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Organic farming-concept, principles, goals & as a sustainable agriculture: A review

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Abstract
After the independence period, the most important emerging challenge has been to produce sufficient food for the growing population of India. In view of rising population and demand for food production, conventional farming systems cannot be abandoned but organic farming should be certified where it already exists and promoted to the newer areas to the extent possible because it seems safer yet for sustainable agriculture at a time when advanced technologies are still costly and have to be proved safe for long-term development. Organic farming is considered as an ecologically, socially and economically viable agricultural production system. Organic farming is one of the several approaches found to meet the objective of sustainable agriculture. For ensuring sustainable agriculture, organic farming practices mostly relied on biological inputs rather than indiscriminate use of chemical inputs. In organic farming, negative effects of chemical farming are avoided. It is also key approach to solve the problems being faced by agriculture in India today.

Keywords: Organic farming, sustainable agriculture, food security, IFOAM

Introduction

Organic farming based on "Nature can provides for everyone's need but not for greed"……Mahatma Gandhi.

To achieve a more sustainable agriculture that fulfill the feed needs of current population adequately, contributes to rural development and provides livelihoods to farmers without endangering the natural resource basis, we need more changes in the global food system. Organic farming has been proposed as an important means for achieving these goals. Organic farming currently covers only a small area in developing countries but its extent is continuously growing as demand for organic products is increasing. Current agriculture today is leading driver of environmental degradation and a major force driving the Earth system beyond the 'safe operating space for humanity' (Rockstrom 2009) [31]. In developing countries as currently still one in six people are undernourished due to in-sufficient access to nutritious and quality food (FAO 2010) [13]. At presently, the increasing population pressure has forced many countries to use in-organic fertilizers to increase the crop productivity for fulfilling their ever-increasing food requirements. The prolonged and indiscriminate usages of chemicals are resulted in human and soil health hazards along with environmental pollution. Farmers in the developed countries are being encouraged to convert their existing farms into organic farm. (Yadav *et al.*, 2013) [41]. From an agricultural perspective point of view, we need to produce more food in the proper locations at affordable prices, ensuring livelihoods to farmers. The more considerable challenge ahead of us is that to assess the potential contribution of different types of farming systems to sustainable food security. Organic farming as a alternative' farming systems try to mimic ecological processes while minimizing external inputs are often suggested as more sustainable forms of food production. (Rigby *et al*., 2001) [30].

Organic movement in India owes its origin primarily to the work of Sir Albert Howard, who formulated and conceptualized most of the views which were later accepted by those people who became active in this movement (Howard 1940) [18]. Sir Albert Howard was a key founder of the post-industrial-revolution organic movement. To meet objectives of organic farming farmers need to implement a wider range of practices that optimize nutrient and energy flows and reduce risk of crop rotations and enhanced diversity of crop; various combinations of

livestock and plants; symbiotic nitrogen fixation with legumes; use of organic manure; and biological pest control (Scialabba and Hattam, 2002) [34].

As per the definition of the USDA study team on organic farming "organic farming as a production system which avoids or largely excludes the use of synthetic in-organic inputs (such as fertilizers, pesticides, hormones, livestock feed additives etc.) and to the largely 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".

According to the Codex Alimentations Commission (FAO, 2001) [12], "organic agriculture is a holistic production management system which promotes and enhance agro-ecosystem health including biodiversity, biological cycle and soil biological activity".

Organic agriculture is an alternative way for conventional agricultural practices which leads to a sustainable resource utilization and contributes in mitigating the climate change problem.

Concept of organic farming

Organic farming include the concept that the soil, plant, animals, and humans are linked. Concept of organic farming is based on some below mentioned principles:

1 Nature is considered as a best role model for farming, since it does not use any inputs nor demand unreasonable quantities of water.
2 Organic farming system does not believe in mining of the soil of its nutrients and protect the long term fertility of soil.
3 The soil in this system is considered as living entity.
4 On sustained basis living population of microbes and other organisms in soil's are significant contributors to its fertility.
5 Development of biological diversity and the maintenance and replenishment of soil productivity is the major concern of organic farming systems.
6 Importance given on crop rotation, natural predators, biological pest, disease and weed management, resistance varieties instead of chemical control.

The main pillars of organic farming

The main pillars of organic farming (Roychowdhury *et al*., 2013) [32] are as below –

1. Organic threshold standards.
2. Reliable mechanisms regarding certification and regulatory affairs.
3. Technology packages.
4. Efficient and feasible market network

The Principles of Organic Agriculture

To understand the motivation for organic farming, it is important to understand the guiding principles of organic agriculture. These principles encompass the fundamental goals and caveats that are considered important for producing high quality food, fiber and other goods in an environmentally sustainable way. Organic agriculture are based on dynamic interaction between the soil, plant, animals, humans, ecosystem and the environment.

The principle aims of organic production and processing (From IFOAM, 2002) [19]

- To produce food of high quality in sufficient quantities,
- Operation within natural cycles and closed systems as far as possible, drawing upon local resources,
- To maintain long term fertility and sustainability of soils,
- The creation of a harmonious balance between crop production and animal husbandry,
- The securing of high levels of animal welfare,
- The fostering of local and regional production and supply chains, and
- To utilize biodegradable, recyclable and recycled packaging materials;
- To support the establishment of an entire production, processing and distribution chain which is both socially and ecologically responsible;
- To recognize the importance of, and protect and learn from, indigenous knowledge and traditional farming systems.
- To consider the wider social and ecological impact of the organic production and processing system. (23%).

The four IFOAM main principles of organic production. (IFOAM, 2005) [20]

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.

The Important Goals of Organic Farming are:

- A sufficiently high level of productivity
- Compatibility of cultivation with the natural cycles of the production system as a whole
- Maintaining and increasing the long-term fertility and biological activity of the soil.
- Maintaining and increasing natural diversity and agro-biodiversity
- Maximum possible use of renewable resources
- To create an integrated, environmentally sound, safe and economically sustainable agriculture production system.
- Protection of, and learning from, indigenous knowledge and traditional management systems.

Components of Organic Farming

Different components of organic farming are as follows.

1 **Crop and soil management**: Organic farming encourages the use of crop rotations and use of organic manure including green manure for increasing soil organic matter. Carefully management of soil offers some advantages with respect to the increase water holding capacity, ion exchange and reduces soil erosion. Green manuring and inter-cropping of legumes is another important aspect for organic farming systems. It is not only helps in controlling weeds but also in improving its chemical and physical properties by reducing the leaching of nutrients and reducing soil erosion. For success of sustainable agriculture a mixed cropping with

pasture and livestock system is desirable or even essential.

2 **On-farm Waste Recycling:** Increase in price of chemical fertilizers has enabled organic wastes to regain an important role in the fertilizer practices on the farm. Composting of all organic wastes and Farm Yard Manure (FYM) or feedlot manure is important in organic farming.

3 **Non-chemical Weed Management:** Weed management is one of the main concerns in organic agriculture. The some important practices that consider in preventing weed problems are tillage, crop rotation, manure management, use of cover crops, mulches and green manuring.

4 **Domestic and Industrial Waste Recycling:** Among the industrial by products, molasses and press mud from sugar industry have good manurial value. It is important to use only well decomposed press mud at 10 tones/ha. Addition of press mud improves the soil fertility and enhances the activity of microbes. Coir waste can be used as manure after proper decomposition. Use of sewage and sludge for crop production can form an important component of organic farming if treatment and application methods are improved further.

5 **Biofertilizers:** It has been observed that there is decline in crop yield due to continuous apply of inorganic fertilizers. Therefore, increasing need is being felt to integrate nutrient supply with organic sources to restore the health of soil. Bio-fertilizers are the biological active product called microbial inoculates which containing active strain of selective micro-organisms like bacteria, fungi, algae or in combination.

Organic Farming in India

Historical background

The concept of organic agriculture is not alien to India. In fact, the first scientific approach to organic farming dates back to the Vedas of the later Vedic period, the essence of which is to live in harmony with, rather than exploit, Mother Nature. There is brief mention of several organic inputs in our ancient literatures like Rigveda, Ramayana, Mahabharata, Kautilya Arthasashthra etc. In fact, organic agriculture has its roots in traditional agricultural practices that evolved in countless village's and farming communities over the millennium.

More recently, Mahatma Gandhi pioneered organic farming through his constructive programmes in several locations in India. It was the aggressive promotion of the green revolution, which led to a reverse in the spread of the Gandhian movement's organic farming programme. There is evidence to suggest that small farmers, especially in the Third World, are more likely to apply agricultural practices, such as crop rotations and mixed cropping, which are the essential building blocks of organic farming. They also usually combine agriculture with livestock rearing and utilize the manure to replenish the soil fertility. Empirical evidence further suggests that while conventional agriculture goes better with large holdings, organic farming functions better in small farms. A study by Gupta and Verma (1997) [17], comparing grain production in organic vis-à- vis conventional methods, observed that as farm size increases, the advantages of organic rotation become less visible. Further, the study reported that on a smaller scale, organic farming was more profitable and productive than conventional farming.

Government initiative

The lucrative market of the developed world has so far acted as the primary driving force behind the development of the 'certified organic' sector, which is still in a nascent stage in India. According to one estimate, in 1999 merely 0.001 per cent of the total agricultural land in India was under certified organic cultivation. It is predominantly the NGOs and people's organizations that have been spearheading organic agriculture movement in different parts of the country during the last two decades. The Government of India has set up a special cell under the Agricultural and Processed Food Export Development Authority (APEDA) of the Ministry of Commerce and Industries (MOCI). The MOCI has come out with the 'National Programme of Organic Products' (NPOP) in 2000, and the 'India Organic' logo in 2002. While these initiatives have been undertaken to promote exports of Indian organic products, the Department of Agriculture and Cooperation has formulated a 'National Project on Organic Farming' to promote organic agriculture as part of an exercise to curb the use of chemical pesticides and make agricultural activity more eco-friendly. Shifting to organic farming, even if it promises higher returns in terms of better prices and international acceptability in the long run, may not be preferred by the majority of farmers as they are dependent on the farm for livelihood and any departure would affect them immediately. To make majority of small farmers shift to organic farming, several subsidies have to be given on organic inputs. Such initiatives are a step in the right direction, but they should be weighed against the huge subsidies that the Central Government has been providing for the production and import of chemical fertilizers and pesticides. There is a great potential for organic farming to flourish in this country and given an appropriate institutional and policy framework, it will not be very difficult to promote the existing 'de-facto organic' farms to the category of certified organic farms. This would enable the small farmers to take advantage of the lucrative market for certified organic products in the developed world, which could directly contribute towards the improvement of their economic well-being.

Status of organic farming in India

Extent of Organic Area and Production

At present in the world Australia at number one position with total 12, 29, 290 ha area under organic agriculture, in terms of per centage of total land Italy take first position with 9 per cent of total agriculture land cover under organic and with 17, 557 number of organic farms Germany recorded highest organic farms in the world. India stand on 14th rank in the world with 528, 171 ha area comes under organic agriculture and it covers 0.3 per cent area under organic agriculture of total agriculture land and 44,926 total number of organic farms in the country. The Asian countries together currently account only 7 per cent of the total global organic land, China and India being major contributors (Musa *et al.*, 2015) [25].

Table 1: Rank (on basis of total area) under organic agriculture

Rank (on basis of total area)	Country	Area under organic agriculture (ha)	Percentage of total agriculture land	Number of organic farms
1	Australia	12,294,290	2.8	1550
2	China	2,300,000	0.4	1600

3	Argentina	2,220,489	1.7	1486
4	USA (2005)	1,620,351	0.5	8493
5	Italy	1,148,162	9.0	45,115
6	Uruguay	930,965	6.1	630
7	Spain	926,390	3.7	17,214
8	Brazil	880,000	0.3	15,000
9	Germany	825,539	4.8	17,557
10	UK	604,571	3.8	4485
11	Canada	604,404	0.9	3571
12	France	552,824	2.0	11,640
13	India	528,171	0.3	44,926
	World	30,418,261	0.65	718,744

(Source: Ramesh *et al*., 2010) [28]

According to APEDA 2013–14, India ranks 10th in the world in terms of cultivable land under organic certification. The certified area includes 15 per cent cultivable area with 0.72 million Hectare and rest 85 per cent (3.99 million Hectare) is forest and wild area for collection of minor forest produces. The total area under organic certification is 4.72 million Hectare. India produced around 1.24 million MT of certified organic products which includes all varieties of food products namely Sugarcane, Cotton, Oil Seeds, Basmati rice, Pulses, Spices, Tea, Fruits, Dry fruits, Vegetables, Coffee and their value added products. The production is not limited to the edible sector but also produces organic cotton fibre, functional food products etc. Among all the states, Madhya Pradesh has covered largest area under organic certification followed by Himachal Pradesh and Rajasthan.

Table 2: The status of organic production in India (2013–2014)

Total area under certified organic cultivation	0.72 M ha
Forest and wild area for collection of minor forest produces	3.99 M ha
The total area under organic certification	4.7 M ha
Total production	1.24 million MT
Total quantity exported	177766 MT
Value of total export	1328.61 crores

(Source: APEDA. 2014) [2]

The Indian Government has realized the potential significance of organic agriculture for the country and has recently started to support organic agriculture on a large scale and on various levels. A national regulatory framework (standards, accreditation regulations) has already been passed in 2000. There are various schemes and events to support and facilitate exports of organic products (*e.g.* the large conference 'Indian Organic Products – Global Markets' held in Delhi in December 2002, mainly sponsored by the Indian Government). The Ministry of Agriculture announced that various forms of support for organic producers, processors and traders were to be included within the latest five-year plan.

India has other comparative advantages for organic production:

1. India is strong in high quality production of certain crops like tea, some spices, rice specialties, ayurvedic herbs etc.
2. India has a rich heritage of agricultural traditions that are suitable for designing organic production systems. Sophisticated crop rotation or mixed cropping patterns, for example the famous agro-forestry systems of the Western Ghats, facilitate the management of pests, diseases and nutrient recycling. Botanical preparations, some of which originate from the ancient Veda scripts, provide a rich source for locally adapted pest and disease management techniques. The widespread cultivation of legume crops facilitates the supply of biologically fixed nitrogen.
3. In several regions of India agriculture is not very intensive as regards the use of agro-chemicals. Especially in mountain areas and tribal areas, use of agro-chemicals is rather low, which facilitates conversion to organic production. On these marginal soils, organic production techniques have proved to achieve comparable or in some cases (especially in the humid tropics) even higher yields than conventional farming.
4. Compared to input costs, labour is relatively cheap in India, thus favouring the conversion to less input-dependent, but more labour- intensive production systems, provided they achieve sufficient yields.
5. The NGO sector in India is very strong and has established close linkages to a large numbers of marginal farmers. Many NGOs are engaged in promotion of organic farming and provide training, extension services information and marketing services to farming communities.

Accreditation boards in India

Country has recently started to support organic agriculture on a large scale and on various levels. A national regulatory framework (standards, accreditation regulations) has already been passed in 2000. There are various schemes and events to support and facilitate exports of organic products (e.g., the large conference 'Indian Organic Products – Global Markets' held in Delhi in December 2002, mainly sponsored by the Indian Government). The Ministry of Agriculture announced that various forms of support for organic producers, processors and traders were to be included within the latest five-year plan. The Ministry of Commerce has identified six organisations as accreditation agencies of organic products, they are (1) Agricultural and Processed Food Products Export Development Authority (APEDA), (2) Tea Board, (3) Spices Board, (4) Coconut Development Board, (5) Directorate of Cashew and Cocoa, and (6) Coffee Board. These accreditation boards give permission to certifying agencies for certifying organic products, following the prescribed norms. Certification through these boards and agencies has been made compulsory, particularly for export market, as 'the Government of India has issued a public notice according to which no organic products may be exported unless they are certified by an inspection and certifying agency duly accredited by one 22 of the accreditation agencies designated by the Government of India'. Several certifying agencies are functioning in India.

Big Consumers of Indian Organic Products

India exported 135 products last year (2013–14) with the total volume of 177766 MT, with total coast 1328.61 crores. In last three year trend it is found that European Union, USA and Canada contributes more than 91 per cent of total export from India if Switzerland, Japan and Australia included in this list than it cross over 96 per cent total volume exported from India are consumed by these countries.

Export Trend

A general trend observed that U.S.A. and Canada nowadays giving fight to European Union breaking monopoly as organic product importer from India. If we observe last three year tend, in 2011–12 total share of European Union is 60 per cent which reduced to 42 per cent in 2013–14 but total remain same above 90 per cent for European Union, USA and Canada.

Challenges of Indian Organic Farming

Organic farming in the Indian context has to resolve several issues at both micro and macro level.

Micro level issues

The micro level issues confronting organic farming include economic viability, particularly for small and marginal farmers, marketing, etc. For example, one of the greatest barriers for organic farming is the so-called conversion period due to the direct and indirect costs. The conversion of a conventional farm to an organic farm requires strictly adhering the rules and standards of production, processing and labelling at prescribed international levels. During the conversion period all the standards required for certifying a product as 'organic' must be fulfilled and verified by a certifying agency. Costs due to things, such as information, marketing charges, inspection, and certification expenses also increase the cost of organic farming. For instance, fees for the inspection and certification can be prohibitively high at Rs. 5000, since this equals the returns from agriculture for many small farmers (Brook and Bhagat, 2004) [5]. The often reduced yields of organic farming, as compared to conventional farming particularly during the conversion period before soil nutrients and organic matter are replenished with bio-fertilizers, are an additional liability to the farmer. Particularly during the conversion period when the products are not certified as organic, and thus, they cannot be sold at the organic market price. Farmers often incur expenditures for things, such as farm machinery, bunding and purchase of bio-inputs to augment soil fertility and yield. In addition, various barriers like transaction costs (lack of access to relevant knowledge on cultivation practices, market), mandatory documentation required for inspection and certification, lack of demand in domestic market and constraints to enter international market and institutional factors restrict the spread of organic farming

Macro level issues

The macro challenges include impacts mainly on food security, employment, and environment. The question of food security assumes significance considering potential yield reductions of organic farming vis-à-vis conventional farming (Pandey and Singh, 2012) [26], particularly in the two to three year conversion period. Given India's history of inadequate food production, it is necessary to examine food security related issues, taking into account the large number of marginal and small farmers, before organic farming is promoted en masse. Another macro dimension of promoting organic farming is its impacts on rural employment. Organic farming is expected to increase employment opportunities owing to requirement of producing various agricultural inputs, like bio-fertilisers and bio- pesticides, using locally available materials. The scope for increased employment opportunities need to be assessed at the regional and national level. From the environmental point of view, apprehensions have been raised that organic farming might also lead to unsustainable problems, due to increased land and water use to offset decrease in yield. Considering the Indian case, even in organic practices water conservation must ultimately remain the paramount concern. Considering the various challenges to the adoption of organic farming the Working Group on Organic and Bio-dynamic Farming of the Planning Commission suggested examination of some important issues for effective promotion and practice of organic farming and sustainable agriculture. These include economics of organic crop production, economic and environmental externalities associated with conversion to organic farming, comparative study of chemical based and organic farming covering social, environmental and economic costs.

Current situation of organic farming

According to current situation there are two different kinds of organic farm

1. Certified organic farms
2. Non-certified organic farms

In several developing countries the proportion of organic land has been rapidly increasing in the last some years, with several Latin American countries which having more than 1% of their agricultural land under certified organic production Willer and Yuseffi (2006) [40]. The rapid and continued growth in organic markets in the developed world provides an impetus for farmers in both developed and developing countries to change practices to meet this demand Grolink (2001) [16]. In 2015, the export and domestic market of Indian organic industry grew by 30 per cent and 40 per cent respectively. According to IFAD, India has more than 15,000 certified organic farms. These farms provide many ecological benefits and delivers nutritious food. India has 30 per cent of total organic cultivable land in Asia. In India, Sikkim state with 75,000 hectares of land under organic cultivation is an organic state. By 2030, Meghalaya another north-east state of India also eyes to transfer 200, 000 hectares of land into organic cultivation. (NPOF, 2015-16) [27].

Due to climate change at global level, organic farming practice has made a significant position. The Indian Government is promoting organic farming through diverse scheme under National Mission Sustainable Agriculture (NMSA).The government has introduced Paramparagat Krishi Vikash Yojna (PKVY) and Organic Value Added Development schemes under the NMSA to promote organic farming in India. Under this scheme, the state and central government, based on cluster for every 20 hectare land, will support farmers by offering financial assistance for maximum two hectare land. It primarily aims to increase soil fertility and thereby helps in production of healthy food through organic practices without the use of agro-chemicals.

Organic farming as a Food security

Organic agriculture supports and enhances ecologically sound systems of food production that can achieve food security by

1. Increasing and stabilizing yields in low input areas.
2. Increasing resistance to pests and diseases.

3. Reducing erosion and improving water uptake and retention.
4. Battling poverty through reducing debt and increasing returns on labor invested.
5. Maintaining genetic diversity of crop, which helps cope with climate change.
6. Maintaining and improving environmental services.
7. Providing diversified, healthy and nutritious food for farming families and communities.
8. Being sustainable in long term.

Organic farming as a sustainable agriculture

Sustainable is derived from the Latin word, *sustinere*, meaning to keep in existence, implying permanence or long-term support. In the context of agricultural production, according to Ikerd (1993) [21], sustainable agriculture as 'capable of maintaining its productivity and usefulness to society over the long run, it must be environmentally-sound, resource-conserving, economically viable and socially supportive, commercially competitive, and environmentally sound". Sustainable agriculture integrates three main goals profitability, and social and economic equity.

Organic agriculture evades all kinds of practices of inorganic farming and alleviates all environmental and social nuisances arising from chemical based farming. Agriculture can be sustainable only if it has a long term economic viability. Organic farming ensures long term economic sustainability than modern chemical based farming. Organically produce product carry a premium price in market which makes organic farming more profitable. It is clear that agriculture needs to undergo a radical refurbish to become more sustainable practices. However, this is important to take care of the environment and to improve the productivity of agro-ecosystem. The policy measures are important to support agricultural activities which reflect the long term social and environmental sustainability (Asokan and Murugan, 2018) [3].

Plants nutrient availability through organic sources

At present, most optimistic estimates show that about 25–30 percent of nutrient needs of Indian agriculture can be met by various organic sources. Supplementation of entire nitrogen through FYM sustains crop productivity at more than use of conventional N fertilizers. The combined use of chemical fertilizers along with various organic sources is capable of sustaining higher crop productivity, improving soil quality, and productivity on long-term basis (Yadav *et al*., 2013) [42]. Organic sources besides supplying major nutrient like N, P, and K also make unavailable sources of elemental nitrogen, fixed phosphates, micronutrients, and decomposed plant residues into an available form to facilitate the plants to absorb the nutrients. The growth and activity of mycorrhizal and other beneficial organisms in the soil are stimulated by use of organic sources and these are helpful in alleviating the increasing incidence or deficiency of secondary and micronutrients and is capable of sustaining high crop productivity and soil health (Rigby, 2001) [30]. Nutrient concentrations in FYM are usually low and vary greatly depending upon source, conditions, and duration of storage.

Effect of Organic Sources on Crop Productivity

However, Sharma and Sharma (2002) [35] revealed that application of FYM@ 10 t ha^{-1} increased the grain yield of rice-wheat system by 1.2-1.3 t ha^{-1} and straw yield by 0.7-2.3 t ha^{-1}. The findings of Jat and Ahlawat (2006) [22] reported that the application of 3 t vermicompost ha^{-1} to chickpea improved growth parameter, grain yield, and grain protein content in chickpea, dry fodder yield of succeeding maize (*Zea mays* L.) and total nitrogen and phosphorus uptake by the cropping system over no vermicompost. Davari and Sharma (2010) [11] reported that combination of FYM + wheat residue (WR) +Biofertilizer (BGA, PSB and cellulolytic culture) and vermicompost (VC) + WR + biofertilizer (B) resulted in highest increase in yield attributing characters and grain yield of basmati rice over control by 51-58%. Singh *et al.* (2007) [38] reported that application of all the four organic amendments such as blue green algae 15kg ha^{-1}, azolla @ 1.0 tonne ha^{-1}, vermicompost and farm yard manure 5.0 tonne ha^{-1} together had the maximum cumulative effect and increased grain yield by 114 to 116.8% over absolute control. Meena *et al.* (2015) [24] reported that combined application of PSB + BGA + FYM (5 t ha^{-1}) recorded the maximum grain yield and straw yield of rice (49.27 q ha^{-1}) and (61.76 q ha^{-1}) respectively. Channabasanagowda *et. al.* (2008) [8] recorded that application of vermicompost @ 3.8 t per ha + poultry manure @ 2.45 t per ha recorded significantly higher number of tillers (94.60) at 90 DAS and higher number of ear heads per meter square (160.10), 1000 seed weight (42.73 g) and seed yield (3043 kg/ha) of wheat. Bana *et al.* (2012) [4] reported that vermicompost (10 t/ha) + biofertilizer produced the highest pearl millet grain yield, that is 2.18 and 2.04 t/ha during 2004 and 2005 respectively; and had maximum residual effect on wheat yield.

Effect of Organic Sources on quality parameters of crops

Gangwar and Dubey (2013) [14] carried out an experiment to find out the effect of different combinations of organic manures and biofertilizers on grain quality of rice in organic farming. Combination of BGA with FYM, vermicompost (VC) and neem cake resulted better grain quality than other treatments. Datt *et al*. (2013) [10] revealed that protein content in green pod of french bean was maximum 23.3% (pooled over four year) in organic treatment (10 t FYM/ha^{-1}+nitrogen fixer-biofertilizer, Phosphate solubilizers and chopped crop residues of same plot) and minimum (17.9) in control (No fertilizer or FYM). Kumar *et al*. (2015) [23] conducted an experiment to assess the effect of nutrient supplementation through organic sources on growth, yield and quality of coriander and reported that incorporation of FYM 25% (2.5 t ha^{-1}) in combination with vermicompost 75% (3.75 t ha^{-1}) recorded maximum essential oil and moisture contents of 0.66 and 12.7 per cent, respectively

Effect of Organic Sources on Physio-chemical properties of soil

The basic concept of integrated organic nutrient management is the maintenance and possible improvement in soil fertility for sustained crop productivity on long term basis. The major organic sources of nutrient supply are FYM, vermi-composting, green manure, crop residue and biofertilizers. These components posses great diversity in terms of physical and chemical properties, nutrient release efficiencies, positional availability, crop specificity and farmer acceptability (Singh and Dwivedi, 1996). Clark *et al*. (2004) [36, 9] carried out a long term study on organic practices and reported that organic practices, after 4 years led to an increase in the organic carbon content, soluble phosphorus, exchangeable potassium, and pH and also the reserve pool of stored nutrients and maintained relativity stable EC level. Urkurkar *et al*. (2010) [39] reported that application of nitrogen 120 kg/ha for rice and 150 kg/ha for potato in a rice-potato

cropping system 1/3 each from cow dung manure, neem cake and composed crop residue considerably increased the organic carbon (6.3 g kg^{-1}) over initial value (5.8 g kg^{-1}) as compared to supply from inorganic fertilizers alone. Aher *et al*. (2015) [1] carried out an research in soybean crop under semi-arid tropical conditions in Central India, found that soil organic carbon (11.3 g kg^{-1}), available N (125 mg kg^{-1}), P (49.7 mg kg^{-1}) were found significantly higher in the plot managed organically.

Effect of Organic Sources on biological properties of soil

Compost contains bacterial, fungi and actinomycetes; hence, a fresh supply of humic material not only added microorganisms but also stimulated them (Gaur *et al*., 1973) [15]. Plenty of carbon added by composting material and thus increased heterotrophic bacteria and fungi in soil and further increased the activity of soil enzymes responsible for the conversion of unavailable to available form of nutrients. Bulluck *et al*. (2002) [6] reported that organic fertility amendments enhanced beneficial soil microorganisms, reduced pathogen population, total carbon, and cation exchange capacity, and lowered down bulk densities, thus improved soil quality. Singh and Bohra (2009) [37] carried out an experiment on cropping system and reported that cropping system of rice-pea-black gram recorded higher population of bacteria, actinomycetes, and fungi than rice-wheat cropping system.

Soil Fertility Stability

Soil fertility declines over time due to continuous extraction of nutrients with crop harvest, problem of soil acidification and compaction and when the replenishment with fresh nutrients is inadequate, over application is inevitable. Global fertilizer use increased from 27.4 million tons in 1959/60 to 143 million tons in 1989/90 which is anticipated to reach to 208.0 million tons by 2020 (Byrnes and Bumb, 1998) [7]. Thus, nutrient management through organic farming helps maintaining soil fertility via improving nitrogen fixation and reducing nutrient leaching.

XU *et al*., (2008) reported that in red soil of tea garden in China, soil amendments with straw mulching + 100% organic manure; straw mulching + 75% organic manure + 25% fertilizer; straw mulching + 50% organic manure + 50% fertilizer; straw mulching + 25% organic manure + 75% fertilizer; 100% fertilizer, and intercropping with white clover, increased the microbial biomass by 17.05%, 32.38%, 32.05%, 24.30% 26.23% and 24.63% respectively.

Research findings on contrasting features of difference between conventional & organic farming

Organic farming, in spite of the reduction in crop productivity by 14.6 per cent, provided higher net profit to farmers by 21.5 per cent compared to conventional farming. This was mainly due to the availability of premium price (20–40 per cent) for the certified organic produce and reduction in the cost of cultivation by 15.9 per cent. In cases, where such premium prices were not available and the cost of cultivation was higher primarily due to purchased off-farm inputs, organic farming was not found economically feasible. However, there was an overall improvement in soil quality in terms of various parameters, viz. physical, chemical, biological properties, availability of macro- and micronutrients, indicating an enhanced soil health and sustainability of crop production in organic farming systems.

According to Ramesh *et al*. (2010) [28], A survey was made on certified organic farms in the country to ascertain the real benefits and feasibility of organic farming in terms of the production potential, economics and soil health in comparison to the conventional farms, the study revealed that organic farming, in spite of the reduction in crop productivity by 9.2 per cent, provided higher net profit to farmers by 22.0 per cent compared to conventional farming. This was mainly due to the availability of premium price (20–40 per cent) for the certified organic produce and reduction in the cost of cultivation by 11.7 per cent. In cases, where such premium prices were not available and the cost of cultivation was higher primarily due to purchased off-farm inputs, organic farming was not found economically feasible. However, there was an overall improvement in soil quality in terms of various parameters, viz. physical, chemical, biological properties, availability of macro- and micronutrients, indicating an enhanced soil health and sustainability of crop production in organic farming systems.

According to Sahu *et al.* (2010) [33], it may be concluded that majority farmers were found in the range of high level of knowledge of organic farming practices. The wide knowledge gapes are in the areas of organic farming practices like use of Ha NPV, use of trichocards, use of bio-pesticides and use of NADEP compost. The farmers need to be made well aware about the use of such practices so that the basic concept of organic farming and its application part could be familiar to the farmers.

Conclusion

According to Ramesh P. *et al.* (2005) [29] the following conclusions can be drawn on important issues regarding organic farming:

1. Large-scale conversion to organic agriculture would result in food shortage with the present state of knowledge and technology, as the yield reductions of organic systems relative to conventional agriculture average 10–15 per cent, especially in intensive farming systems. However, in traditional rainfed agriculture, organic farming has the potential to increase the yield, since 70 per cent of total cultivable land falls in this category. Mere 5–10 per cent increase in farm production would definitely help to achieve the targeted growth rate of 4–5 per cent in agricultural production in the Tenth Plan period.
2. Organic manure is an alternative renewable source of nutrient supply. A large gap exists between the available potential and utilization of organic wastes. However, it is not possible to meet the nutrient requirements of crops entirely from organic sources, if 100 per cent cultivable land is converted to organic farming.
3. Organic farming systems can deliver agronomic and environmental benefits both through structural changes and tactical management of farming systems. The benefits of organic farming are relevant both to developed nations (environmental protection, biodiversity enhancement, reduced energy use and CO_2 emission) and to developing countries like India (sustainable resource use, increased crop yields without over-reliance on costly external inputs, environment and biodiversity protection, etc.).
4. Organic foods are proved superior in terms of health and safety, but there is no scientific evidence to prove their superiority in terms of taste and nutrition, as most of the studies are often inconclusive.

5. Combination of lower input costs and favourable price premiums can offset reduced yields and make organic farms equally and often more profitable than conventional farms. However, studies that did not include organic price premiums have given mixed results on profitability. Thus it is the premium price on the organic food which decides the economic feasibility of organic farming, at least at the current rate of development in organic agriculture.
6. In organic farming systems, pest and disease management strategies are largely preventive rather than reactive. In general, pest and disease incidence is less severe in organic farms compared to conventional farms.

In nut shell the performance of organic agriculture on production depends on the previous agricultural management system. An over-simplification of the impact of conversion to organic agriculture on yields indicates that:

- ✓ In industrial countries, organic systems decrease yields; the range depends on the intensity of external input use before conversion;
- ✓ In the so-called Green Revolution areas (irrigated lands), conversion to organic agriculture usually leads to almost identical yields;
- ✓ In traditional rain-fed agriculture (with low-input external inputs), organic agriculture has the potential to increase yields.

Organic farming can provide quality food without adversely affecting the soil's health and the environment. Organic Farming has a concept and some principles to achieve the objectives of sustainability issues and environmentally sensitive. Use of chemical fertilizers cannot be totally eliminated, rather can be reduced, or minimized. Conjoint application of in-organic fertilizers along with various organic sources are capable of sustaining higher crop productivity, improving soil quality and soil productivity, besides supplying major nutrients N, P and K. In India, farmers are more aware of the fact that organic farming is a practice that can sustain Indian agriculture. Organic agriculture is gaining greater recognition as a possible major contributor to combating poverty and achieving food and nutrition security and the way for making sustainable agriculture and protecting people's health.

References

1. Aher *et al*. Effect of organic farming practices on soil and performance of soybean (Glycine max) under semi-arid tropical conditions in Central India. Journal of Applied and Natural Science. 2015; 7(1):67-71.
2. APEDA. Agricultural and Processed food product Export Development Authority, Ministry of Commerce and Industries, GOI, www.apeda.gov.in, 2014.
3. Asokan R, Murugan D. Sustainable agriculture through organic farming in India**.** Multidisciplinary global journal of academic research. 2018; 5(3):27-34.
4. Bana RS, Gautam RC, Rana KS. Effect of different organic sources on productivity and quality of pearlmillet (Pennisetum glaucum) and their residual effect on wheat (*Triticum aetivum*). Ann. Agric. Res. New Series. 2012; 33(3):126-130.
5. Brook, Bhagat G. Organic by default: The irony of organic farming in India, available at: http://www.ecoworld.org/Home/ Articles2.cfm? TID=349, 2004.
6. Bulluck LR, Brosius M, Evanylo GK, Ristaino JB. Organic and synthetic fertility amendments influence soil microbial, physical and chemical properties on organic and conventional farms. Applied Soil Ecology. 2002; 19(2):147-160.
7. Byrnes BH, Bumb BL. Population growth, food production and nutrient requirement. J. Crop. Prod. 1998; 1:1-7.
8. Channabasanagowda NK, Biradar Patil BN, Patil JS, Awaknavar BT, Ninganur, Ravi Hunje. Effect of Organic Manures on Growth, Seed Yield and Quality of Wheat. Karnataka. J. Agric. Sci. 2008; 21(3):366-368.
9. Clark MS, Horwath WR, Shennan C, KM. Scow Changes in soil chemical properties resulting from organic and low-input farming practices," Agronomy Journal. 1998; 90(5):662-671.
10. Datt N, Dubey YP, Chaudhary, Rohina. Studies on impact of organic, inorganic and integrated use of nutrients on symbiotic parameters, yield, quality of French-bean (Phaseolus vulgaris L.) vis-à-vis soil properties of an acid alfisol. African Journal of Agricultural Research. 2013; 8(22):2645-2654.
11. Davari MR, Sharma SN. Effect of different combinations of organic materials and biofertilizers on productivity, grain quality and economics in organic farming of basmati rice. Indian Journal of Agronomy. 2010; 55(4):290-294.
12. FAO. Codex Alimentations – Organically Produced Foods, FAO, Rome. Fertilizer statistics 2003-04, The Fertilizer Association of India, New Delhi, 2001, 77p.
13. FAO. The State of Food Insecurity in the World. Addressing food insecurity in protracted crises. Rome, Food and Agriculture Organization, 2010.
14. Gangwar S, Dubey M. Impact of organic nutrient management practices on quality of Basmati rice (*Oryza sativa* L.). Crop Research. 2013; 46(1, 2&3):6-10.
15. Gaur AC, Sadasivam KV, Vimal OP, Mathur RS, Kavimandan SK. Studies on the humification of organic matter in a red Rakar soil," Zentralblatt fur Bakteriologie. 1973; 128(1):149-161.
16. Grolink. Development of Organic Agriculture, 2001.
17. Gupta A, Verma J *et al*. Vanishing breeds, Down to Earth. 1997; 11(15):27-37.
18. Howard A. Agricultural testaments. The Oxford University Press, 1940, 233p.
19. IFOAM. IFOAM Norms – IFOAM Basic Standards – IFOAM Accreditation Criteria. IFOAM, Tholey Theley, Germany, 2002.
20. IFOAM. The IFOAM Norms for organic production and processing including IFOAM Basic Standards and IFOAM Accreditation Criteria. Version 2005. IFOAM, Bonn, Germany, 2005.
21. Ikerd J. Two related but distinctly di erent concepts: organic farming and sustainable agriculture. Small Farm Today. 1993; 10(1):30-31
22. Jat RS, Ahlawat IPS. Direct and residual effect of vermicompost, biofertilizers and phosphorus on soil nutrient dynamics and productivity of chickpea-foddermaize sequence," Journal of Sustainable Agriculture. 2006; 28(1):41-54.
23. Kumar Rajesh, Singh MK, Kumar Vijay, Verma RK, Kushwah JK, Pal Mahender. Effect of nutrient supplementation through organic sources on growth, yield and quality of coriander (Coriandrum sativum L.). Indian J. Agric. Res. 2015; 49(3):278-281.

24. Meena RK, Neupane MP, Singh SP. Effect of phosphorus levels and bio organic sources on growth and yield of rice (*Oryza sativa* L.). International journal of Agricultural Science. 2015; 11(2):26-289
25. Musa M, Bokhtiar SM, Gurung TR. (Eds) Status and future prospect of organic agriculture for safe food security in SAARC countries, 2015.
26. Pandey, Jitender, Singh Ashima. Opportunities and constraints in organic farming. An Indian perspective. Journal of Scientific Research. 2012; 56:47-72
27. National Project on Organic Farming (NPOF), Estimates Committee, 2015-16. Lok sabha 9th report.
28. Ramesh P, Panwar NR, Singh AB, Ramana S, Yadav SK, Shirvastava R *et al*. Status of organic farming in India, Current Science. 2010; 98(6):1190-1194.
29. Ramesh P, Singh M, Rao SA. Organic farming: Its relevance to the Indian context, Current Science. 2005; 88(4):561-568.
30. Rigby D, CaAceres D. Organic farming and the sustainability of agricultural systems. Agricultural Systems. 2001; 68:21-40
31. Rockstrom J. A safe operating space for humanity. Nature. 2009; 461(7263):472-475.
32. Roychowdhury R, Gawwad MRA, Banerjee U, Bishnu S, Tah J. Status, Trends and Prospects of Organic Farming in India: A Review. Journal of Plant Biology Research. 2013; 2(2):38-48.
33. Sahu RP, Singh RJ, Singh K. Knowledge Gap about Organic Farming Practices of Farmers of Bageshwar District of Uttarakhand, Indian Journal of Extension Education. 2010; 45(1&2):135-136.
34. Scialabba EN, Hattam C. Organic agriculture, environment and food security. Food and Agriculture Organization of the United Nations, Rome, 2002, 252.
35. Sharma SK, Sharma SN. Integrated nutrient management for sustainability of rice-wheat cropping system. Indian Journal of Agricultural Sciences. 2002; 72:573-576.
36. Singh GB, Dwivedi BS. Integrated nutrient management for sustainability. Indian farming. 1996; 46(9):9-15.
37. Singh K, Bohra JS. Net working project on diversification of rice-wheat system through pulses and oilseeds, Project Report, UPCAR, 2009.
38. Singh YV, Singh BV, Pabbi S, Singh PK. Impact of organic farming on yield and quality of basmati rice and soil properties. Zwischen Tradition und Globalisierung Wissen schaftstagung Ökologische Landbau, Universität Hohenheim, Stuttgart, Deutschland, 2007. Archived at http://orgprints.org/9783/.
39. Urkurkar JS, Chitale S, Tiwari A. Effect of organic v/s chemical nutrient packages on productivity, economics and physical status of soil in rice (Oryza sativa)-Potato (Solanum tuberosum) cropping system in Chhattisgarh. Indian Journal of Agronomy. 2010; 55(1):6-10.
40. Willer H, Yuseffi M. The World of Organic Agriculture: Statistics and Emerging Trends. IFOAM, Bonn, Germany, 2006.
41. Yadav SK. A Review of Organic Farming for Sustainable Agriculture in Northern India, 2013.
42. Yadav SK, Babu, Subhash, Yadav MK, Singh Kalyan, Yadav GS *et al*. A Review of Organic Farming for Sustainable Agriculture in Northern India. International Journal of Agronomy. 2013; 2013(718145):8p.