



Futuristic Agriculture (Organic Farming) in India: A Review

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Abstract

Agriculture covers around 38% of the land surface of the earth, it is a major source to greenhouse gas emissions, species extinction, agrochemical contamination, and soil degradation, even though it offers increasing amounts of food and other items. Most of these environmental impacts are caused by agricultural land, which accounts for around 12% of total land cover. It will be difficult to produce more food of 9 to 10 billion people by 2050 while also conserving the ecosystem. Our best chance of overcoming this big challenge and guaranteeing future food and environmental security is to adopt truly sustainable agricultural techniques on a large scale. Worries about commercial agriculture's longevity have sparked interest in alternative agricultural systems such as organic, diversified, and conservation agriculture. Organic farming produces lower yields on average than conventional farming, which constitutes just for 1% of worldwide agricultural production. If majority of the farmers adopt to organic techniques, the observed production differences may widen even more due to increased expertise needs. Organic agriculture's massive adaptation will result in further damage to natural resources as well as higher output prices, making food less accessible for poor customers in developing nations. Organic foods are in growing market because people believe they are healthier, tastier, and more ecologically friendly than conventional items. Organic agriculture has an enormous role to play in the development of appropriate agricultural systems, but no one technique will be able to feed the world safely. Instead, a combination of organic and perhaps other new agricultural practises is required.

Keywords: Organic Farming; Conservation; Conventional; Pesticides

Abbreviations

GMO: Genetically modified organisms; IFOAM: International Federation of Organic Agriculture Movements; N: Nitrogen

Introduction

Organic agriculture started modernising the main industrial countries like Britain, Germany, and the United States as an alternate to rising intensive agriculture, notably the use of inorganic nitrogen compounds in the 1930s and 1940s. After World War I, the machinery for the manufacturing of weapons, which was based on the Haber-Bosch method for fixing nitrogen, was switched to N fertiliser manufacturing. Consumer worries about the detrimental effects of conventional agriculture on human, animal health and the ecosystem are driving the increase in demand [1].

Most people, particularly in industrialised nations, where the food cultivated organically is nutritious than food grown conventionally. Organic farming, often known as biological or ecological farming, blends traditional protection of natural resources farming techniques with contemporary agricultural technology. Organic farming has such a strong national reputation in Europe that it is sometimes referred to as the basis for sustainable agribusiness. According to a representative study which was conducted in Germany, about half of the public views broader use of organic production as an essential method for combating world hunger. Synthetic pesticides and genetically modified organisms (GMOs) are often seen as serious dangers to agricultural production, according to the same study [2-4].

Organic agriculture is still less well-known in poor nations, but European opinions and food preferences are beginning to gain traction, particularly among better-off urban customers. Organic farming methods are typically seen to be even more ecologically benign than traditional cultivation systems, according to reviews and meta-analyses. Advanced machinery, improved crop types, soil and water management practises, and the newest developments in animal nutrition and management are used by organic farmers. These systems range from stringent complex systems that are beyond certified organic standards by limiting passive components, as well as more typical systems that meet certified organic requirements [5,6]. Organic farms also tend to have higher species diversity, faunal variation (insects, soil fauna and microbes, birds), and ecological and environment diversity. Most operational groupings in organic agricultural systems, such as herbivore, pollinator, competitors, and providers (plants), are more complex. Furthermore, in study covering eight western and eastern European countries, pesticides and fungicides typically had negative consequences on the environment, with insecticides significantly decreasing the bio-control capabilities in farming methods [7-9].

of the first organic certification guidelines in European and the United States, kicking off a continual development of certifiers that currently encompasses 282 organic certifying organizations working in near about 168 countries [10,11]. This growth of certifiers shows a complicated record of often conflicting individual norms, as well as a need for global access to certifiers. Many farms in developed and developing nations use organic farming but do not have certified organic sustainability. Producers on the other hand, are widely resorting to accredited organic farming systems to verify production practises, reduce dependency on finite resources, find high valued trades and premium pricing, and increase farm profitability [12,13]. Even though the prerequisites differ slightly among certifying agencies, they generally favour soil health, agronomic practices, animal and plant diversity, physiological functions, and animal welfare, while preventing radiation exposure, wastewater sludge, genetic modification, antibiotic prophylaxis, and virtually all chemically synthesized pesticides and fertilisers [14]. With changing technology and socioecological situations, standards continue to develop; some criteria are based on scientific fact, while others are motivated by ideology. Organic farming calls for a variety of crop and animal rotations, as well as the merging of several farm businesses including the use of leguminous crops for fixing atmospheric nitrogen [15]. A planter must contact multiple segments of these foods through cultivating a greater array of more nutrition and protein-rich crops, whether for exporting or survival. Subsequently 841 small organic and conventional farmlands in the Philippines, scientists noticed that between 2000 and 2007 Utilization of vegetable and mineral intake increased 2 to 3 times more than that for organic farmers than for conventional farmers [16-18].

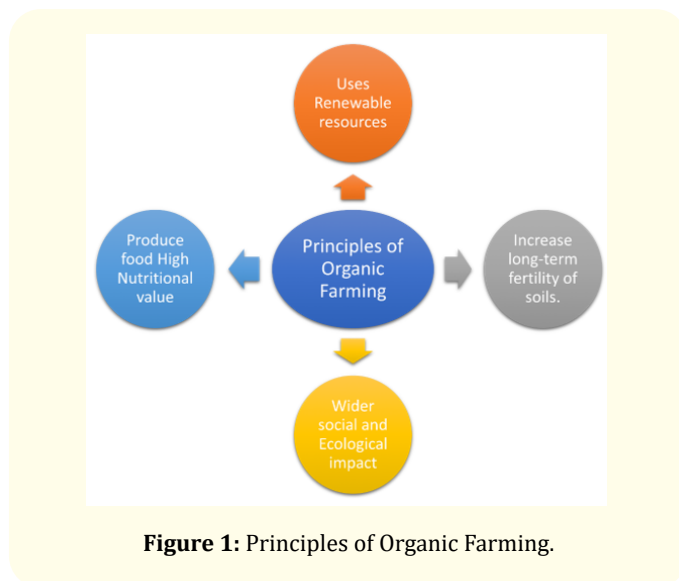


Figure 1: Principles of Organic Farming.

Early discoveries of diverse benefits

Rudolf Steiner defined the ideas of Biodynamic Agriculture, an early operational version of Organic Agriculture, in Germany in the 1920s. This Biodynamic method follows precise compost production formulas, incorporates a significant metaphysical part into agricultural activities, and is classified as “organic plus metaphysical.” The demand of organic foods grew, driving the development

Production oriented

On either hand, it’s likely that organic farmers are consistently more competent than conventional farmers, resulting in overestimated production differences when compared actual organic and non - organic yields. Surprisingly, these studies have attempted to account for adverse selection when calculating organic farming yield impacts using statistical data. Even though the prerequisites differ slightly among certifying agencies, they generally favour soil health, agronomic practices, animal and plant diversity, physiological functions, and animal welfare, while preventing radiation exposure, wastewater sludge, genetic modification, antibiotic prophylaxis, and virtually all chemically synthesized pesticides and manures [19]. With changing technology and socioecological situations, standards continue to develop The situation is more nuanced

| Region | Countries | Share (%) |
|---------------|-----------|-----------|
| Asia | 43 | 86 |
| Africa | 48 | 80 |
| Europe | 48 | 92 |
| Latin America | 39 | 69 |
| Oceania | 12 | 41 |

Table 1: Countries and territories covered by survey on organic agriculture 2020.

Source: FiBL survey 2022.

| Region | Land (ha) | Regions Share (%) |
|------------------|-----------|-------------------|
| Africa | 2086859 | 2.8 |
| Asia | 6146235 | 8.2 |
| Europe | 17098134 | 22.8 |
| Northern America | 3744163 | 5 |
| Latin America | 9949461 | 13.3 |

Table 2: World Organic agricultural land and regions shares of organic farming.

Source: FiBL survey 2022.

than kilos of food per hectare, yet yield is a crucial sustainability statistic. Conventional agricultural practises have improved food and other resource availability, but at the risk of the other major environmental goals. Traditional agricultural practises have led to environmental degradation, public health issues, crop variance and genetic species extinction, as well as substantial impacts on ecological functions. Externalities with negative consequences are ignored. In terms of sustainability, organic farming practises beat conventional agricultural systems, indicating that can bit more balance several sustainability targets. We suggest, based on current research, that organic agricultural methods provide lower returns than conventional agriculture. Organic farming methods outperform conventional agricultural systems in terms of sustainability measures, indicating that they can bit more balance several sustainability goals [20-21]. It has been proposed that, while organic farming methods offer lower yields than traditional farming, which are further financially and ecologically pleasant, but supply as or more nutritionally dense foods with fewer or no environmental toxins, based on current research. Preliminary research suggests that organic agriculture improves the supply of ecological systems other than produce, and certain social and environmental sustainability advantages. Furthermore, the corpus of exploration of arti-

cles has a strong bias favouring industrialised territories, whereas research in under-developed countries, particularly in arctic and sub-arctic environments, ought to be considerably expanded [20].

Enhanced income

In organic and non - organic comparative research, few economic analyses have taken into consideration favourable or unfavourable externalities, as well as related market price. Given that organic production has a poorer ecological impact than non-organic farming, placing the burden on the harmful outwardness created by farming, such as soil corrosion or nitrate leaching into groundwater, will indeed make organic agriculture much more economical [21-24]. Furthermore, switching to organic farming has been expected to reduce the negative externalities of agricultural production in the UK by 76%, from \$1,845 million yrs.’ to\$ 470 million yr. Several research have examined ecosystem benefits in organic and non - organic agricultural systems [25]. A handful of these research have taken into consideration the monetary worth of ecosystem services; in general, these studies suggest that conventional farming techniques reduce farms’ capability of producing some economically ecological benefits when compared to organic farming practises. In a study involving 14 organic and 15 conventional fertile land fields in New Zealand, the overall economic valuation of three ecological systems such as control of insect pests, soil structure, and crop nutrient mineralization in organic fields was considerably higher at US \$231 ha/yr: compared to US \$145 ha/yr: in non-organic fields [26-28].

There is minimal or no threat for chemical pesticide contamination of surface and ground waterways since organic agriculture employs nearly no synthetic pesticides. Regarding nitrate and phosphorus runoff, as well as greenhouse gas releases. However, when expressed per unit of production, this gain is much less obvious, and in some cases overturned, application of organic farming’s lower land-use efficacy in developed countries [29]. Organic farms showed lower levels of nitrate percolation, nitrous oxide pollution, and ammonia pollution per unit of field area than conventional farms, but higher levels of leaching and emission per unit of production. The widespread use of nitrogen and phosphorus fertilisers has been linked to serious degradation of groundwater and marine environments across the world, culminating in eutrophication of freshwater and the establishment of hypoxic zones in coastal waters [30]. Social wellness goals have been embraced by organic certification programmes. Organic farmers as well as other employees should be able to sustain themselves and other employ-

ees with decent wages while operating in safe and adequate circumstances, according to the International Federation of Organic Agriculture Movements (IFOAM) regulations [31,32]. Animals that are organically accredited must be raised in humane settings that allow them to exhibit their natural behaviours and demands. Organic production regulations in the EU, the US, and Japan mandate cattle have approach to fresh air or grazing wherever feasible, and ill animals to be handled as needed, including the use of antibiotics if necessary. Organic farming may increase food security by diversification on-farm agricultural and animal activities, broadening revenue streams and increasing diet diversity.

Betterment of resources

Organic systems offer an advantage when it comes of water allocation and accessibility because soils treated using organic techniques have superior water-holding capacity and higher rates of water infiltration. This is one of the reasons why organic systems, especially in dry circumstances, are thought to become more durable and yield stable. Organic farms are more sensitive to insect outbreaks, resulting in lower yields and greater unpredictability. The prohibition of synthetic pesticides and genetically modified organisms (GMOs) restricts farmers' ability to successfully manage weeds, harmful insects, and crop diseases [33]. Organic agriculture productivity disparities are greater in high pest pressure situations, where insects and illnesses that are difficult to manage using biological approaches are prevalent, than in lower pest pressure conditions. The reported production discrepancies in organic agriculture can be explained in part by nutrient restrictions. Lower yield grade disparities for legume and fruits are understandable in this context [34,35]. Because legumes can fix nitrogen from the atmosphere, they are less reliant on nitrogen from outside sources than other crops. Fruits develop on trees with extended growth stages and thicker root systems, enabling them to metabolise faster in accordance to crop requirement.

Quality of food produced

When tried to compare to conventionally grown foods, organic foods contain little or no chemical pesticide residues. Children who consume conventionally grown foods have much greater amounts of organophosphate pesticide compounds in their urine than children who consume organically grown foods, according to studies. The American Academy of Paediatrics concluded in 2012 that eating an organic diet minimises children's pesticide exposure and offered tools for parents looking for information on which foods have the most pesticide residues [36]. The types and amounts of pesticides used in traditional farming determine whether this

distinction is important to human health. In affluent nations with relatively strong pesticide laws, the danger of exceeding maximum allowable concentrations is often insignificant in terms of other hazardous compounds. Most assessments imply that organically grown products have considerably greater amounts of secondary metabolites such phenolic, which are nutritionally advantageous. The effects for vitamin C and carotenoids are varied. Organic milk and poultry have higher quantities of omega-3 fatty acids. Organic products included somewhat lower levels of proteins and amino acids. However, it is unclear if these nutritionally beneficial component changes between organic and conventional diets are clinically significant [37]. Because agricultural techniques can impact plant chemistry, certain discrepancies in the content of nonorganic foods may not be surprising amounts of omega-3 fatty acids in animal products may be connected to outdoor feeding and more diversification in organic agricultural pastures. Organic agriculture has an unexplored impact on global food and environmental safety; however, no one farm technique can feed the world safely. For future global food and ecosystem safety, a combination of organic as well as other novel farming methods, agroforestry, integrated farming, mixed crop, livestock, and yet-to-be-discovered methods are required. Integrated farming methods, which combine largely organic with some conventional techniques, have already been proved to be more sustainable than traditional agricultural systems and are anticipated to play a key role [38]. More than merely establishing sustainable agricultural systems throughout the world is required to achieve global food and environmental security. Food waste must be reduced, food distribution and access must be improved, the human population must be stabilised, food transformation to fuel must be eliminated, and consumption habits must shift onto a more plant-based meal amounts of omega-3 fatty acids in animal products [39,40]. Integrated farming methods, which combine largely organic with some conventional techniques, have already been proved to be more sustainable than traditional agricultural systems and are anticipated to play a key role. More than merely establishing sustainable agricultural systems throughout the world is required to achieve global food and environmental security. Food waste must be reduced, food distribution and access must be improved [41,42].

Human welfare

Farming systems, both traditional and alternative, perform well in terms of social justice (for example, concerns of gender, race, ethnicity, and class) and farm worker quality of life. Due to a lack of study, little info is known about families and communities. According to available statistics, both organic and non - organic ag-

ricultural systems must make substantial improvement to achieve social sustainability goals. Organic farming, on the other hand, has been demonstrated to offer certain sociocultural advantages, such as favourable changes in community economic growth, enhanced social contacts between farmers and consumers, and higher farm worker employment and collaboration. Organic farming, while requiring more physical labour on the farm, decreases farm workers' exposure to harmful chemicals and other pollutants [43,44]. One thing to remember is that most of the research in poor nations is based on case studies of regions where organic farmers have benefited from developmental projects. Rigorous training in organic agriculture methods, facilitation of access to certified markets, and financial incentives are common forms of project assistance. As a result, even if farmers profit greatly under such conditions, upgrading these advantages would be difficult unless other farmers and communities receive the same extensive assistance. Organic farming is not a method that expands naturally in underdeveloped nations because of more farmers following in the footsteps of early pioneers [43,44]. Another key consideration is that most organic farmers in undeveloped nations have traditionally grown cash crops for export. These examples' results cannot be applied to the cultivation of food crops for the home market. When considerable price premiums for organic products can be gained, positive socioeconomic impacts for farmers are most probable. While some high-income customers in developing nations are ready and able to pay a higher price for organic goods, many local consumers are impoverished and unable to afford major rising prices [45].

Discussion

Farming by using organic practices is far better and feasible method in traditional agriculture, products obtained from this method will have more nutritious values compared to other methods, and it reduces soil and air pollution, utilizing many hazardous chemical fertilizers and pesticides. India was the place where organic farming takes place abundantly in the world. Organic farming leads to safe environment. Integrated agricultural methods, which combine largely organic with some traditional means, have already been found to be more ecological than traditional cultivation system and are expected to play a key role. Merely establishing sustainable agricultural systems throughout the world is required to achieve universal food and environmental protection. Food waste must be reduced, food distribution and access must be improved, the human population must be stabilised, food converting to fuel must be eliminated, and consumption patterns must shift on to a

more plant-based diet. This is no easy endeavour, but the implications for food and environmental security are enormous. To achieve this, the complete arsenal of successful policies, scientific and social economic achievements, farmer innovation, and community opinion will be required.

Organic farming and foods over previous three decades overall amount of cropland under organic farming has continuously expanded since 1984. In 2017, a total of 69.8 million ha of organically managed land were registered worldwide, representing a 20% increase of 11.7 million hectares over the previous years. This is the most significant increase in organic agricultural history the nations with the biggest acreage of organic farmland documented in 2017. Australian has the most organic fields with 36 million hectares, and India is in ninth place with 1.8 million hectares of available organic farmland. Gujarat, Cochin, Kannada, Uttarakhand, Gangtok, Rajasthan, Maharashtra, Tamil Nadu, Madhya Pradesh, and Himachal are the key states in India that practise sustainable farming. According to the Agricultural and Processed Food Products Trade Development Agency and the report of the Research Centre of Food And agriculture, India placed 9th in terms of organic farmland and 87th in proportion of organic crops to farmland [47-49].

Conclusion

There are various areas where further study is needed to expand our knowledge of sustainable agriculture's impacts. To begin with, most of the research on yield climate and operational consequences that are accessible focus on industrialised countries. Extensive studies in underdeveloped nations in appropriate methods would be extremely beneficial. Secondly, several recent research using farm statistics do not adequately account for selection bias. More way of obtaining research is required. Third, while various studies have shown that organic farming may be economic with current subsidies and development initiatives, it is less evident if organic farming can be successful without such support.

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Conflict of Interest

Authors declare no conflict of interest.

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