Sustainable Agriculture

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Ram Swaroop Meena

JRF, SRF, Ph.D., PDF, NET, Raman Fellow (MHRD, Govt. of India)
Ex-Visiting Scientist, C-MASC, USA
Assistant Professor, Dept. of Agronomy
Institute of Agricultural Sciences,
BHU, Varanasi (UP) - 221 005, India

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Preface

Sustainable development means that the needs of the present generation should be met without compromising the ability of future generations to meet their own needs. Sustainability is the key to preventing or reducing the effect of environmental issues. Agriculture sustainability is the process of making sure current processes of interaction with the Agriculture are pursued with the idea of keeping the environment as pristine as naturally possible based on ideal-seeking behaviour. Ecosystems are dynamic interactions between plants, animals, and microorganisms, and their environment working together as a functional unit. Ecosystems will fail if they do not remain in balance. This book examines our current cultivation system from production to consumption, and the urgent need to transition to long-term sustainability. The book promotes the study and application of Agro-ecology for developing alternatives to the complex problems of resource depletion, environmental degradation, a narrowing of agro-biodiversity, consolidation and industrialization of the food system, climate change, and the loss of farm land. The book uses a food systems approach, and seeks experiences in eco-friendly that are on-farm, participatory, change-oriented, and backed by broad-based methodologies of sustainability analysis and evaluation. The objectives of this book are: (1) to understand the role sustainable agricultural productivity and its importance to the sustainable soil managements, (2) to restore soil health to transforming agriculture for sustainability, and (3) to understand the matching of management rules in climatic perspective. In general, the book will be suitable for teachers, researchers, policy makers, undergraduate and graduate students of soil science, soil microbiology, agronomy, ecology, and environmental sciences. Highly professional and internationally renowned researchers has invited to contribute, authoritative and cutting-edge scientific information on a broad range of topics covering sustainable management of agriculture. All chapters are well-illustrated with appropriately placed data, tables, figures, and photographs and supported with extensive and most recent references.

The submitted chapters are reviewed by the members of the relevant field for further improvement and authentication of the information provided. I am also provide a roadmap for sustainable approaches for agriculture systems for food and nutritional security, and soil sustainability in the ecosystem.

Ram Swaroop Meena

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12 Present Status and Future Prospects of Organic Farming in India

Raghuveer Singh[1]**, N.K. Jat[2*], N. Ravisankar[1], Sudhir Kumar[3*], T. Ram[3*] and R.S. Yadav[4*]

[1]ICAR-Indian Institute of Farming Systems Research, Modipuram, Meerut (UP) – 250 110
[2]ICAR-Central Arid Zone Research Institute, Jodhpur (Rajasthan)- 342 003
[3]ICAR- Indian Agriculture Research Institute, New Delhi- 110 012
[4]ICAR- IISWC RC, Datia (Madhya Pradesh)- 475 661
**Formerly associated with ICAR-Indian Institute of Farming Systems Research, Modipuram, Meerut (UP)*
***Corresponding Author's E mail- rsbicar@gmail.com*

ABSTRACT

Every technology or interference in the natural ecosystem has its own side effect; from last half a century we are using the pesticides and herbicides indiscriminately to raise the crop production, but now its ill effect visible for us. Story of Malwa region of Punjab (cancer belt) and Kerala's endosulfan tragedy are epitome example of it. Now we achieve the self-sufficiency in food grain production our next motto to serve healthy food to people. We are looking for alternative nature based chemical free farming and that is organic farming. It also helps to get the premium price by exporting the chemical free agriculture commodity to the developed countries, day by day demand for healthy and residue free food increase all over the world as well as country itself. People are now ready to pay extra amount if they are ensured that they are purchasing geniunely raised food through natural system. Thus strengthening the certification process in country is must.

***Keywords*:** Conventional farming, Future prospects, India, Organic farming, Present status

1. INTRODUCTION

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

It is definitely true that India had witnessed a tremendous growth in agricultural production in the era of green revolution. Food grain production, which stood at a mere 50 million tons at the time of independence, had increased almost five and half times to 273.38 million tons by the end of 2016–17 (Press Information Bureau, GOI, 2017) from 159.59 million hectares of cultivated area in country (Agriculture Census, 2010–11). The technologies involved during the inception of green revolution supported by policies and further propelled by agrochemicals, machinery and irrigation were the main driving forces for the enhanced agricultural production and productivity (Roychowdhury *et al.,* 2013). Despite the fact that the food security of India was definitely addressed by these technologies (Charyulu and Biswas, 2010), an important setback was that the farmers using these technologies were still had to depend upon the purchased inputs. With manufacturing of fertilizers and pesticides as the two major inputs of Green Revolution (GR) technologies, an important point of consideration was the need for fossil fuels and/or expensive energy which are associated with serious environmental and health problems. In last 50 years we are using heavy amount of fertilizers and pesticides and we already reach on plateau and diminishing low of return start to work (Venkateswarlu *et al.,* 2008), so we need to apply more input (fertilizer and pesticides) to get small raise in production which cause second generation problem and few of such epitome examples are some regions of Punjab (cancer belt of country) and endosulfan story of cashew plantations area in Kerala (proving finding of Rachel Carson's Silent Spring was published in 1962). Insecticides and herbicides in ideal condition lethal for target group only, for non-target group and human it is safe but this principle is not followed strictly and indiscriminate use of these chemicals put human life and ecosystem health on verge (Aktar *et al.,* 2009). All these thing and un-sustainability issue associated with modern agriculture force us to look back (Balachandran, 2004) in history to know either we are not doing any mistake by depending on off farm inputs because crop production is a recycle system of nature by putting too much off farm input we are making it fragile day by day. One of such natural, recyclable and sustainable approach of farming is Organic farming. It is the effective and cost efficient way to achieve sustainable development in the agriculture sector (IFOAM, 2010). Organic source of nutrient also helps to combat with the problem of multi nutrient deficiency and low organic content in our soil which is affecting productivity of major food crops at farmer field (Singh *et al.,* 2017).

Organic farming is a method of farming system which primarily aimed at cultivating the land and raising crops in such a way, as to keep the soil alive and in good health by use of organic wastes (crop, animal and farm wastes, aquatic wastes) and other biological materials along with beneficial microbes (bio-

fertilizers) to release nutrients to crops for increased sustainable production in an eco-friendly pollution free environment (Narayanan, 2005; Guruswamy and Gurunathan, 2010; Makadia and Patel, 2015).

As per the definition of the United States Department of Agriculture (USDA), study team on organic farming "organic farming is a system which avoids or largely excludes the use of synthetic inputs (such as fertilizers, pesticides, hormones, feed additives etc.) and to the maximum extent feasible rely upon crop rotations, crop residues, animal manures, off-farm organic waste, mineral grade rock additives and biological system of nutrient mobilization and plant protection".

FAO suggested that "Organic agriculture is a unique production management system which promotes and enhances agro-ecosystem health, including biodiversity, biological cycles and soil biological activity, and this is accomplished by using on-farm agronomic, biological and mechanical methods in exclusion of all synthetic off-farm inputs".

2. MAIN PRINCIPLES OF ORGANIC FARMING

The main principles of organic farming by (Chandrashekar, 2010) are as follows:

- To work as much as possible within a closed system, and draw upon local resources.
- To maintain the long-term fertility of soils.
- To avoid all forms of pollution that may result from agricultural techniques.
- To produce foodstuffs of high nutritional quality and in sufficient quantity.
- To reduce the use of fossil energy in agricultural practice to a minimum.
- To give livestock conditions of life that confirm to their physiological need.
- To make it possible for agricultural producers to earn a living through their work and develop their potentialities as human being.

All the above principles based on the four ethical principles (Principle of Health, Principle of Care, Principle of Fairness and Principle of Ecology) IFOAM, 2005.

3. THE MAIN PILLARS OF ORGANIC FARMING

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

- Organic threshold standards.
- Reliable mechanisms regarding certification and regulatory affairs.

- Technology packages.
- Efficient and feasible market network.

4. ORGANIC FARMING IN INDIA

4.1. 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. Major milestones in the area of organic farming are presented in Table 1.

Table 1. Historical perspective of organic farming in India

Ancient period	Oldest practice 10000 years old, dating back to Neolithic age, practiced by ancient civilization like Mesopotamia, Hwang-Ho basin etc.
Ramayana	All dead things - rotting corpse or stinking garbage returned to earth are transformed into wholesome things that nourish life. Such is the alchemy of mother earth - as interpreted by C. Rajagopalachari
Mahabharata (5500 BC)	Mention of Kamadhenu, the celestial cow and its role on human life and soil fertility.
Kautilya Artha-shastra (300 BC)	Mentioned several manures like oil cake, excreta of animals.
Brihad-Sanhita (by Varahmihir)	Described how to choose manures for different crops and the methods of manuring.
Rig Veda (2500–1500 BC)	Mention of organic manure in Ria Veda 1, 161, 10, 2500–1500 BC, is Green Manure in Atharva Veda II 8.3, (1000 BC). In Sukra (IV, V, 94, 107–112) it is stated that to cause healthy growth, the plant should be nourished by dungs of goat, sheep, cow, water as well as meat. A reference of manure is also made in Vrksayurveda by Surpala (manuscript, oxford, No 324 B, Six, 107-164)
Holy u;-an (590 AD)	At least one third of what you take out from soils must be returned to it implying recycling or post-harvest residue.

(*Source*: Bhattacharyva and Chakraborty, 2005)

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), 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.

4.2 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.

4.2.1 *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).

Table 2. 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)

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 3. 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)

Commodities produced under organic farming

Commodities produced under organic farming in India mainly include tea, basamati rice, cardamom, black pepper, ginger turmeric, mango cashew and herbal extracts.

Table 4. Major products produced in India by organic farming

Type	**Products**
Commodity	Tea, coffee, rice, wheat
Spices	Cardamom, black pepper, white pepper, ginger, turmeric, vanilla, mustard, tamarind, clove, cinnamon, nutmeg, mace, chili
Pulses	Red gram, black gram
Fruits	Mango, banana, pineapple, passion fruit, sugarcane, orange, cashew nut, walnut
Vegetables	Okra, brinjal, garlic, onion, tomato, potato
Oil seeds	Sesame, castor, sunflower
Others	Cotton, herbal extracts

(*Source*: Salvador and Katke, 2003)

Details of herbal extracts

Table 5. Details of herbal extract commonly exported

Sr. No.	Comman name	Scientific name
1	SafedMusali, Dry roots	*Chlorophytum borivillianum*
2	Ashwagandha, Dry roots	*Withania somnifera* (Whole Powder)
3	Ginger root whole & Powder	*Zingiber officinale*
4	Kalmegh, whole plant (leaf)	*Andrographis paniculata*
5	Shatavari, yellow dry roots	*Asparagus racemosa* (Powder)
6	Kapikacchu	*Mucuna pruriens* (Seed)
7	Amalaki	*Emblica officinalis* (Fruit no stone)
8	Haritaki	*Terminalia chebula* (Fruit no stone)
9	Bibhitaki	*Terminalia belerica* (Friut no stone)
10	Guduchi	*Tinosporia cordifolia*
11	Pushkaramool	*Inula racemosa* (Root)
12	Vacha, dry root	*Acorus calamus*
13	Shankapushpi	*Canscora decussata*
14	Gurmar	*Gymnema sylvestre*

(*Source*: Salvador and Katke, 2003)

Products for which Indian production has a comparative advantage

India being a country with different agro-climatic zones, each state produces its own specialty products (Shetty *et al*., 2014). Based on soil and climate, India is divided into 21 agro-ecological zones. Products for which production in India has a comparative advantage are given in Table 6.

Table 6. Products for which Indian production has a comparative advantage

Product	Season	States	Major Locations
Tea	Throughout the year	Assam, West Bengal, Uttranchal	Darjeeling, Guwahati, Dehradun
Spices	Throughout the year	Kerala, Tamil Nadu, Karnataka	Cochin, Coimbatore, Idduki, Coorg
Coffee	Throughout the year	Kerala, Tamil Nadu, Karnataka	Coimbatore, Coorg, Wayanadu, Peeremade

Product	Season	States	Major Locations
Rice	*Kharif & Rabi*	Punjab, Haryana, Assam, Maharashtra, Tamil Nadu	Amritsar, Jalandhar, Darrang, Ratnagiri, Kanchipuram, Thiruvallur
Wheat	*Kharif & Rabi*	Punjab, Haryana, Uttar Pradesh	Ambala, Patiala, Bhatinda, Faridkot
Vegetables	Throughout the year	All India	Various locations
Fruits	Throughout the year	All India	Various location
Cotton	*Kharif*	Maharashtra, Gujarat Madhya Pradesh	Akola, Amravati, Amreli, Kheda, Indore

**Kharif* and Rabi are two growing seasons in India. *Kharif* is essentially from May to September and Rabi is from November to March (*Source*: Salvador and Katke 2003).

Besides the broad range of products and the seasonal advantages mentioned above, India has other comparative advantages for organic production:

i. India is strong in high quality production of certain crops like tea, some spices, rice specialties, ayurvedic herbs etc.

ii. 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.

iii. 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.

iv. 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.

v. 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.

vi. 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.

4.2.2. *Organic certification and marketing in India*

4.2.2.1. *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' (Salvador and Katke, 2003). Several certifying agencies are functioning in India.

4.2.2.2. *List of Certifying agency in India who providing certificates*

Name of the Certification Agency With Certification Mark	**Name of the Certification Agency With Certification Mark**
Bureau Veritas Certification India (BVCI) Pvt. Ltd.	Indian Organic Certification Agency (INDOCERT)
ECOCERT India Pvt. Ltd.	Lacon Quality Certification Pvt. Ltd.
IMO Control Pvt. Ltd.	OneCert Asia Agri Certification (P) Ltd.
SGS India Pvt. Ltd.	APOF Organic Certification Agency (AOCA)
Control Union Certification	Rajasthan Organic Certification Agency (ROCA)

Name of the Certification Agency With Certification Mark	Name of the Certification Agency With Certification Mark
Uttarakhand State Organic Certification Agency (USOCA)	Vedic Organic Certification Agency
ISCOP (Indian Society for Certification of Organic Products)	Chhattisgarh Certification Society, India (CGCERT)
Food Cert India Pvt. Ltd	Tamil Nadu Organic Certification Department (TNOCD)
Aditi Organic Certifications Pvt. Ltd	Intertek India Pvt. Ltd.
Madhya Pradesh State Organic Certification Agency	Natural Organic Certification Agro Pvt. Ltd.

Name of the Certification Agency With Certification Mark	Name of the Certification Agency With Certification Mark
Biocert India Pvt. Ltd	Fair Cert Certification Services Pvt. Ltd.
Odisha State Organic Certification Agency (OSOCA)	Gujarat Organic Products Certification Agency (GOPCA)
Uttar Pradesh State Organic Certification Agency	

(*Source*: APEDA, 2014)

4.3 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.

4.4. 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.

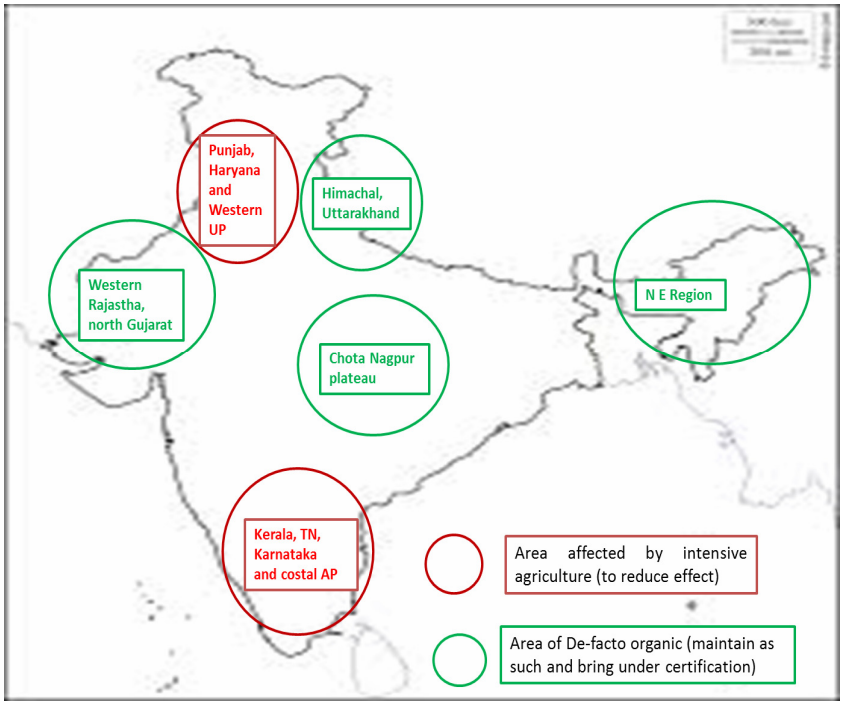
Table 7. Export volume and value from country in last three year

Countries	2011–12		2012–13		2013–14	
	Export volume (MT)	Value (Rs. crores)	Export volume (MT)	Value (Rs. crores)	Export volume (MT)	Value (Rs. crores)
European Union	51138.8	505.29	82835.37	678.51	56946.72	553.85
U.S.A.	37630.23	197.94	34292.35	228.72	74942.72	498.83
Canada	19848.91	66.66	33645.80	146.05	38545.57	182.41
Switzerland	2161.51	21.04	3455.27	27.57	4306.56	33.88
Japan	232.77	8.79	199.22	11.11	309.07	16.12
Australia	349.14	5.15	468.26	6.60	749.95	14.58
Rest	4055.78	34.47	5380.68	57.25	1964.66	28.94
Total	115417.2	839.3	160276.9	1155.8	177765.2	1328.6

(*Source*: Ministry of Commerce and Industries, GOI, 2014)

5. FUTURE PROSPECTUS OF ORGANIC FARMING

In this India divided under two groups –



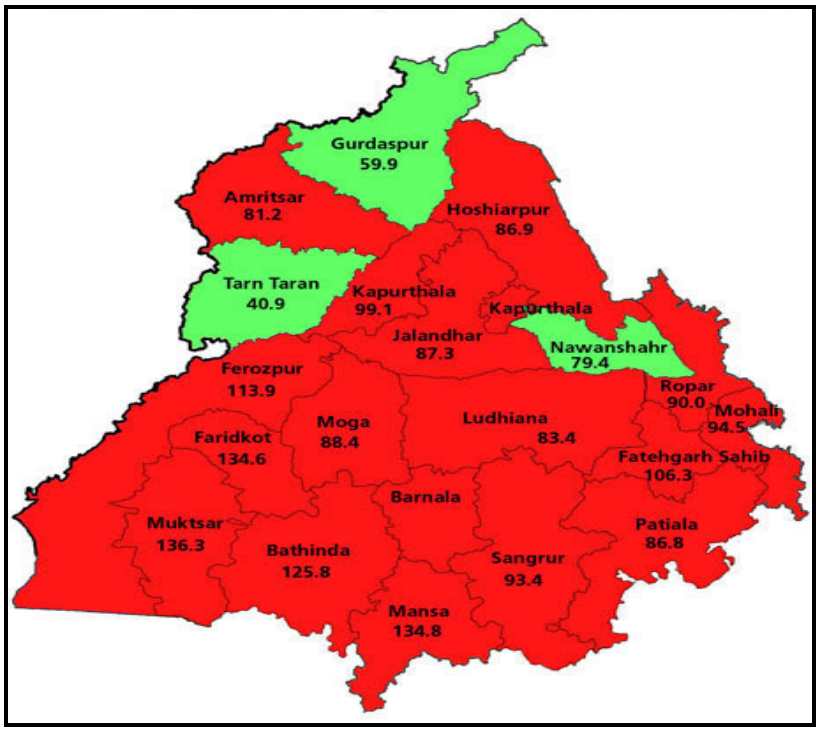
5.1 Area affected by intensive agriculture (to reduce ill effect)

In this we cover North India (Punjab, Haryana and Western UP) and South India (Kerala, Tamil Nadu, Karnataka and costal Andhra Pradesh) which are affected by intensive agriculture, indiscriminate use of off farm inputs (pesticides and fertilizer). Main target by promoting organic farming we reduce ill effect of intensive agriculture

5.1.1. *No more cancer belt and cancer train*

The Malwa region of Punjab, India, is facing an unprecedented crisis of environmental health linked to indiscriminate, excessive, and unsafe use of pesticides, fertilizers, and poor groundwater quality. The region has been described as India's "cancer capital" due to abnormally high number of cancer cases, which have increased 3-fold in the last 10 years. Studies of this region have also highlighted a sharp increase in many other pesticide-related diseases, such as mental retardation and reproductive disorders. The most affected individuals are the agricultural workers who are directly exposed to pesticides. The Malwa region of Punjab, India, is less than 15 per cent of the total area of Punjab (only 0.5 per cent of the total geographical area of India), but it consumes nearly 75 per cent of the total pesticides used in Punjab. As per the 2007 State of Environment Report prepared by the Punjab State Council for Science and Technology. The state, in turn, uses 17 per cent of the total pesticides applied in India. The high use of pesticides, along with environmental and social factors, is responsible for the high concentration of pesticide residues in the food chain of this region. Moreover, many banned and restricted pesticides are still in use in this region, warranting strict periodical health checkups and other interventions. Though several studies in the past decade had showed that Punjab has higher incidence of cancer than the rest of the country, this is for the first time the state government conducted a comprehensive door-to-door survey to quantify the problem. The study underscores that the Malwa region, already infamed as the cancer belt, has the highest number of cancer patients - 107 in 100,000 population. Four districts that topped the cancer incidence list are from this region. With 136 cancer cases per 100,000 populations, Muktsar district fares the worst. It is closely followed by Mansa, Bathinda and Ferozepur districts. Tarn Taran district in the Majha region has the least number of cancer patients - 41 per 100,000 people (Singh J., 2013).

'Cancer train' a lifeline for stricken patients Cancer patients from various towns of Punjab travel on this Lalgarh-Abohar-Jodhpur Train No. 339 to a hospital in Bikaner for cheap treatment. This train famous in farming community and locally known as cancer train. So this is the time to rethink about the our old age practices for farming in place of depending on off farm chemical input which will in long term collapse our health we need to aware our farmer the importance of organic farming so they not look towards market for chemicals and also get themselves to purchase there bad self-health and soil health by waiting in queue.



Cancer prevalence per (100,000) peoples in Punjab (Source: Singh J. 2013)

5.1.2. *No more Kerala's Endosulfan Tragedy*

What is Endosulfan?

Endosulfan is a pesticide belonging to the organochlorine group of pesticides, under the Cyclodiene subgroup. It was introduced in the 1950's and it emerged as a leading chemical used against a broad spectrum of insects and mites in agriculture and allied sectors. It is used in vegetables, fruits, paddy, cotton, cashew, tea, coffee, tobacco and timber crops. It is also used as a wood preservative and to control tse-tse flies and termites. The chemical is out of patent and is marketed by many different companies under a variety of names like Agrosulfan, Aginarosulfan, Banagesulfan, Cyclodan, Endocel, Endoson, Endonit, Endomil, Endosol, Endostar, Endodaf, Endosulfer, E-sulfan, Endorifan, Hildan, Redsun, Seosulfan, and Thiodan. Endosulfan is a highly toxic, ubiquitous environmental pollutant that causes long-term harm to humans and wildlife. It is widely considered to be a Persistent Organic Pollutant (POP) and is readily absorbed by stomach, lungs and through the skin. It has been banned in over 68 countries. Some areas where it is banned are Belize, Singapore, Tonga, Syria, Germany, the USA, the Brazilian state Rondonia, the UK, Sweden, Netherlands, Colombia, and the Indian state Kerala. It is severely restricted in Australia, Bangladesh, Indonesia, Cambodia, Japan, Korea, Kazakhstan, Kuwait, Philippines, Lithuania,

Sri Lanka, Taiwan, Thailand, Denmark, Yugoslavia, Norway, Finland, Russia, Venezuela, Dominica and Canada. This pesticide is classified as a Highly Hazardous chemical by the US Environmental Protection Agency (EPA) and the European Union, as a Persistent Toxic Substance by the United Nations Environmental Programme (UNEP), as a Category II - Moderately Hazardous chemical by the World Health Organization (WHO), and as Extremely Hazardous chemical by the Industrial Toxicological Research Centre (ITRC) in India. However, India is the largest producer, consumer and exporter of Endosulfan.

How did the disaster happen?

The endosulfan tragedy happened in Kasaragod district of Kerala in India. It is not a well-known tragedy. It is considered by many experts in the field of pesticide toxicity as one of the world's worst pesticide disasters. The Plantation Corporation of Kerala (PCK), a public sector undertaking under the State Government, which owns three cashew plantations covering 4600 hectares in Kasargod, sprayed endosulfan aerially in these plantations for 24 years (1976 to 2000), three times a year. These uninterrupted spraying in spite of several warnings about its disastrous impact on health and environment has resulted in several chronic, critical and life-threatening ailments in the areas surrounding the plantations.

What are its impacts?

Eleven Gram Panchayats covering twelve villages (group and sub-villages) have been severely affected. These villages are Enmakaje, Belur, Kumbadaje, Badiadka, Muliyar, Karadukka, Periya, Pullur, Ajanur, Kallar, Panathady, Kayyur, Cheemeni. In these villages there is a very high concentration of chronic health complications like Mental, Physical and Behavioural disorders, Sensory loss, Neurological ailments, Cardiovascular diseases, Congenital Anomalies, Dermatological and Musculoskeletal disorders etc. *This tragedy occurred because a toxic chemical was used continuously in a populated area with several (open) natural drinking water sources.*

5.2. Area of de-facto organic (maintains as such and brings under certification)

In this we cover Western India (Western Rajasthan and North Gujarat) and NE Region Main target maintains as such and brings under certification so small farmers to take advantage of the lucrative market for certified organic products in the developed world In India, approximately 70 per cent of arable land, where rainfed or dry farming is practiced, agro-chemicals are not generally used. According to an estimate made by the Institute of Integrated Rural Development in 2001, only one fifth of the dry land farmers in India use chemical inputs, the rest rely on manure and green compost for maintaining soil fertility. The majority of these people use traditional methods, often in highly heterogeneous and risk-

prone marginal environments. In fact, given their situation, these farmers have little choice, but to rely upon locally available natural resources to maintain soil fertility and to combat pests and diseases. Whatever may be the reasons, the fact is that the diverse farming systems managed by such small farmers could be considered as organic, as they do not rely on synthetic chemical pesticides or fertilizers and use technologies that optimize nutrient flows and use local resources such as native seeds and traditional knowledge. In technical terms such farms are called *'de-facto organic'* (as distinct from certified organic) farms, *i.e.,* farms that rely exclusively on natural methods of building soil fertility and combating pests and diseases, but are not inspected and verified by any organic certification agency.

Table 8. State wise consumption of plant nutrients per unit of gross cropped area in N E State as compared to national average

	Consumption				**Difference with national average**			
	N	**P_2O_5**	**K_2O**	**Total**	**N**	**P_2O_5**	**K_2O**	**Total**
Arunachal Pradesh	1.9	0.8	0.3	3.0	84.3	41.1	18	143.3
Assam	34.8	14.5	18.2	67.6	51.4	27.4	0.1	78.7
Manipur	21.9	4.7	1.3	27.9	64.3	37.2	17	118.4
Meghalaya	9.0	4.5	1.4	15.0	77.2	37.4	16.9	131.3
Mizoram	16.7	19.8	9.1	45.5	69.5	22.1	9.2	100.8
Nagaland	1.6	1.0	0.3	2.9	84.6	40.9	18	143.4
Tripura	26.0	14.4	11.2	51.6	60.2	27.5	7.1	94.7
All-India	86.2	41.9	18.3	146.3				

(*Source*: FAI, 2011-12)

5.2.1. *N E region, Western India*

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 N E region, Western India to the category of certified organic farms (Shetty *et al.,* 2013). 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. In India same region like as N E Region, Western Rajasthan Himalayan region and Chota Nagpur plateau are naturally growing crops without fertilizer and pesticides, due to climate reason even same farm, a single particle of urea never used in history so government should cover these areas and reserve for organic region. Government should

concentrate these areas and try to give them organic certificate at policy level so they can get benefit of premium price of organic certification. In this direction Sikkim declared first organic state in the country after 13 years effort from 2003 to 2016 (Indian Express, 2016; The Hindu 2016). And now government focusing on Himalayan region adjoining to Sikkim, Ministry of Agriculture and Farmer Welfare has launched a Central Sector Scheme entitled "Mission Organic Value Chain Development for North Eastern Region" for implementation in the states of Assam, Arunachal Pradesh, Meghalaya, Manipur, Mizoram, Tripura, Sikkim and Nagaland, during the 12th plan period (Ministry of Agriculture and Farmer Welfare 2016).

6. CHALLENGES OF INDIAN ORGANIC FARMING

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

6.1. 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). 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 bioinputs 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 (Das, 2004).

6.2. 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), 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 (GOI, 2001b) 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.

7. RESEARCH FINDING

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 (Dadhwal *et al*., 2011). 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), 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.

Table 9. Productivity of crops (t/ha) in organic *versus* conventional farming

State	Crop	Organic farming	Conventional farming	Per cent increase (+)/ decrease (-) in organic farming
Maharashtra	Vegetables	11.0	13.0	-15.3
	Fruit crops	11.4	13.6	-16.1
	Rice	2.0	2.5	-20.0
	Wheat	1.2	1.5	-20.0
Karnataka	Soybean	0.9	1.1	-18.2
	Chickpea	0.8	0.8	0.0
	Fruit crops	8.0	9.0	-11.1
	Groundnut	1.2	1.4	-14.2
	Sugarcane	120	140	-14.3
Tamil Nadu and Pondicherry	Cotton	0.6	0.8	-25.0
	Cashew	1.3	1.0	+30.0
	Banana	25.0	30.0	-16.6
	Mango	8.0	6.0	+33.3
	Guava	20.0	23.0	-13.0
	Coconut	28,250 nuts	28,750 nuts	-1.7
Kerala	Rice	5.0	6.0	-16.6
	Pepper	1.38	1.40	-1.4
	Banana	23.6	27.2	-13.2
	Coconut	31,000 nuts	30,500 nuts	+1.6
	Coffee	1.23	1.31	-6.1
	Turmeric	22.5	25.0	-10.0
Uttarakhand	Rice	3.77	3.82	-1.3
	Wheat	3.12	3.92	-20.4
	Potato	12.0	15.0	-20.0
Mean				-9.2

(*Source*: Ramesh *et al.,* 2010)

According to Sahu *et al*. (2010), 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.

Table 10. Knowledge gap of farmers on the basis of the organic farming practices

S.No.	Organic farming practices	Maximum knowledge (score)	Total obtained Knowledge (score)	Knowledge gap percentage	Rank
1.	Knowledge about concept of organic farming	90	76	15.56	IX
2.	Use of bio-pesticides	90	55	38.88	III
3.	Use of organic manure and crop residues	90	66	26.66	VII
4.	Use of mechanical cultivation	90	61	32.22	VI
5.	Use of vermicompost	90	74	17.77	VIII
6.	Use of bio-fertilizers	90	58	35.55	V
7.	Use of HaNPV	90	51	43.34	I
8.	Use of NADEP compost	90	56	37.77	IV
9.	Use of trichocards	90	53	41.12	II
	Over all knowledge gap	810	550	32.10	

(*Source*: Sahu *et al.,* 2010)

8. CONCLUSION

According to Ramesh P. *et al*. (2005) 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.

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