvest gathering area of 1681295.61 hectares (Table 1.) Madhya Pradesh is the leading organic producer among all the states, followed by Maharashtra, Karnataka and Rajasthan (Figure 3).

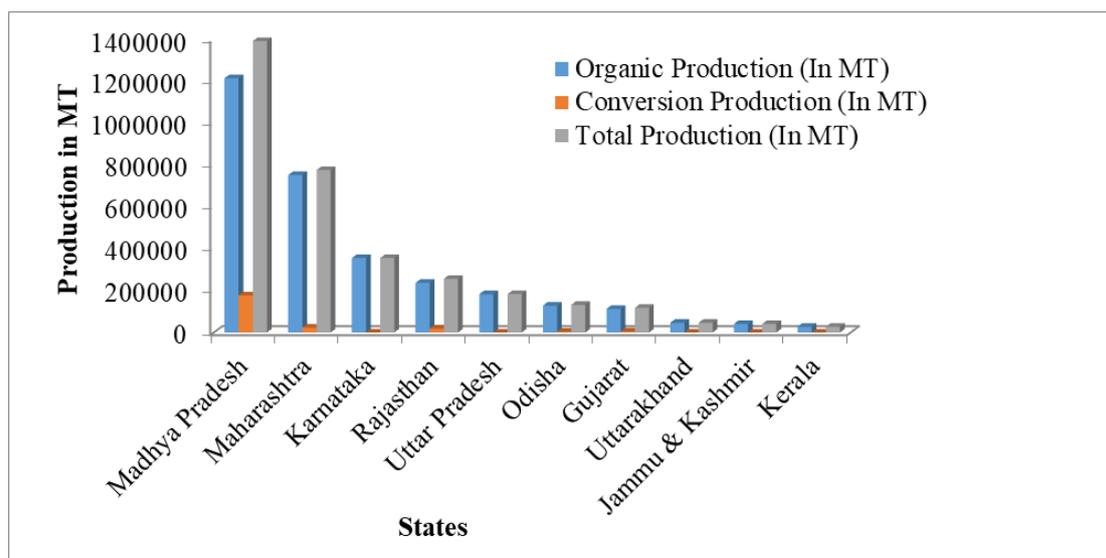


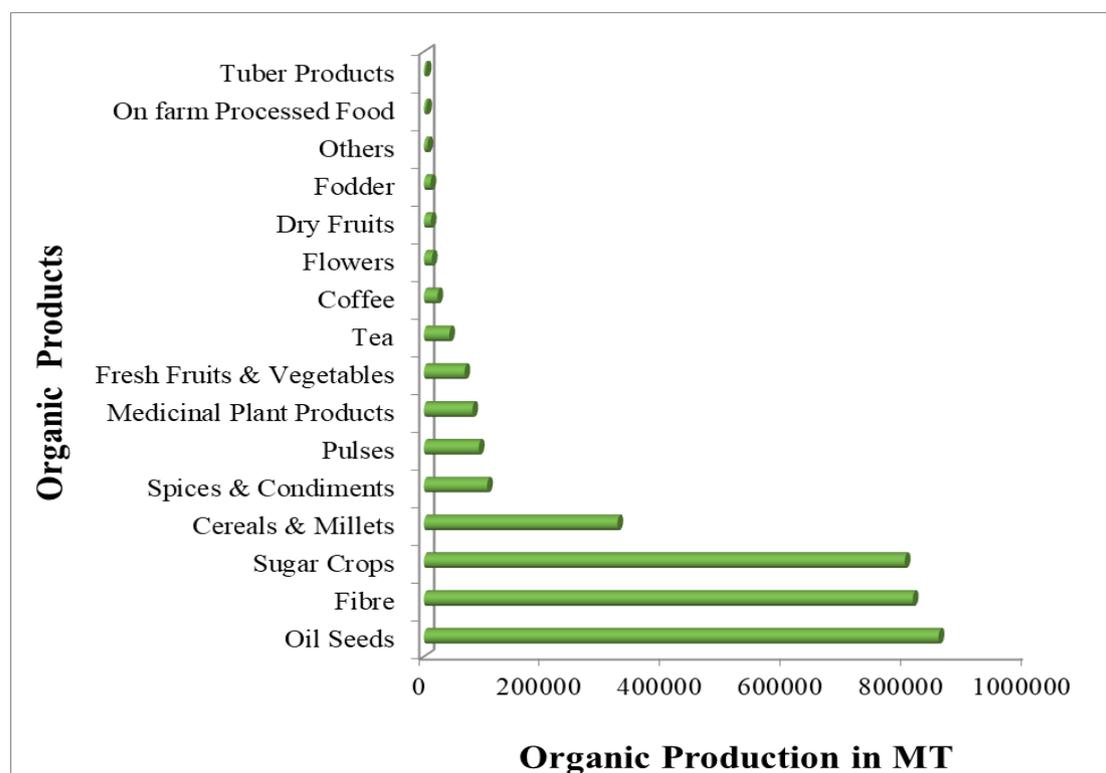
Figure 3: Indian state wise organic production in the year 2020-2021

Table 1: Organic production in India for the year 2020-21

S.No.	Organic Production in India	
1	Total Area (Cultivated and wild harvest)	4339184.93 ha
2	Total Production (Farm and wild harvest production)	3496800.34 MT
3	Total Exports quantity	888179.68 MT
4	Total Export Value (INR)	707849.52 Lakhs
5	Total Export Value (US\$)	1040.95 million USD

Source: https://apeda.gov.in/apedawebsite/organic/data.htm#Summary_Statistics_2021

India has generated around 3496800.34 MT (3.496 MMT) of certified organic harvests, which includes processed food, oilseeds, sugar crops, cotton, pulses, cereals and millets, plantation crops (tea and coffee), spices, fruits, dry fruits, vegetables, medicinal plants etc. with a maximum production of oilseeds, followed by fibres, sugar crops, cereals and millets (Figure 4).

**Figure 4:** Production of organic products (In MT) during year 2020-2021 in India

Sikkim made the incredible achievement of changing its whole cultivable area (around 75000 acres) to organic production in 2016. So far, Sikkim is the only Indian state that

has achieved complete organic status. Organic farming accounts for only a minor portion of the total planted area in the majority of states. The ranking of top seven states in terms of organically certified land is as follows: Madhya Pradesh>Rajasthan>Maharashtra>Chhattisgarh>Himachal Pradesh>Jammu & Kashmir>Karnataka (http://apeda.gov.in/apedawebsite/organic/Organic_Products.html).

Indian exports were 888179.68 MT in the year 2020-21. Around INR 707849.52 lakhs were realised through organic food exports (1040.95 million USD) (Table 1). In terms of realising the value of exports, processed foods, such as soya meal are the most popular, followed by oilseeds, cereals and millets, plantation crop goods including tea and coffee, spices and condiments, medicinal plants, dry fruits, sugar crops, and others (Table 2; https://apeda.gov.in/apedawebsite/organic/Organic_Products.htm)

According to APEDA 2020-2021, the top ten countries where organic products get exported are the USA, with maximum export in terms of quantity (500935.95 MT) followed by European Union (267076.35 MT), Canada (69142.41MT), Great Britain (20844.14 MT), Korea Republic (4536.34 MT), Israel (4480.12 MT), Switzerland (3924.64 MT), Ecuador (3708.05 MT), Vietnam (3276.59 MT), Australia (2923.47 MT) etc. (https://apeda.gov.in/apedawebsite/organic/data.htm#Summary_Statistics_2021).

Table 2: Percentage export value realization of organic products in India (2020-2021)

S.No.	Organic products	Percentage export value realization
1	Processed foods including soya meal	57%
2	Oilseeds	9%
3	Cereals and millets	7%
4	Plantation crop products such as Tea and Coffee	6%
5	Spices and condiments	5%
6	Medicinal plants	5%
7	Dry fruits	3%
8	Sugar Crops	3%
9	others	5%

Source: https://apeda.gov.in/apedawebsite/organic/data.htm#Summary_Statistics_2021

8. SOCIO-ECONOMIC IMPLICATIONS AND CHALLENGES ASSOCIATED WITH ORGANIC FARMING

Organic farming is an environment friendly method that guarantees sustainable development; preserves and maintain soil fertility, provides employment, assures long term income and thus promises better livelihood to the farmers. Organic farming is based primarily on the use of natural resources and integrates traditional knowledge and skills of the organic system thereby having a positive effect on the environment's health (Das et al., 2017; Das et al., 2020; Singh, 2021). Organic foods offer various nutritional, health as well as safety benefits. This is one of the major reasons of their growing demand which is a result of growing concern and awareness among the public regarding food safety and health issues. Thus, purchasers are willing to pay the elevated price for these products which are comparatively greater than products derived via conventional farming. These organic products also have a longer shelf life as they have lesser nitrate content and an elevated amount of antioxidants (Mukherjee et al., 2018; Das et al., 2020).

India has a history of practising the indigenous method of organic farming in numerous rural areas and with the availability of huge area under natural organic cultivation, it possesses immense potential for the cultivation of organic products. Presently, it is one of the leading organic producers in the world. As per the Agricultural and Processed Food Products Export Development Authority and report of the Research Institute of Organic Agriculture, India ranks 8th with respect to organic agriculture land and holds 88th position in regard to fraction of organic crops to agricultural land. There are several states in India like Himachal Pradesh, Kerala, Karnataka, Gujarat, Maharashtra, Madhya Pradesh, Uttarakhand, Rajasthan, Sikkim and Tamil Nadu that majorly practise as well as promote organic farming among their farmers (Willer & Lernoud, 2017, 2019; Das et al., 2020).

Organic farming is a labour intensive and thus is a costly method but this problem can be overcome as the family members of small-scale producers work on subsistence or small holdfarms. Besides this, organic farming is based on use of the available local or natural resources which further cuts down the cost of production. As it is labour demanding system, it can also help in eradicating poverty by providing employment

opportunities in developing countries, particularly for the small holder and farmers with small resources. It promises increased sustainable income, better livelihood and access to education and health facilities (Kleemann, 2011; Jouzi et al., 2017).

The cost of organic products is reported to be 10%–40% more than the food crops grown by conventional methods that depend on various parameters in the terms of both input and output costs involved. The input factors that result in the higher cost is due to various reasons like a high cost for getting the organic certification, labour intensive, be deficient in subsidies available on organics like in India, but on the contrary, it also minimizes the other input cost involved in the purchase of fertilizers, pesticides, etc. The biofertilizers and biopesticides can be produced locally using plant and animal waste that reduces the investment in chemical inputs. Moreover, despite the low productivity; the profit is significantly higher (22–35%) in organic farming which is because of the price premium of these organic products (Nemes, 2009). It also promotes social capital by promoting NGO and social organizations at both local as well as regional levels and encourages farmer's organizations too. The small scale holders can derive numerous benefits like bargaining rights, access to markets and credits facility, low certification costs etc. (UNEP, 2008). It has a positive role in the occupational health of farmers as it reduces their exposure to agricultural chemicals (Das et al., 2020).

As organic farming is based on the application of indigenous knowledge and skills, thus producers can apply their knowledge and skills rather than learning new methods and this encourages sharing their knowledge regarding their traditional practise. This method is also profitable for women running deficit of credits, thus empowering and enabling them to provide better nutrition to their families as well. This also provides opportunities to augment their income by growing cash crops that require little input (Seufert, 2012).

There are several examples of organic projects that have employed small-scale farmers like organic tea production in Sri Lanka and China, cotton (India), rice (Philippine), honey (Ethiopia) and pineapple (Ghana) (Kleemann, 2011; Panneerselvam et al., 2012; Fayet & Vermeulen, 2014; Girma & Gardebroek, 2015; Qiao et al., 2015). According to studies, organic farming in countries like India and China is beneficial for farmers with

low income and small scale holders, living in more difficult environmental situations. There are several reports where it has been found that organic cultivation increases the income of these farmers. For example, the income of farmers producing organic cotton in India was increased by 10 to 20% and in Kenya, increased by 40% (UNEP, 2008; Jouzi et al., 2017). It is reported that the price premiums of these organic products are between 10 and 300% and farmers get 44–50% of this price premium. Hence adopting organic farming can help in eradicating poverty in developing countries and also decreases the risk of failure of the main crop through numerous ways like intercropping, rotation and other agroforestry systems (Müller, 2009; Jouzi et al., 2017).

Thus it has been observed that organic farming involves low cost input, possesses less risk and provides a high price premium, enhances social competence; empowers farmers and women with low income and no credits; sustainable source of income, improved livelihood and health and also helps in improving the quantity as well as the quality of the natural resources. Thus cultivation via organic farming is more feasible for poor farmers in contrast to conventional methods of farming and promoting organic farming among poor and small scale holders could be one of the best strategy in overcoming various socio-economic problems as discussed above (Jouzi et al., 2017; Mariappan & Zhou, 2019; Das et al., 2020).

9. CHALLENGES AND DRAWBACKS ASSOCIATED WITH ORGANIC FARMING

The demand for organic products and subsequently organic farming has been reported to get increased all over the world. Despite of numerous advantages it offers in terms of preservation of natural resources, protection of environment, better food quality etc., a shift to organic farming still remains a big challenge in developing countries like India. Besides other drawbacks, government policies in regard of promoting organic farming is one of the biggest challenge in India (Bhardwaj & Dhiman, 2019; Das et al., 2020). Also, other constraints like lack of good marketing; proper agricultural policies and guidelines; in apt marketing of organic input; complexity involved in certification process; lack of proper education and research among small scale holders and farmers; lack of awareness; scarcity of biomass; paucity of good quality of manure and seeds;

dearth of livestock; difficulty in soil nutrients management; low yield as well as failure in achieving the desired quality of the organic produce; lack of constancy in quality of the produce, organic pesticides are less effective in comparison to chemical pesticides; labour intensive process and thus high input cost, lack of finances or credits; insufficient infrastructure; inability to meet the export demand (like high price related to quality, paper related work is a complicated as well as time taking process and lack of proper economic amenities required for quality assessment both for input as well as organic produce which opens up the possibility for fake products in the market resulting in loses of trust and interest in the product among the consumers (Barik, 2017; Bhardwaj & Dhiman, 2019; Das et al., 2020). Organic farming has a major disadvantage in that it produces low yield which in turn is balanced with the high price premium and low input cost involved in producing organic products. However, in India, organic produce does not offer a high price premium, thus decrease yield leads to lower profit if they are sold domestically. Other limiting factor is that a large number of farmers belongs to a marginal and small category and therefore, to support organic farming in a country like India, the government needs to invest to provide financial incentives to the farmers. There is a need to bring out more schemes wherein cooperation with non-government agencies, they should help in the certification process and provide special training to the farmers to enhance their knowledge and skills that are required for the production, processing and for the marketing strategy of organic products. Besides financial assistance, they need to be supported by extension programmes on how to use their own input resources instead of purchasing and relying on outside resources and also there is a need to encourage them in making associations and trade unions to improve their marketing efficiency (Barik, 2017; Das et al., 2020; Yadava & Komaraiah, 2021).

10. FUTURE PROSPECTS OF ORGANIC FARMING

Agriculture is the main source of livelihood in India and accounts for 20-30% for each household income (Qiao et al., 2015). Organic farming has been a traditional practice in India. However, the increasing population posed a huge pressure on agricultural land to produce more in order to meet the food demand which consequently forced to shift to conventional mode of farming. Conventional farming is an intensive process which

requires use of fertilizers, pesticides and herbicides; use of genetic modification tools, recent agricultural techniques and irrigation methods, etc. Conventionally agricultural products have been found to have an adverse effect on health due to the occurrence of elevated levels of pesticide residue, antibiotic residue, nitrate, hormones, heavy metals etc. Thus the demand for organic products has increased in the past as a result of growing knowledge and awareness among consumers regarding the nutrition, health and safety issues related to food.

India is bestowed with a variety of naturally occurring organic nutrients which is more suitable for the organic cultivation of a wide range of crops. Moreover, the climate and soil conditions of India's drylands are also appropriate for organic agriculture in comparison to the convention system (Barik, 2017; Jouzi et al., 2017; Das et al., 2020; Yadava & Komaraiah, 2021). Interestingly, India also has a history of traditional farming methods where indigenous farmers and natives have been making use of their traditional knowledge and skills and using organic fertilizers and pesticides made from wastes derived from plants and animals. In many parts of India like the north-east, hilly areas and several rural areas have been practising organic farming for quite some time where very less amount of chemicals are required. The traditional farmers also have deep knowledge as to how to maintain the fertility of the soil and pest disease management which would be of great value in organic production (Deshmukh & Babar, 2015; Gour, 2016; Das et al., 2020). Thus organic farming can help in restoring and maintaining the ecological health of these drylands.

Organic farming though requires less investment, but being a labour-intensive method increases product cost. However, labour here in India, being in abundance and inexpensive, it is feasible to adopt organic farming. It involves less investment, less risk, promises increased income, assures debt-free and better livelihood for farmers (Barik, 2017; Das et al., 2020).

At present, India is the biggest producer of organic products and was assigned the eighth position with organic cultivable land of 1.78 million ha in the world, in 2017 (Willer & Lernoud, 2017, 2019; Das et al., 2020). The rising demand for organic produce in developed countries and government policies supporting their exports are the major

factors accountable for the growth of organic food industry in India (Das et al., 2020). Several technologies like nanobiostimulants and mycorrhizal fungi as bio fertilizers, sensor tools to map cultivatable land areas, spatial geodata, 3D Printers, better drip irrigation, Bee Scanning App; Inhana Rational Farming Technology; production from waste and side streams along with major, site specific farming (precision agriculture), and agro-environmental practices were invented to boost organic farming. The growing demand for organic products along with these innovations and their implementation will further confirm the feasibility of organic cultivation. This would help in promoting farmers to adopt organic farming even without the requirement of any subsidy and premium price (Nova-Institut GmbH, 2018; Barik, 2017).

The government of India has been trying its best by starting programmes and bringing out various schemes to popularize organic farming among farmers. There are also several schemes initiated by public institutions for example- NPOP, Paramparagat Krishi Vikas Yojana- sPKVY, etc. Different Non-profit Organisations-NGOs are also putting in a lot of effort to popularize organic farming practise in India (Yadava & Komaraiah, 2021). The PGS-India i.e. Public Guarantee System India is spreading in many states of India. In this system, the farmers share their information about their organic practices; organize themselves for the common-pool resources in addition to other programmes that work towards the self-interest of farmers to achieve both economic as well as health benefits of farmers (Lemeilleur & Allaire, 2019; Yadava & Komaraiah, 2021). Thus promoting the adoption of organic farming can facilitate in achieving both an economically and ecologically sustainable nation.

11. CONCLUSION

Organic farming is an economical and environmental-friendly method that has immense potential in preventing environmental degradation as well as improving socioeconomic status. Organic food is rapidly gaining popularity all over the world as a result of growing concerns and awareness among consumers regarding nutrition and food safety and health issues. It produces safe and healthy nutritious food with very less or no contaminants, also decreases the risk of crop failure, promises high net return, is less dependent on the outside or purchased farm inputs, decreases the financial risk and assures the improved

livelihood of the farmers. It is also economically practical to carry out organic farming as it reduces input costs and in turn, farmers get a higher premium price for their produce. However, the conventional producers have better economies of scale in comparison to organic producers. However, favouring and supporting the premium price of organic produce and providing accessibility to the marketplace would encourage the farmers to opt for organic farming. Moreover, the various innovative organic farming methods will further help promote organic farming among poor farmers by ensuring economical and ecological production. Therefore, practising the indigenous method of organic farming, providing better organic market facilities, support funding, training, education and awareness programs would facilitate in production of more land for organic farming for profitable, healthy, as well as sustainable agricultural production.

CONFLICT OF INTEREST

The authors have no conflict of interest to declare that are relevant to the content of this article.

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