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# **Impact of Organic Farming on Sustainable Agriculture System and Marketing Potential: A Review**

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## **Authors' contributions**

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

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## **ABSTRACT**

Organic farming helps to improve the health of agro-ecosystem by its holistic approach using on-farm agronomic, biological and mechanical methods in exclusion of all synthetic off-farm inputs. Although the organic farming is eco-friendly, question arises about possibility to adopt the organic farming for the large scale and its impacts on maintaining the productivity of land to meet the food security challenges from the ever-increasing population of the world. But at the same time, consumer's behaviour and consciousness toward the safe and healthy food enforced the thinking of farmers toward the organic farming which is more lucrative due to high market demand and value of organic produce. This paper mainly addresses about the present status and future scope of organic farming especially in North eastern region of India, State of Sikkim, Indian and Global scenario and to investigate the major external and internal factors that influence the whole organic system including production and marketing of organic commodity.

**Keywords:** *Organic farming; sustainable agriculture; organic markets; organic food; consumer behaviours etc.*

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## 1. INTRODUCTION

The exploiting population and to meet out their need for food full of nutritional values is an incredible concern of world since early 21<sup>st</sup> century. The resources available through nature are bending their backs with limited reserves and over exploitation by human beings is making scenarios worst for current agriculture practices. The interdependency on environment and ecosystem for valuable resources for own benefits of peoples are largely indicating much broader scenarios and worst future for upcoming generations for exploiting and sustaining livelihood for food and nutrition. [1–6] These changing scenarios have forced major advancements in global food system. Despite increasing quantity of food production in last few decades, the climate change in agriculture and malnutritional food production causing widespread environmental and health impacts are seen due to overdosing and excessive use of chemical fertilizers, plant protection agents and pesticides on ecosystem.[7–10] The worldwide impacts both incremental and decremental are seen through declining performance of modernized agriculture.[11–13]

Last few decades of Indian agriculture have shown drastic changes with phase of Green evaluation to farm mechanization, irrigation advancements, use of high yielding varieties, chemical fertilizer and pesticide exploitation. Conventional farming practices have shown food grain production increase in many folds and achieved food self-sufficiency in India. The achieved practice has yielded lots of problems like degradation of soil health, human health issues and climate change. Majority of soil degradation issues like salting, waterlogging, soil acidity, alkalinity and erosion are increasing with use of synthetic pesticides and fertilisers. Also, production processes based on conventional fuels is attributing to climate change by pollution. Currently, agriculture is seen as major contributor of Greenhouse gas (GHG) emissions.[14–18] According to Patra and Babu (2017)[19] India is one of largest contributor to GHG emissions and climate change and being signed a Paris agreement, India is making bold moves to mitigate GHG emissions and climate change through various initiatives and promotion to organic agriculture is one of it. This review has been based on various researches, reports, reviews and communications as mentioned in references and is formulated on the concept of providing a deep review of organic food, its

status in India and abroad, comparison of organic and conventional agricultural practices, soil health, food packaging and marketing and consumer behaviour.

## 2. ORGANIC FOOD AND CONSUMER'S BEHAVIOUR

Consumer's perspectives of organic farming and organic foods are misunderstood despite they are not new to them. Practice of Organic farming is not new and has been employed by humans in last few thousands of years. [20–22] The rise of health issue and carcinogenic problems has made people aware of healthy practices of food through organic food. There is consensus that organically produced food is healthier than conventional food.[23–26] But there are some researchers which do not agree the proposition and reported no significance difference present in the organic and conventional food. [27–35] The nutritional organically grown food consisting of free radicals, antioxidants and minerals can cure and protect the human beings from numerous diseases and has the potential to cure cancer.[36–40] scientific studies focusing on nutritional balances of organic foods and their other products has revealed that polyphenol, minerals, vitamins and antioxidant level in the food may increase with adaptation of organic farming. This increase can be seen in vegetables, fruits, grains and dairy products used in daily diet recommended for proper body maintenance and calorie control. [41–50]

Now a day's people are searching for sustainable agriculture which means the good yield per unit area with minimum impact on ecological system.[51–55] But the question is that can it produce a surplus amount fulfilling the needs of all? The study by Storstad and Bjorkhaug (2003) has shown that there is complete and considerable difference in application attitude of farms towards environment and animal welfare issues when shifting from conventional to organic farming.[56] The critics and various researchers have argued about lower yield from organic farming practices and cannot feed exploiting population as production per hectare is lowering and more agricultural areas are required to produce same amount of food. More required land can lead to issues affecting ecosystem through deforestation and biodiversity loss. It is also reported that organic yields are lower than the yield obtained through conventional farming, ranging from 5% to 34 %. [57–62]

Organic food consumers have always shown a positive approach for buying but the number of consumers is still very low compare to inorganic food. It is below one per cent in some southern, central and eastern European countries and 5% in Austria and Denmark.[63–67] A lot of literature is available on the theoretical and practical aspect of different organically managed food and organically processed food. [68–70] This paper mainly focuses on the concept organic farming, organic food production, processing and marketing strategies and future growth of organic market along with the status of organic market throughout the world.

### 3. WHAT IS ORGANIC AND WHY ORGANIC?

It is evitable that organic farming system and its products are beneficial for environment and health compared to conventional farming practices. [23,33,53,58,62,71,72] The regulation of organic farming at international level is governed by various bodies like Food and Agriculture Organisation (FAO), European Commission (EC), United States Department of Agriculture (USDA) and international federation of organic agriculture movements (IFOAM) through various Codex Alimentarius, EC guidelines, USDA organic regulations and IFOAM standards. [73] Despite variable definitions and conceptuality of organic farming and organic food, basic idea remains same globally. According to Nadia Scialabba [74], organic agriculture is defined as a holistic approach of agriculture production and management which avoids use of synthetic soil enhancers and crop protection methods, biotechnological advanced organisms to minimise the environmental pollution and health impacts optimizing the health and productivity of interdependencies. According to the IFOAM, organic agriculture is a production system that have sustainability of soils, ecosystem and people by relying on ecological processes, biodiversity and cycles adapted to local conditions, rather than the use of adverse affecting inputs and which combines traditional, innovative and scientific way to benefit all ecosystem, people and environment. [75] In Indian context, the term organic food can be referred as the food or product produced from agricultural activity, processed organic crops without using chemical and synthetic agents for consecutive three years.[76] Promotion of organic farming or agriculture provides the aim of balancing environment thus can have synonyms

like ecological farming, biological farming or zero budget farming. [77-79] The organic system follows system the organically fed animals and have less fat content as compare to conventionally fed animals. Weight of organically fed hen's egg albumen reported as 54.6% of egg's total weight whereas, conventionally fed hen's egg albumen weight reported 55.7% of total egg's weight. [80,81]

### 3.1 Overview of World's Organic Status

Inorganic farming practices and grown food have impacted drastic issues throughout world. The focus of whole world is shifting towards organic farming.[82,83] According to recent data till 2018 about 186 countries started actively practicing organic farming. But the share of organic farming land to the total agricultural land is only 1.5 % which is very low. In the last few decades, the dramatic increase in the total organic agricultural land was observed, total organically managed land in 1999 was 11 million hectares only but in 2018 it reached to 71.5 million hectares. Due to increase in the total land and market size, farmers showed interest in organic farming. Thus, involvement of farmers increased in organic farming and it reached to 2.8 million in 2018. India ranked 1<sup>st</sup> with 1.149 million organic producers in the world followed by Uganda and Ethiopia. In 1999, organic market size was reported to 15.1 billion Euros but in year 2018, it reached to 96.5 billion Euros.[84] The growth rate of organic market seems very fast as compared to other markets. [85,86]

From the Fig. 1, it is observed that there is almost linear growth towards the increase in number of countries for adopting the organic agriculture over the period and the world's attention is increasing towards the organic sector. Fig. 1 also revealed that gradually more countries are participating in the organic mission throughout the world. More attraction for the adoption of organic agriculture may be due to degradation in the health of soil and human which mainly due to the use of inorganic substances in the modern farming system. According to recent survey about 70% consumer purchase organic food to avoid the hazardous effects of pesticides.[87–90] The world is having numerous scopes for marketing opportunities of organic produce. USA is the largest single market in the world followed by European Union and China.[84]

From Fig. 2, it is observed that Oceania had the maximum organically managed agricultural land

followed by Europe, Latin America, Asia, North America, and Africa. Socio-economic conditions of the region may be the reason for least contribution of Africa in the organic farming.

### 3.2 Overview of India's Organic Status

India is a home for organic producers and farming is the main business of Indian population as 60% people directly rely on it. India accounts about 2.4% of the world's geographical area and provides shelter to about 17% of the world's

human population and 15% of the livestock. [91] Continuous developments in the agriculture and agri-based sectors have played an important role towards the sustainable growth and development of the Indian economy. Total geographical area of the country is 328.73 million hectares consisting of about 142.02 million ha net sown area.[92] Organic farming is a state of art in India and is being followed by the farmers from the ancient times.[93] In India, small and marginal farmers cultivate 44% of the area but their contribution towards national food security is immense.[94]

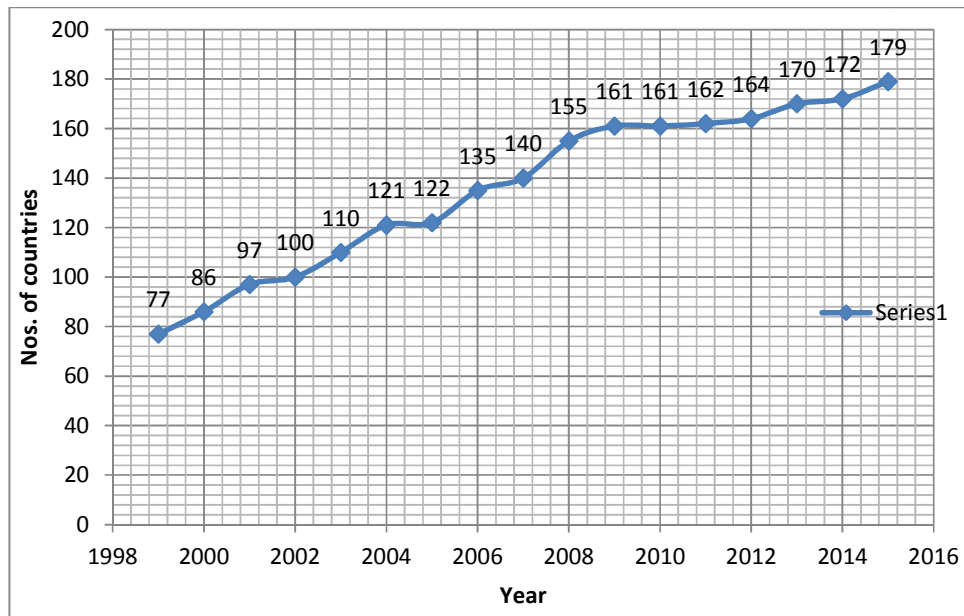


Fig. 1. Development of the number of countries with organic agriculture (Source: FiBL-IFOAM-SOEL-Surveys 1999-2018)

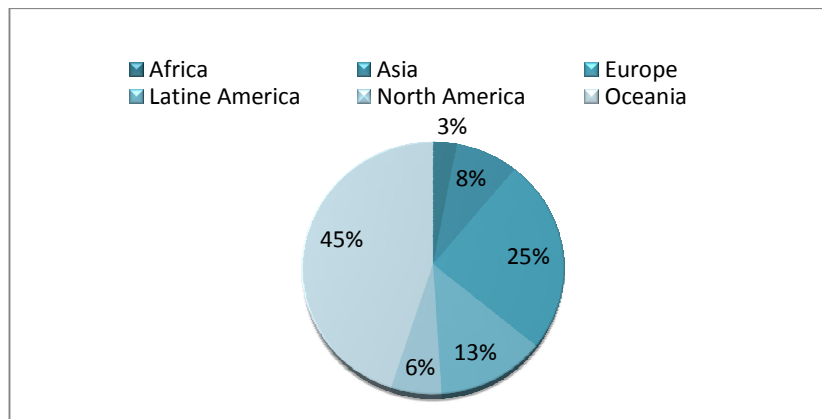


Fig. 2. State-wise details of total area under organic certification process (Source: FiBL survey, 2017)

Being applied and used from ancient times Organic farming system in India shows promising views as a method of farming produces sustainable production and can utilize available organic farm wastes in location itself. [95,96] Organic farming system avoids the use of synthetic and artificial inputs and rely on natural resources only. India has a lot of potential for producing organic produce due to its various agro climatic regions. India holds promise for the organic producers to tap the market which is growing steadily in the domestic market related to the export market. As per the available statistics, India's ranks 9<sup>th</sup> in terms of world's organic agricultural land. [84] The total area under organic certification is 3.56 million hectare (2018). This includes 50% cultivable area with 1.78 million hectare and rest 50% (1.78 million Hectare) forest and wild area for collection of minor forest produces. Area under organic farming in India increased from 42,000 hectares in 2003-04 to more than 14.89 lakh ha in 2015-16.[97] State-wise details of total area under organic certification process are presented in Fig. 3. It is observed that Madhya Pradesh has largest area under organic certification followed by Maharashtra, Rajasthan, Telangana, Odisha, Karnataka and Uttar Pradesh among the states. India produced around 1.71 million MT (2018) of certified organic products which includes all varieties of food products, oilseeds and fibres etc. The total volume of export during 2015-16 was 5.48 Lakh MT. The organic food export realization was around 516 million USD. Oil

seeds (50%) lead among the products exported followed by Cereals and millets (10.4%), Plantation crop products such as Tea and Coffee (8.96%), Dry fruits (8.88%), Spices and condiments (7.76%) and others.[97]

### 3.3 Prospect of Organic Farming in the NEH Region of India

As agriculture in NEH region is rain fed and resource poor farmers are unable to use agro-chemicals, the farming is more or less organic. [98] As the organic farming, in general, has now become economically attractive and rewarding in addition to offering health and environmental benefits, the region is trying to achieve sustainability in organic farming. The organic farming in true sense is related to resource conservation agriculture with no use of chemical inputs. The north-eastern region occupies eight per cent of India's land area and is home for four percent of its population. Agriculture provides livelihood to 70% of the region's population. The NEH region is a net importer of food produce to fulfil for their own consumption productivity is lower and facilities have low proportion of irrigated area and low investment in building irrigation. The region has shown its efforts in growth of fruits, vegetables, and other horticulture products. [98–100]

Fig. 4 shows State-wise details of total area under organic certification process in North eastern region of India.

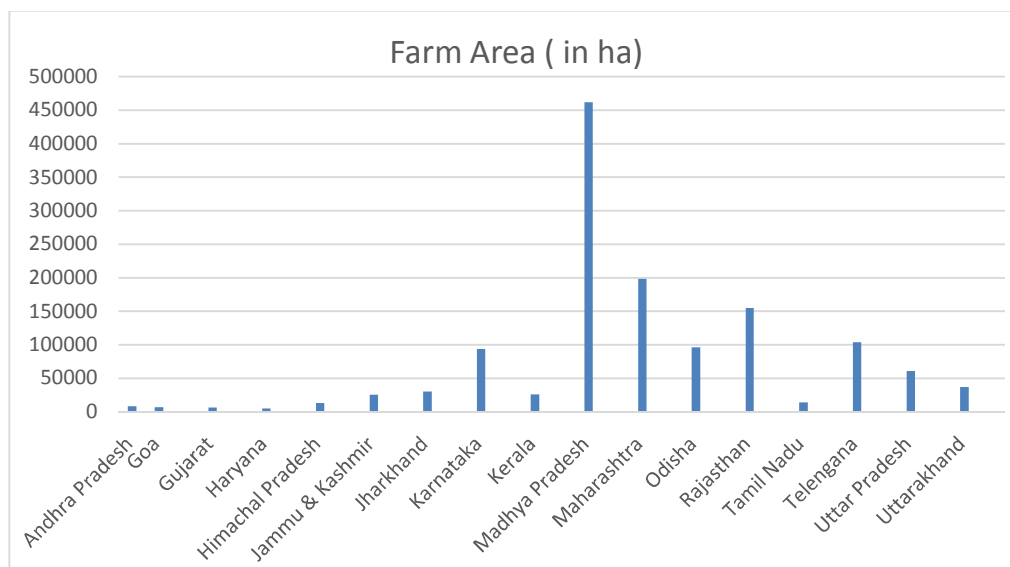
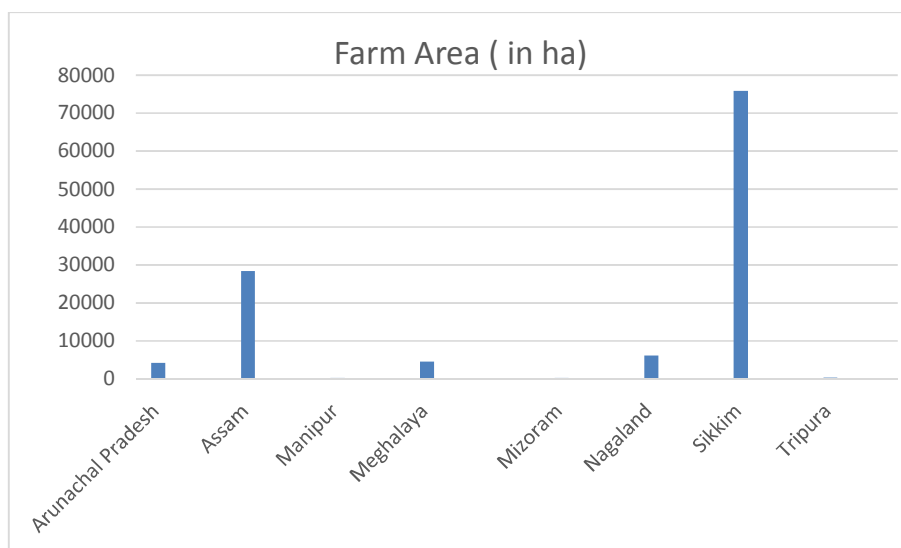


Fig. 3. Share of Farm area state wise for India (Source: FiBL survey, 2017)



**Fig. 4. State-wise details of total area under organic certification process in North eastern region of India**

#### 4. ORGANIC FARMING SYSTEM

With the growing population, demand of food supply is also increasing every year and to accomplish the requirement of increasing food demand, several techniques of organic farming came into limelight that has helped the farmers to produce maximum production per unit land with the minimum use of natural resources.[101,102] For the growth and development of plant, it required different types of nutrients and minerals.[103,104] It is already reported by Bhattacharya (2004)[105] 16 minerals are

essentially important for proper growth and development of plants (Table 1).

There is a wide range of management practices that can be utilized by the organic farmers and growers to maintain and develop the soil fertility in order to achieve the goal of maximum productivity per unit organically managed land.[72,106] It was reported that there were about 2.0 million hectares more of organically managed agricultural land in 2018 than in 2016. [84] The trend for organic agriculture and other tends to change with location, region and climate

**Table 1. Essential elements required for growth of plant**

S. No.	Essential Element	Category	Source
1.	Carbon	NR	Air
2.	Oxygen	NR	Air
3.	Hydrogen	NR	Water
4.	Nitrogen	MACN	Soil
5.	Phosphorous	MACN	Soil
6.	Potassium	MACN	Soil
7.	Calcium	MACN	Soil
8.	Magnesium	MACN	Soil
9.	Sulphur	MACN	Soil
10.	Iron	MICN	Soil
11.	Manganese	MICN	Soil
12.	Boron	MICN	Soil
13.	Zinc	MICN	Soil
14.	Copper	MICN	Soil
15.	Molybdenum	MICN	Soil

# NR, Nutrient; MACN, macronutrient; MICN, micronutrient

also [25,107,108]. According to Kumar et al. (2017)[76] continuous decline in the area and production of major cereal crops were found in Sikkim, India which is a matter of concern in the context of food security in state. Based on the use and purpose of management organic land can further divided into different categories. Apart from cultivation, organic land can be used for rough grazing, permanent pasture, temporary ley, arable production, livestock farming and production of horticultural crops. Conversion from the conventional farming to organic farming, changes the soil nutrient composition and chemical availability in soil. Clark et al. (1998)[109] reported that in organic farming, soil had higher organic C, soluble P and exchangeable K and pH. For the plant nutrients, some of the potential organic sources are crop rotation, crop residue, organic manure, farmyard manure, night soil, sludge, agricultural waste, blood meal, press mud, oil cakes, bio-fertilizers etc. In organic agriculture practice proper soil health management can be maintained through seasonal soil analysis and natural nutrient balancing.[110] There is an another aspect of organic farming researched by various researchers stating that the soils with heavy metals are not feasible for organic agricultural practices as chemical nutrient management strategies are needed to be supplemented.[111,112] Some management techniques are discussed in this paper.

## **4.1 Mixed Farming System**

### **4.1.1 Crop rotation method to manage soil fertility**

Crop rotation is technique in which different plants are grown in a chronic, defined sequence. In crop rotation techniques, cash crops are mixed with the fertility building crops like leguminous that help in nitrogen fixation that maintains the fertility of soil. It is the main mechanism for supply of nutrient within the organic system with addition of external agents to improve the health of soil.[113–115] Rotations can also be designed to minimize the spread of weeds, pests and diseases. A complete crop rotation have different phases including, nitrogen building and depletion phase, availability of other minerals etc. but these all phenomenon should be in the balanced rate to maintain the long term fertility of the soil and optimum production of organic crops.[113–117] Atmospheric nitrogen fixed by the legume-rhizobium symbiosis is made available to subsequent cash crops when the ley is

incorporated and the nitrogen is mineralized through the action of soil microorganisms.[118] Complicated weed management is another drawback of organic farming but studies reveal that weed population density and biomass production may be noticeably control using the crop rotation and intercropping method.[119–122]

### **4.1.2 Management of crop residue**

Crop residues have several potential uses by the people such as food, shelter, feed, fuel and soil amendment. Residue obtained from the crop can be as major source of nutrients for the subsequent crop of the field and this technique can provide additional nutrient to crop and amplify the productivity. Crop residues have the potential for enhancing soil and water conservation and thus, improve the soil productivity and crop yields. According to study conducted by Wilhelm et al. (1986)[123], a positive linear response was found between production of corn and soybean and stover yield and amount of residue applied to the soil surface. The 0.10 Mg ha<sup>-1</sup> and 0.30 Mg ha<sup>-1</sup> reduction has been observed for grain yield and residue yield respectively. Similar type of study conducted by Wilhelm et al. (2007)[124] reported that the amount of corn Stover needed to maintain soil carbon, were 5.25 – 12.50 Mg ha<sup>-1</sup>. This study showed that Stover and other residues improve the productivity and maintain the nutrient in the soil; it also restricts the wind erosion and control water for the high production from the land.

### **4.1.3 Managing additional nutrient in organic farming**

Major objective of use of bio-fertilizers is crop improvement and maintenance of nutritional value of a crop. Use of microorganism in agriculture became popular in recent few decades. Biologically nitrogen and phosphorous solubilization/mobilization by microorganism can provide surplus additional nutrient to soil for the high productivity and healthy yield in organic agriculture. Microorganism metabolic function mainly responsible for the enhancement for the nutrient in soil. By N-fixation, P-solubilization, transformation, decomposition and other biological activities microorganism increase the nutrient content of agriculture land. There are basically three bio-fertilizers used in the organic farming Nitrogenous biofertilizers (NBF), Phosphorous bio-fertilizers (PBF) and Compost bio-fertilizers (CBF). Rhizobium, Azotobacter,

Azospirillum, Blue green algae and Azolla are some microorganism that can use in the organically managed land as NBF for enhancement of nitrogen content of land. Whereas, Bacillus, pseudomonas, VA Mycorrhiza or VAM are some microorganism recommended for all crops as a PBF. [105] Saadatnia et al. (2009)[125] reported that rice seed treated with cyanobacteria, germinated faster than control and increased 53% in the plant height, 66 % in root length, 58% fresh leaf and stem weight, 80% in fresh root weight, 20% in soil moisture, 28% soil porosity and decrease of 9.8% in the soil bulk density and 4.8% in soil particle density. The application of bio-fertilizers not only helps in physical growth but it also increases the chemical and nutrient content in the crops. Akladiou et al. (2012)[126] reported that when the seed and soil of the maize treated with *Trichoderma harziunum* T22 caused an increase of all parameters including physical growth parameters, chlorophyll content, starch content, total protein contents and phytohormones content of applied maize plant. The concept of use of pesticides and fungicides is now a days popular in organic farming with a concept that it should be derived from natural sources. There are number of organic fungicides like Sulfur, Copper, Oils and Bicarbonates are being used in organic farming for disease prevention. [127,128]

#### 4.2 Organic Farming and Resource Conservation Technologies

Organic farming is described as a unique production management system which promises and enhances agro-ecosystem health including biodiversity, biological cycles and soil biological

activity. [129–132] Organic farming has been recommended by National Commission on Farmers as a tool for second green revolution for regions like rainfed areas, hilly and mountain regions of India.[132,133] Organic farming is also believed to be a viable option for sustainable development of farming based rural livelihood of small farmers. In organic farming, use of chemicals, be it fertilizer, insecticides or pesticides, is avoided and the entire ecosystem i.e. plants, animals, soil, water and micro-organisms is to be protected.[134–137] Comparison between traditional methods and recommended management practices are presented in Table 2.

The conservation agriculture that features little or no soil disturbance, no burning of crop residues, direct seeding into previously untilled soil, crop rotations and permanent soil cover through the retention of crop residues and mulching are highly relevant in organic farming. The potential benefits of resource conservation technology in terms of agricultural sustainability, relative to conventional farming are given in Table 3. Some of the advantages and few weaknesses towards the adaptation of organic farming are summarized in Fig. 5.

#### 4.3 Marketing of Organically Produced Commodity in India and World

The world is moving toward organic food and market for organic foods is developing rapidly throughout Europe.[134,138–141] In the purchase of organic food, the major factor play key roles are knowledge about the organic food, consumer perception and cost acceptability of organic commodity. There is growing demand for

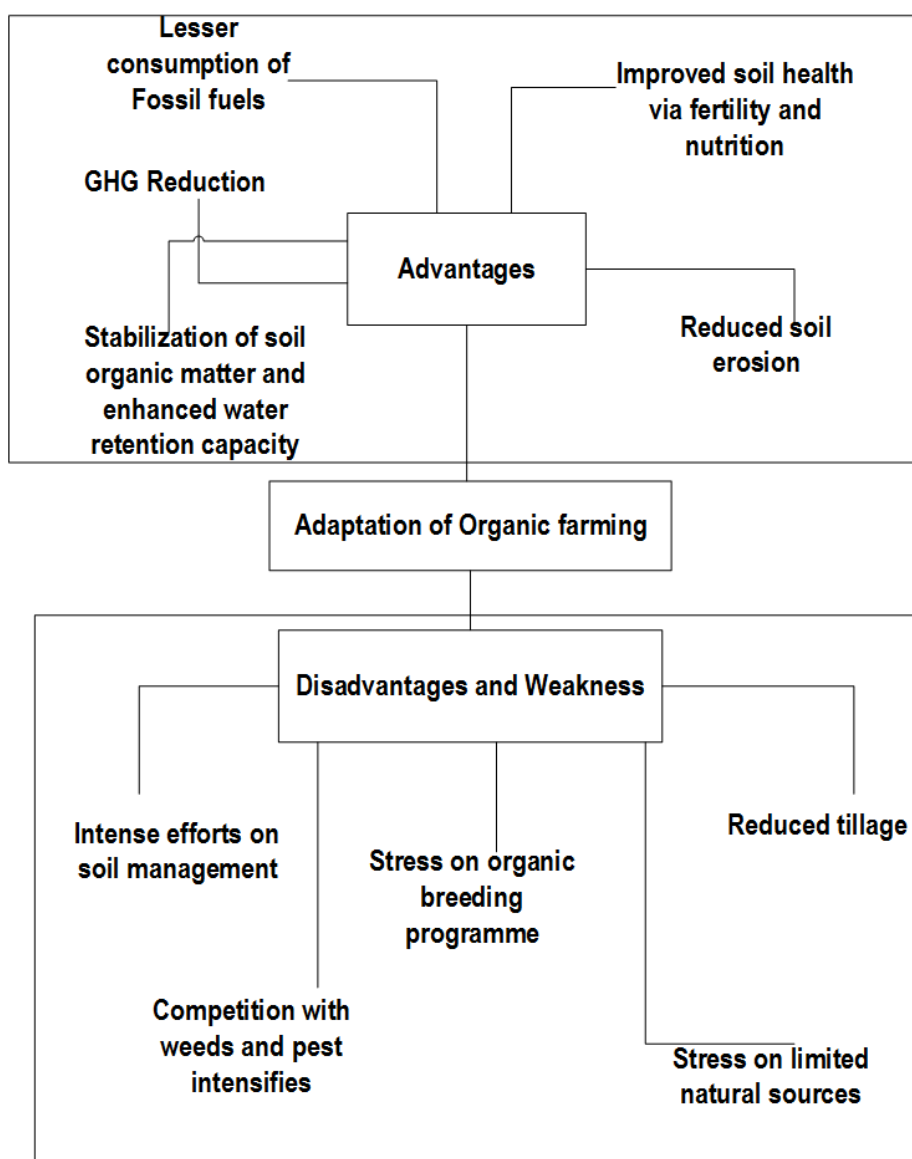
**Table 2. Comparison between traditional methods and recommended management practices**

<b>Traditional methods</b>	<b>Recommended management practices (RMPs)</b>
Biomass burning and residual removal	Residue return as surface mulch
Conventional tillage and clean cultivation	Conservation tillage, no till and mulch farming
Bare/idle fallow during off season	Growing cover crops during off-season
Continuous monoculture	Crop rotations with high density
Low input subsistence farming and soil fertility mining	Judicious use of off-farm input
Intensive use of chemical	Integrated nutrient management, fertilizers with compost, bio-solids and nutrient cycling, precision farming
Intensive cropping	Integrated trees and livestock with crop production
Surface flood irrigation	Drip, furrow or sub irrigation
Indiscriminate use of pesticides	Integrated pest management
Cultivating marginal soils	Conservation reserve programme, restoration of degraded soils through land use programme



**Table 3. Resource conversion technology and potential benefits to conventional farming**

<b>Key resource conversion technology</b>	<b>Potential benefits relative to conventional farming</b>
Zero tillage	Reduced water use, carbon sequestration, increased yield and income, reduced GHGs emission, more tolerance to heat stresses.
Direct Seeding (of rice)	Reduced water requirement, saving in time, better condition of field for succeeding crop, adequate root growth, better tolerance to water and heat stress, reduced methane emission.
Raised bed planting	Less water use, improved drainage, better residue management, less lodging of crop, more tolerance to water stress.
Diversification	Efficient use of water, increased income, increased nutrient security, conservation of soil fertility, reduced risk



**Fig. 5. The advantages and few weakness towards the adaptation of organic farming**

organic food driven by consumer's perception of the quality and safety factor of these food and positive impact on the environment. [134,138–141] Consumer's behaviour toward the acceptability of organic also directly depends on motivational factor. [142,143] For consumers organic food is related to less interference, less processing activities, less or no artificial additives during any stage of processing. [144] Deaton and Muellbauer (1980)[145] explained consumer's behavior in language of preferences and opportunities of choice available. The principal obstacle in the organic farming is lack of information regarding the organic products within the consumers. Organic food several times misunderstood in different prospective by the consumers due to several contradiction and claims and due to lack of proper and defined definition of organic.[145–148] According to researchers the issue of organic food safety and higher nutritional content and potential to cure diseases still under the controversial claims and not proven yet.[27,149,150] According to recent data reported by Willer et al. (2020)[84] and various other resources, organic food market is having higher growth rate as compared to other product market and probably it could happened due to several disease epidemic like foot-and-mouth epidemic, Belgian dioxin scandal, mad cow diseases etc. in the numerous places of the world derived from the conventional food. [151,152] Major challenge in the organic marketing is lacking of branding and certification of organic products. According to result presented by Kumar et al. (2017)[76], Sikkim is 100% organic state of India but still only 19.9% consumers can differentiate between the organic and inorganic foods and 75% consumers prefer organically food products. [153,154] There are three sections of consumer behavior that need to be addressed carefully for the successful marketing of organic food and products: psychological influences, socio-cultural influences and situational influences. [155–157] Apart from the above mention reasons location and types of food products available in market also affect the choice and preference of consumers. In addition to this distribution of organic food has been dominated by supermarket trend in the most of developed and developing countries. [155,158,159] In UK, four chains of supermarket control over 80% sales of organic commodity, whereas; in Australia only two supermarket chains account about 80% organic sales. [160–164] Similarly, in Sikkim, India about 31.41% consumers prefers to purchase organic commodity from the

supermarket. Government owned shops and other regulated shops by different agencies are also working for the growth of organic market and providing scopes to farmers for the better growth of organic market. [165] Preferences and believe of the consumers also give direction to the organic market, according to conclusion of survey reported by Schobesberger et al. (2007)[166] more than 33.33% of respondent having purchased organic fruits and vegetable. Similar result also reported by Kumar et al. (2017)[76] about 28% consumers preferred vegetable and fruits in Sikkim, India. But at the same time world organic market is growing at very high rate for example US organic industry is flourishing with annual increase in consumption of 20% per year.[167,168] As well as world organic market growth rate predicted to increase at the rate of 30%.[169,170] A simple route for marketing of organic commodity including production, marketing, processing and impact on ecosystem is presented in Fig. 6.

#### 4.4 Primary Processing

Primary processing of organic commodity includes operation like cleaning, sorting, grading, waxing, washing and other simple operation that do not change the form of the commodity. Primary processing before packaging help to increase the self-life of commodity and reduce the cost of transportation by eliminating the defected sample from the lot of commodity. Cleaning / washing are required to remove the undesirable parts from the commodity like soil, dirt and other contaminants. Waxing is another primary processing that insures reduction in the water loss during the storage and transportation; natural waxes can be used for waxing of organic commodity to increase the self-life of the commodity. [171–173]

#### 4.5 Packaging of Organic Commodity

The packaging protects from external threat like contamination, mechanical damage, microbial attack, environmental conditions and other external affairs. The package must suit the nature of the containing material. Biological material (Organically produced food) shows respiration, ethylene production, release the heat and other biological activities after the harvesting. Thus, maintaining the level of O<sub>2</sub>, CO<sub>2</sub> and other gaseous composition play major role in safe and sound transportation of organically produced commodity. Packaging of the commodity known as the silent salesman that

contains all the essential and important information about the product. [174–178] According to Zagory et al. (1988)[179], many factors must be taken into consideration in creating gaseous micro-environment for packaged produce to maintain the quality of fresh biological materials (fruits and vegetables). Modified Atmospheric Packaging (MAP), Controlled Atmospheric Packaging (CAP), Active Packaging and other packaging method are useful in protecting and transportation of Organic commodity to short and long distance.[180,181] The presence of mycotoxins i.e. metabolites produced from fungi has to be mentioned on packaging and labels of organic food products as they have harmful impacts on humans and animals. [182,183]

#### 4.6 Marketing Status of Organic Food

India has very big market for the organic food crop and provides number of opportunities to the organic grower for high market value of their organic produce. India having more than 300 million of middle class population which is potential consumers for the organic food market.[180,181] In the recent few years the area under the organic cultivation has increased rapidly. According the recent data in 2013 – 2014 area under the organic cultivation has increased by 0.2 million hectares in India. Major organic crops exported from the India to the different countries consists of oil seed (50%), processed food products (25%), cereals & millets (17%), Tea (2%), Pulses (2%), spices (1%), dry fruits (1%), others (2%). [84]

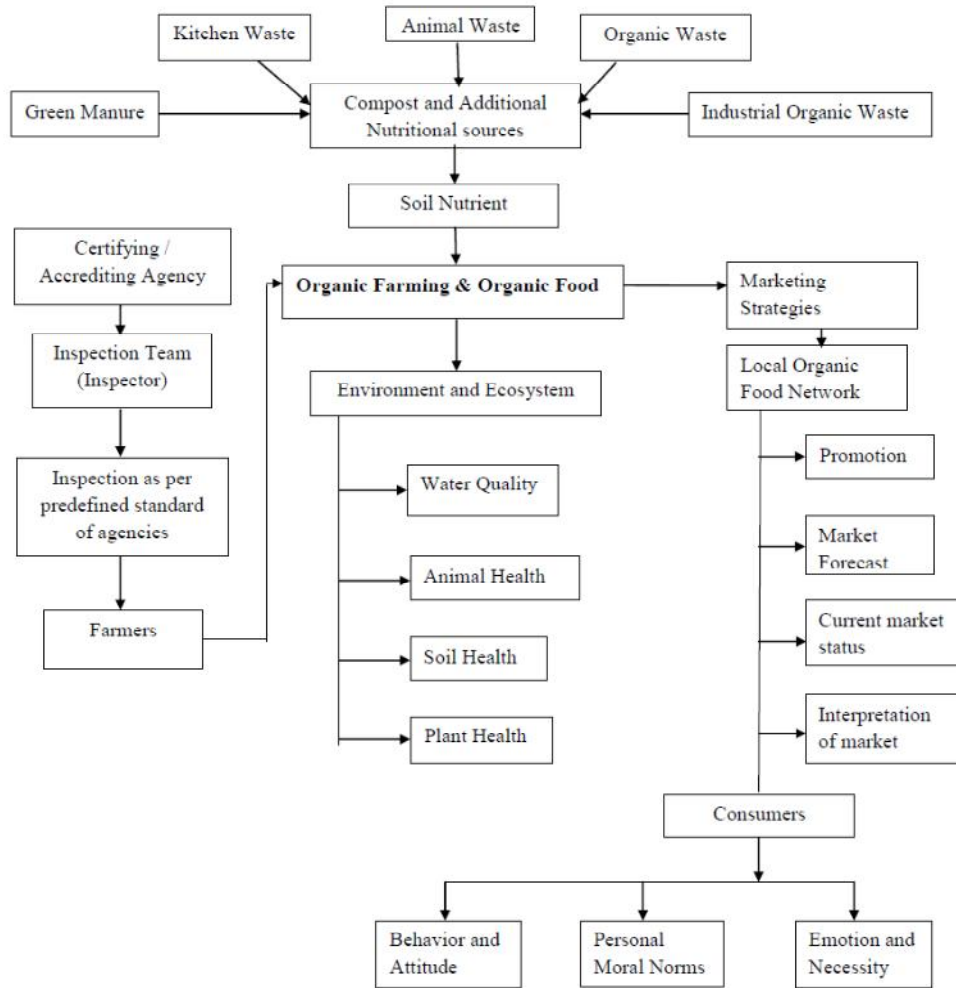


Fig. 6. Simple route for marketing of organic commodity including production, marketing, processing and impact on ecosystem

Indian Agriculture having significant potential to meet the requirement of organic food to the domestic and international market. India having more than 720000 hectares of land under the organic agriculture which is only 0.4% of total land under the organic cultivation worldwide by 2014. Major livelihood function in India is agriculture in which more than 6,50,000 farmers are involved in organic activities by 2014. [184–186] India produced about 1.35 million MT (2015-16) of certified organic products. The major countries where these products get exported are US, Canada, New Zealand, South East Asian Countries, European Union, Australia, Switzerland etc.[187,188] It includes not only food but organic cotton fibers, functional food products also. The major food crops in India which are organically produce are sugarcane, oil seed, cereals & millets, cotton, pulses, medicinal plants, tea, fruits, spices, dry fruits, vegetables, coffee etc.[97]

## 5. CONCLUSIONS

Worldwide conventional mechanized farming helped to increase the food production but over the period come with a host of problems including human health, pollution, degradation of soil and water, and impact on eco system. Organic farming system avoids the use of synthetic inputs and mainly relies upon crop rotations, crop residues, animal manures, off-farm organic waste, and biological system of nutrient mobilization and plant protection. Organic agriculture is potentially capable to serve the twin role of countries' food security and the environment protection. Even though the increasing trend in the organic agricultural area in the country, there is still need for further improvement, especially in the areas of research, extension and awareness among personnel directly or indirectly involved in the organic farming.

## COMPETING INTERESTS

Authors have declared that no competing interests exist.

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