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3. Organic Farming in India: Potential Technologies and Way Forward

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Abstract:

Organic farming in India has emerged as a sustainable and environmentally friendly alternative to conventional agriculture, aiming to reduce reliance on synthetic inputs and promote ecological balance. This abstract explores the potential technologies and outlines the way forward for the organic farming sector in the country. Key technologies include the adoption of bio-fertilizers, organic pest management, crop rotation, and precision farming techniques. Bio-fertilizers, such as vermicomposting and green manure, enhance soil fertility and structure while reducing dependence on chemical fertilizers. Organic pest management employs natural predators and botanical extracts, minimizing the use of synthetic pesticides and preserving biodiversity. Crop rotation strategies enhance soil health and break pest cycles, contributing to sustainable farming practices. The way forward for organic farming in India involves policy support, farmer education, and market development. Government policies promoting organic farming practices, financial incentives, and research funding are essential for widespread adoption. Farmer education programs on organic techniques and certification processes empower growers to transition successfully. Market development, including the establishment of organic produce markets and consumer awareness campaigns, ensures a viable market for organic products.

Keywords: *Farming, Sustainable, Conventional, Environment, Chemical.*

3.1 Introduction:

Organic farming is often associated directly with, "Sustainable farming." However, ‘organic farming’ and ‘sustainable farming’, policy and ethics-wise are two different terms. Many techniques used in organic farming like inter-cropping, mulching and integration of crops and livestock are not alien to various agriculture systems including the traditional agriculture practiced in old countries like India. However, organic farming is based on various laws and certification programmes, which prohibit the use of almost all synthetic inputs, and health of the soil is recognized as the central theme of the method. Organic products are grown under a system of agriculture without the use of chemical fertilizers and

pesticides with an environmentally and socially responsible approach. This is a method of farming that works at grass root level preserving the reproductive and regenerative capacity of the soil, good plant nutrition, and sound soil management, produces nutritious food rich in vitality which has resistance to diseases. The farming being practiced for the last five decades in India has increasingly been found non-sustainable. The system is oriented towards high production without much concern for ecology and the very existence of man himself. Adverse effects of modern agricultural practices not only on the farm but also on the health of all living things and thus on the environment have been well documented all over the world. Application of technology, particularly in terms of the use of chemical fertilizers and pesticides all around us has persuaded people to think aloud. Their negative effects on the environment are manifested through soil erosion, water shortages, salivation, soil contamination, genetic erosion, etc. Organic farming is one of the widely used methods, which is thought of as the best alternative to avoid the ill effects of chemical farming. The origin of organic farming goes back, in its recent history, to 1940s.

During this period, the path breaking literature on the subject published by J.I. Rodale in the United States, Lady Balfour in England and Sir Albert Howard in India contributed to the cause of organic farming. In simple words organic agriculture is the production system with the optimum utilization of local resources in such a way so that sustainability of production and wellness of the society and environment can be maintained for fairly long time. Although organic agriculture seems to be just the exclusion of synthetic external inputs but it is the ideological differences with conventional agriculture (Sharma, 2001) that makes organic agriculture friendly to society and environment.

Table 3.1: Ideological Differences Between Organic Agriculture and Conventional Agriculture

Organic Agriculture	Conventional (chemical) Agriculture
Holistic approach: Any technology applied considering the system as a whole- No Imbalance	Reductionist approach: Targeted approach for one commodity or one pest or deficiency of nutrient- creates imbalance in system
Decentralize production: Most of the inputs e.g. seed, manure, bio pesticides etc. produced at farm/village level- suitable to local environment + generate employment + low cost of production	Centralize production: Produced in factories/farms, away from the place of use- no proper use of local resources + least employment+ increase cost of production
Harmony with NATURE: Harness the benefit of natural resources, flora and fauna by using or giving favorable environment to them- sustained productivity of natural resources	Domination on NATURE: Agriculture system is forced to produce more- Regenerative capacity of natural resources decreased + decreased productivity in long term.
Input optimization: best use/recycling of available resources. System regenerative capacity and owners' economic capacity maintained/enhanced.	Output maximization: Over use of resources disturbs system and resources productivity in long-term Increasing cost.

Organic Agriculture	Conventional (chemical) Agriculture
Knowledge Intensive: Only few resources but need how timely and best integrated. Least dependency on experts/imported technologies, once farmer trained possible in remotest area.	Input Intensive: Comprehensive list of chemicals with time and method. Needs experts for timely updating. Only possible in resources sufficient areas.
Preventive, protective and proactive approach: All the actions/ applications are done in anticipation of system requirement-least use of inputs.	Cause and control approach: Most of the actions/applications are done to control the damage to system-heavy use of inputs.
Decreasing input use: As the system reaching at perfection, it conserve/generate its own resources e.g. for nutrition and protection-decreasing requirement of inputs	Increasing input use: Target and action approach that rather, deteriorate systems regenerative capacity increasing requirement of inputs.

3.2 History of Organic Farming:

3.2.1 Pre-World War II:

The first 40 years of the 20th century saw simultaneous advances in biochemistry and engineering that rapidly and profoundly changed farming. The introduction of the gasoline-powered internal combustion engine ushered in the era of the tractor and made possible hundreds of mechanized farm implements. Research in plant breeding led to the commercialization of hybrid seed. And a new manufacturing process made nitrogen fertilizer — first synthesized in the mid-19th century - affordably abundant.

These factors changed the labor equation. Consciously organic agriculture (as opposed to the agriculture of indigenous cultures, which always employs only organic means) began more or less simultaneously in Central Europe and India. The British Botanist Sir Albert Howard is often referred to as the father of modern organic agriculture. From 1905 to 1924, he worked as an agricultural adviser in Pusa, Bengal, where he documented traditional Indian farming practices and came to regard them as superior to his conventional agriculture science.His research and further development of these methods is recorded in his writings, notably, his 1940 book, An Agricultural Testament, which influenced many scientists and farmers of the day.

In Germany, Rudolf Steiner's development, biodynamic agriculture, was probably the first comprehensive organic farming system. This began with a lecture series Steiner presented at a farm in Koberwitz (now in Poland) in 1924. Steiner emphasized the farmer's role in guiding and balancing the interaction of the animals, plants and soil. Healthy animals depended upon healthy plants (for their food), healthy plants upon healthy soil, healthy soil upon healthy animals (for the manure). In 1909, American agronomist F.H. King toured China, Korea, and Japan, studying traditional fertilization, tillage, and general farming practices. He published his findings in Farmers of Forty Centuries (1911, Courier Dover Publication). King foresaw a "world movement for the introduction of new and improved methods" of agriculture and in later years his book became an important organic reference.

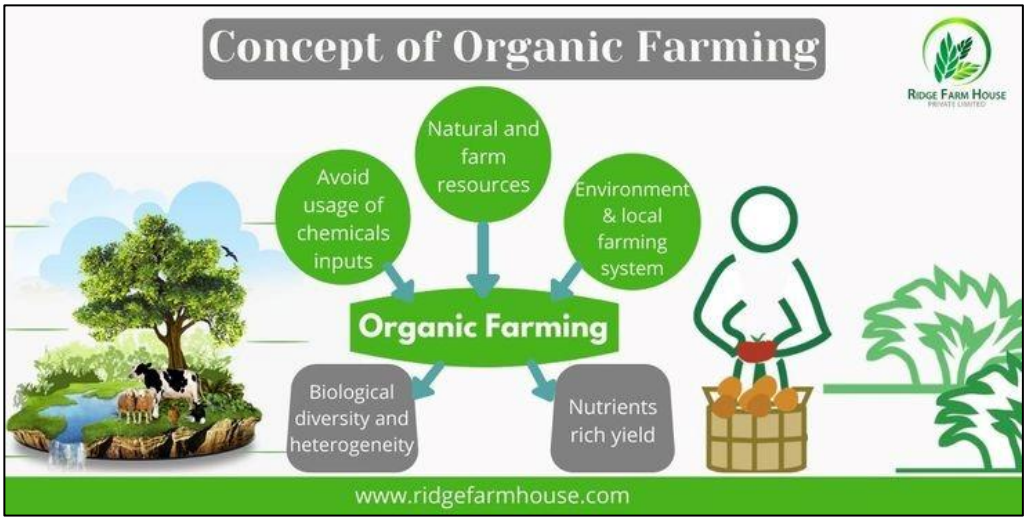

Figure 3.1: Organic Farming

The term organic farming was coined by Lord North Bourne in his book Look to the Land (written in 1939, published 1940). From his conception of "the farm as organism," he described a holistic, ecologically balanced approach to farming. In 1939, influenced by Sir Albert Howard's work, Lady Eve Balfour launched the Hughley Experiment on farmland in England. It was the first scientific, side-by-side comparison of organic and conventional farming. Four years later, she published The Living Soil, based on the initial findings of the Hughley Experiment. Widely read, it led to the formation of a key international organic advocacy group, the Soil Association. In Japan, Masanobu Fukuoka, a microbiologist working in soil science and plant pathology, began to doubt the modern agricultural movement. In 1937, he quit his job as a research scientist, returned to his family's farm in 1938, and devoted the next 60 years to developing a radical no-till organic method for growing grain and many other crops, now known as Nature Farming (Natural Farming), 'do–nothing' farming or Fukuoka farming.

3.2.2 Post-World War II:

Technological advances during World War II accelerated post-war innovation in all aspects of agriculture, resulting in large advances in mechanization (including large-scale irrigation), fertilization, and pesticides. In particular, two chemicals that had been produced in quantity for warfare, were repurposed for peace-time agricultural uses. Ammonium nitrate, used in munitions, became an abundantly cheap source of nitrogen. And a range of new pesticides appeared: DDT, which had been used to control disease-carrying insects around troops, became a general insecticide, launching the era of widespread pesticide use.

At the same time, increasingly powerful and sophisticated farm machinery allowed a single farmer to work larger areas of land and fields grew bigger. In 1944, an international campaign called the Green Revolution was launched in Mexico with private funding from the US. It encouraged the development of hybrid plants, chemical controls, large-scale irrigation, and heavy mechanization in agriculture around the world.

During the 1950s, sustainable agriculture was a topic of scientific interest, but research tended to concentrate on developing the new chemical approaches. In the US, J.I. Rodale began to popularize the term and methods of organic growing, particularly to consumers through promotion of organic gardening.

In 1962, Rachel Carson, a prominent scientist and naturalist, published Silent Spring, chronicling the effects of DDT and other pesticides on the environment. A bestseller in many countries, including the US, and widely read around the world, Silent Spring is widely considered as being a key factor in the US government's 1972 banning of DDT. The book and its author are often credited with launching the worldwide environmental movement. In the 1970s, global movements concerned with pollution and the environment increased their focus on organic farming. As the distinction between organic and conventional food became clearer, one goal of the organic movement was to encourage consumption of locally grown food, which was promoted through slogans like "Know Your Farmer, Know Your Food".

In 1972, the **International Federation of Organic Agriculture Movements (IFOAM)** was founded in Versailles, France and dedicated to the diffusion and exchange of information on the principles and practices of organic agriculture of all schools and across national and linguistic boundaries.

In 1975, Fukuoka released his first book, The One-Straw Revolution, with a strong impact in certain areas of the agricultural world. His approach to small-scale grain production emphasized a meticulous balance of the local farming ecosystem, and a minimum of human interference and labor.

In the 1980s, around the world, farming and consumer groups began seriously pressuring for government regulation of organic production. This led to legislation and certification standards being enacted through the 1990s and to date. Since the early 1990s, the retail market for organic farming in developed economies has been growing by about 20% annually due to increasing consumer demand. Concern for the quality and safety of food, and the potential for environmental damage from conventional agriculture, are apparently responsible for this trend.

3.3 Twenty-First Century:

Throughout this history, the focus of agricultural research and the majority of publicized scientific findings have been on chemical, not organic farming. This emphasis has continued to biotechnologies like genetic engineering. One recent survey of the UK's leading government funding agency for bioscience research and training indicated 26 GM crop projects, and only one related to organic agriculture. This imbalance is largely driven by agribusiness in general, which, through research funding and government lobbying, continues to have a predominating effect on agriculture-related science and policy.

Agribusiness is also changing the rules of the organic market. The rise of organic farming was driven by small, independent producers and by consumers. In recent years, explosive organic market growth has encouraged the participation of agribusiness interests.

As the volume and variety of "organic" products increases, the viability of the small-scale organic farm is at risk, and the meaning of organic farming as an agricultural method is ever more easily confused with the related but separate areas of organic food and organic certification.

In Havana, Cuba, a unique situation has made organic food production a necessity. Since the collapse of the Soviet Union in 1989 and its economic support, Cuba has had to produce food in creative ways like instituting the world's only state-supported infrastructure to support urban food production. Called organopónicos, the city is able to provide an ever-increasing amount of its produce organically.

3.4 Definitions:

There is not one universally accepted definition of organic farming. Most organic farmers and organic consumers expect that organic farming methods should include natural, not chemical growth and production methods such as crop rotation, mechanical cultivation, animal manures, green manure and integrated pest management.

In 1980, the **USDA** released a landmark report of organic farming. The report defined organic farming as a production system, which avoids or largely excludes the use of synthetic organic fertilizers, pesticides, growth regulators and livestock feed additives. Organic farming systems largely depends on crop rotations, crop residues, animal manures, green manures, off-farm organic wastes, mechanical cultivation, mineral bearing rocks and aspects of biological control to maintain soil productivity, supply plant nutrients and to control insects, pathogens and weeds (Sharma 2002).

According to Codex definition (FAO), organic agriculture is production management system, which promotes and enhances agro-ecosystem health, including biodiversity, biological cycles and biological activity.

It emphasizes the use of management practices in preferences to the use of off-farm inputs, taking into account that regional conditions require locally adopted systems. This is accomplished by using, where possible, on-farm agronomic, biological and mechanical methods, as opposed to using synthetic materials to fulfill any specific function within the system.

Organic farming is the form of agriculture that relies on crop rotation, green manure, compost, biological pest control, organically approved pesticide application and mechanical cultivation to maintain soil productivity and control pests, excluding or strictly limiting the use of synthetic fertilizers and synthetic pesticides, plant growth regulators, livestock antibiotics, food additives, and genetically modified organisms.

Organic agricultural methods are internationally regulated and legally enforced by many nations, based in large part on the standards set by the International Federation of Organic Agriculture Movements (IFOAM), an international umbrella organization for organic organizations established in 1972. IFOAM defines the overarching goal of organic farming as follows:

"Organic agriculture is a production system that sustains the health of soils, ecosystems and people. It relies on ecological processes, biodiversity and cycles adapted to local conditions, rather than the use of inputs with adverse effects. Organic agriculture combines tradition, innovation and science to benefit the shared environment and promote fair relationships and a good quality of life for all involved." —**IFOAM**.

3.5 Principles:

The principles of organic agriculture serve to inspire the organic movement in its full diversity. They are the roots from which organic agriculture grows and develops. They express the contribution that organic agriculture can make to the world and a vision to improve all agriculture in a global context. The Principles of Organic Agriculture serve to inspire the organic movement in its full diversity.

3.5.1 The IFOAM Definition of Organic Agriculture is Based on:

A. The Principle of Health:

Organic Agriculture should sustain and enhances the health of soil, plant, animal, human and planet as one and indivisible. This principle points out that the health of individuals and communities cannot be separated from the health of ecosystems - healthy soils produce healthy crops that foster the health of animals and people. Health is the wholeness and integrity of living systems. It is not simply the absence of illness, but the maintenance of physical, mental, social and ecological well-being. Immunity, resilience and regeneration are key characteristics of health.

The role of organic agriculture, whether in farming, processing, distribution, or consumption, is to sustain and enhance the health of ecosystems and organisms from the smallest in the soil to human beings. In particular, organic agriculture is intended to produce high quality, nutritious food that contributes to preventive health care and well-being. In view of this it should avoid the use of fertilizers, pesticides, animal drugs and food additives that may have adverse health effects.

B. The Principle of Ecology:

Organic Agriculture should be based on living ecological systems and cycles, work with them, emulate them and help sustain them. This principal root organic agriculture within living ecological systems. It states that production is to be based on ecological processes, and recycling. Nourishment and well-being are achieved through the ecology of the specific production environment. For example, in the case of crops this is the living soil; for animals it is the farm ecosystem; for fish and marine organisms, the aquatic environment. Organic farming, pastoral and wild harvest systems should fit the cycles and ecological balances in nature. These cycles are universal but their operation is site-specific. Organic management must be adapted to local conditions, ecology, culture and scale. Inputs should be reduced by reuse, recycling and efficient management of materials and energy in order to maintain and improve environmental quality and conserve resources. Organic agriculture should attain ecological balance through the design of farming systems, establishment of habitats

and maintenance of genetic and agricultural diversity. Those who produce, process, trade, or consume organic products should protect and benefit the common environment including landscapes, climate, habitats, biodiversity, air and water.

C. The Principle of Fairness:

Organic Agriculture should build on relationships that ensure fairness with regard to the common environment and life opportunities. Fairness is characterized by equity, respect, justice and stewardship of the shared world, both among people and in their relations to other living beings. This principle emphasizes that those involved in organic agriculture should conduct human relationships in a manner that ensures fairness at all levels and to all parties - farmers, workers, processors, distributors, traders and consumers. Organic agriculture should provide everyone involved with a good quality of life, and contribute to food sovereignty and reduction of poverty. It aims to produce a sufficient supply of good quality food and other products. This principle insists that animals should be provided with the conditions and opportunities of life that accord with their physiology, natural behavior and wellbeing. Natural and environmental resources that are used for production and consumption should be managed in a way that is socially and ecologically just and should be held in trust for future generations. Fairness requires systems of production, distribution and trade that are open and equitable and account for real environmental and social costs.

D. 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. Organic agriculture is a living and dynamic system that responds to internal and external demands and conditions. Practitioners of organic agriculture can enhance efficiency and increase productivity, but this should not be at the risk of jeopardizing health and wellbeing. Consequently, new technologies need to be assessed and existing methods reviewed. Given the incomplete understanding of ecosystems and agriculture, care must be taken. This principle states that precaution and responsibility are the key concerns in management, development and technology choices in organic agriculture. Science is necessary to ensure that organic agriculture is healthy, safe and ecologically sound. However, scientific knowledge alone is not sufficient. Practical experience, accumulated wisdom and traditional and indigenous knowledge offer valid solutions, tested by time. Organic agriculture should prevent significant risks by adopting appropriate technologies and rejecting unpredictable ones, such as genetic engineering. Decisions should reflect the values and needs of all who might be affected, through transparent and participatory processes.

3.6 Concept of Organic Farming:

Organic farming endorses the concept that the soil, plant, animals and human beings are linked. Therefore, its goal is to create an integrated, environmentally sound, safe and economically sustainable agriculture production system. Soil is a living system linked to an organism with different components. Human interact with these natural components (minerals, organic matter, micro-organisms, animals and plants) to achieve harmony with nature and create a sustainable agricultural production. A key feature of organic farming is

the primary dependence on natural resource and those developed locally (green manures, crop residues, farm wastes etc.), rather than external inputs (especially synthetics). The farmer manages self-regulating ecological and biological processes for sustainable and economic production of products.

Organic farming systems do not use toxic agrochemical inputs (pesticides, fungicides, herbicides and fertilizers). Instead, they are based on development of biological diversity and the maintenance and replenishment of soil productivity.

3.6.1 The Concept of Organic Farming Is Based on Following Principles:

- Nature is the best role model for farming, since it does not use any inputs nor demand unreasonable quantities of water.
- The entire system is based on intimate understanding of nature's ways. The system does not believe in mining of the soil of its nutrients and do not degrade it any way for today's needs.
- The soil in this system is a living entity.
- The soil's living population of microbes and other organisms are significant contributors to its fertility on a sustained basis and must be protected and nurtured at all cost.
- The total environment of the soil, from soil structure to soil cover is more important.

Thus, in today's terminology it is a method of farming system which primarily aims 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.

3.6.2 Organic Farming Describes Two Major Aspects of Alternative Agriculture:

- Substitution of manures, farm organic resources and bio fertilizers (INM) for inorganic fertilizers.
- Biological and cultural pest, diseases and weed management (IPM, IDM and IWM) instead of chemical control.

3.6.3 The Key Characterization of Organic Farming in Relation to Soil Fertility and Crop Production Includes:

- Protecting the long-term fertility of soil by maintaining soil organic matter levels, fostering soil and biological activity and careful mechanical inversion
- Plant nutrients supply through relatively insoluble nutrient sources (organic sources) made available by the action of soil microbes
- Meeting crop need of nitrogen through nitrogen fixation by leguminous crops in the cropping systems and recycling of farm organic materials including crop residues and livestock wastes,

- Importance of crop rotation, natural predators, resistance varieties and other agronomic manipulations of plant protection including weed management, and
- Biodiversity management, soil and environmental health.

Organic agriculture is viable alternative to conventional agriculture. It protects the soil from erosion, improves natural resource base and sustains production at levels commensurate with carrying capacity of managed agroecosystem because of reduced dependence on fertilizers and plant protection chemicals. It minimizes environmental pollution and aids in regeneration of ecosystem.

Organic farming is one of several to sustainable agriculture and many of the techniques used (intercropping, crop rotation, ploughing, mulching, integration of crops and livestock etc) are practices under various agricultural systems. What makes organic farming unique is that almost all synthetic inputs are prohibited and soil health improving agronomic practices are mandated.

Organic farming is the pathway that leads to live in harmony with nature. Organic agriculture is the key to sound development and sustainable environment. It minimizes environmental pollution and the use of non-conventional natural resources (resources other than traditional resources). It conserves soil fertility and soil erosion through implementation of appropriate conservation practices. In philosophical terms organic farming means “farming in sprits of organic relationship”. In this system everything is connected with everything else. Since organic farming means placing farming on integral relationship, we should be well aware about the relationship between the soil, water and plants, between soil-soil microbes and waste products, between the vegetable kingdom and the animal kingdom of which the apex animal is the human being, between agriculture and forestry, between soil, water and atmosphere etc. It is the totality of these relationships that is the bedrock of organic farming.

3.7 Relevance in Present Context:

There are three categories of opinions about the relevance of organic farming for India. The first one simply dismisses it as a fad or craze. The second category, which includes many farmers and scientists, opines that there are merits in the organic farming but we should proceed cautiously considering the national needs and conditions in which Indian agriculture functions. They are fully aware of the environmental problems created by the conventional farming. But many of them believe that yields are lower in organic cultivation during the initial period and also the cost of labour tends to increase therein. The third one is all for organic farming and advocates its adoption wholeheartedly. They think that tomorrow's ecology is more important than today's conventional farm benefits. However, among many a major reservation, the profitability of organic farming vis a vis conventional farming, is the crucial one from the point of view of the Indian farmers, particularly the small and marginal. Organic farming involves management of the agro-eco system as autonomous, based on the capacity of the soil in the given local climatic conditions. In spite of the ridicule poured out on organic farming by many, it has come to stay and is spreading steadily but slowly all over the world. India has been very slow to adopt it but it has made Inroads into our conventional farming system.

The relevance and need for an eco-friendly alternative farming system arose from the ill effects of the chemical farming practices adopted worldwide during the second half of the last century. The methods of farming evolved and adopted by our forefathers for centuries were less injurious to the environment. People began to think of various alternative farming systems based on the protection of environment which in turn would increase the welfare of the humankind by various ways like clean and healthy foods, an ecology which is conducive to the survival of all the living and non-living things, low use of the non-renewable energy sources, etc. Many systems of farming came out of the efforts of many experts and laymen. However, organic farming is considered to be the best among all of them because of its scientific approach and wider acceptance all over the world. The International Scene The negative effects of modem chemical-based farming system were first experienced by those countries, which introduced it initially. So, naturally, it was in those countries organic farming was adopted in relatively large scales. There are very large number of organizations promoting the organic farming movement in European countries, America, Australia and rest of the world.

These organizations, for example, the International Federation of Organic Agriculture Movements (IFOAM) and Greenpeace have studied the problems of the chemical farming methods and compared the benefits accruing to the organic farming with the former. Organic farming movements have since spread to Asia and Africa too.

IFOAM was founded in France in 1972. It spearheads and coordinates organic farming efforts the world over by promoting organic agriculture as an environment friendly and sustaining method. It focuses on organic farming by highlighting the minimum pollution and low use of non-renewable natural resources through this method. It has about 600 organizational members spread over about 120 countries including India. IFOAM undertakes a wide range of activities related to organic farming such as exchanging knowledge and thoughts among its members; representation of the movement in governmental, administrative and policy making forums in the national and international arena; updating of production, processing and trading standards; formulation and coordination of research projects; and holding of international conferences and seminars. IFOAM participates in the activities related to organic farming under the auspices of the United Nations and keeps active contacts with several international NGOs.

The Food and Agriculture Organization (FAO) of the United Nations provides support to organic farming in the member countries. It also attempts the harmonization of national organic standards, which is absolutely essential to increase international trade in organic products. The FAO has, in association with the World Health Organization (WHO), evolved the Codex Alimentarius for organic products. Organic farming has several advantages over the conventional one apart from the protection of both the environment and human health. Improved soil fertility, better water quality, prevention of soil erosion, generation of rural employment, etc. are some of them.

The concept of quality food has undergone a drastic change over the past few decades. It does give emphasis on the characteristics of the end product, but the process and method of production and transport are now considered equally important. Not only the importers but also the domestic retailers have their own quality specifications or standards, which in many cases are tougher than those of the government regulations. Consumers have become health

conscious and are willing to pay for the clean, healthy and natural food. Many developed countries have various support programmes to help organic farming with financial incentives and technical guidance.

The organic food market in the world has grown rapidly in the past decade. International trade in organic foods showed an annual growth rate of about 20-22 % during this period. Many retail chains and supermarkets in advanced countries are accorded with 'green status' to sell organic foods. The organic food processing industry is considered nature friendly and thus encouraged.

3.8 Need for Organic Farming in India:

The need for organic farming in India arises from the un-sustainability of agriculture production and the damage caused to ecology through the conventional farming practices. The present system of agriculture which we call 'conventional' and practiced the world over evolved in the western nations as a product of their socio-economic environment which promoted an overriding quest for accumulation of wealth. This method of farming adopted by other countries is inherently self-destructive and unsustainable. The modern farming is highly perfected by the Americans who dispossessed the natives of their farms right from the early period of the new settlers in US (Wadia, 1996). The large farms appropriated by the immigrants required machines to do the large-scale cultural operations.

These machines needed large amount of fossil fuels besides forcing the farmers to raise the same crops again and again, in order to utilize these machines to their optimum capacities. The result was the reduction of bio-diversity and labor. The high cost of the machines necessitated high profits, which in turn put pressure to raise productivity. Then, only those crops with high productivity were cultivated which needed increased quantities of fertilizers and pesticides. Increasing use of pesticides resulted in the damage to environment and increased resistance of insects to them. Pesticides harmed useful organisms in the soil. The monoculture of high yielding seeds required external inputs of chemical fertilizers. The fertilizers also destroy soil organisms. They damage the rhizobia that fix nitrogen and other microorganisms that make phosphates available to plants (Wadia, 1996). The long-term effect was reduction of crop yields. The damaged soil was easily eroded by wind and water. The eroding soil needed use of continuously increasing quantities of fertilizers, much of which was washed/leached into surface and underground water sources. The theme of consumer welfare has become central in the economic activities in the developed countries in the world. Sustainable agriculture based on technologies that combine increased production with improved environmental protection has been accepted as absolutely essential for the maximization of the consumer welfare. The consumers are increasingly concerned about the quality of the products they consume and food safety has become a crucial requirement. Safety, quality and hygienic standards are increasingly being made strict. The mad cow disease and the question of genetically modified food production are the recent instances, which made the countries to tighten the laws. Mycotoxin contamination, unacceptable levels of pesticide residues and environment degradation are the problems on which the attention is centered. Keeping the interests of the consumers, the European Union has taken tough measures including criminal prosecution to ensure food safety. Another area to increase the consumer welfare is promotion of the eco-friendly

methods in agriculture. No-till, or conservation agriculture, lower input approaches of integrated pest or nutrient management and organic farming are some of them. The Indian agriculture switched over to the conventional system of production on the advent of the green revolution in the 1970s. The change was in the national interest which suffered setbacks because of the countries over dependence on the foreign food sources. The national determination was so intense that all the attention was focused on the increase in agriculture production. The agriculture and allied sectors in India provide employment to 65% of the workers and accounts for 30% of the national income. The growth of population and the increase in income will lead to a rise in demand for food grains as also for the agricultural raw materials for industry in the future. The area under cultivation, obviously, cannot be increased and the present 140 million hectares will have to meet the future increases in such demands. There is a strong reason for even a decline in the cultivated area because of the urbanization and industrialization, which in turn will exert much pressure on the existing, cropped area. Science and technology have helped man to increase agricultural production from the natural resources like land. But the realization that this has been achieved at the cost of the nature and environment, which support the human life itself, is becoming clear. It has been fully evident that the present pattern of economic development, which ignores the ecology and environment, cannot sustain the achievement of man without substantial erosion of the factors that support the life system of all living things on the Earth. The evidence of the ill effects of development is well documented. As said earlier, we in India have to be concerned much more than any other nation of the world as agriculture is the source of livelihood of more than 6-7 million of our people and it is the foundation of the economic development of the country. There were times when people lived close to nature with access to flora and fauna in healthier and cleaner surroundings. One has to look back at our present metropolitan cities or other large towns before the past fifty years as recorded in history/memories of the present elder generation to see the striking differences in the surroundings in which the people lived there. Land, water and air, the most fundamental resources supporting the human life, have degraded into such an extent that they now constitute a threat to the livelihood of millions of people in the country. Ecological and environmental effects have been highly publicized all over the world. Many times, these analyses have taken the shape of doomsday forecasts. Powerful interests in the developed western countries have also politicized these issues to take advantage of the poor nations of the world. Efforts to impose trade restrictions on the plea of environment protection are a direct result of these campaigns. But we have to recognize that the abysmal level to which we have degraded our resources, requires immediate remedial measures without terming the demand for them as the ploys of the rich nations to exploit the poor. Another turn of the events has been the blame game for ecological problems stated at the Earth Summit and other international conferences. The developed countries, it is true, are to a great extent instrumental to degrade the environment. However, the poorer countries of the world including India cannot delay or ignore the need for remedial measures, which are to be effectively implemented. We cannot gloss over the fact that we have also contributed to the degradation of ecology; look at the droughts and floods, disappearance of forests, high noise level and air pollution in the cities which are our own creations. Organically cultivated soils are relatively better attuned to withstand water stress and nutrient loss. Their potential to counter soil degradation is high and several experiments in arid areas reveal that organic farming may help to combat desertification (Alam and Wani, 2003). It is reported that about 70 hectares of desert in Egypt could be converted into fertile soil supporting livestock through organic and biodynamic practices. India, which has some areas of semi-arid and

arid nature, can benefit from the experiment. The organic agriculture movement in India received inspiration and assistance from IFOAM which has about 600 organizational members from 120 countries. All India Federation of Organic Farming (AIFOF) is a member of IFOAM and consists of a number of NGOs, farmers' organizations, promotional bodies and institutions. The national productivity of many of the cereal crops, millets, oilseeds, pulses and horticultural crops continues to be one of the lowest in the world in spite of the green revolution. The fertilizer and pesticide consumption has increased manifold; but this trend has not been reflected in the crop productivity to that extent.

The country's farming sector has started showing indications of reversing the rising productivity as against the increasing trend of input use. The unsustainability of Indian agriculture is caused by the modern farming methods which have badly affected/damaged production resources and the environment. In India, the development of organic agriculture is receiving increasing attention among farmers, producers, processors, traders, exporters and consumers. Growing consciousness of health hazards due to the possible contamination of farm produce from the use of synthetic chemicals have immensely contributed to the revival of this form of farming during the last ten years. Agro-climatic conditions in India and our agricultural biodiversity are conducive to organic agriculture and hence offer tremendous scope for cultivation of a wide range of organic products. India is now understood to be a potential supplier of organic products to the international market. Presently, India is exporting these products to Europe, US and Japan and volumes are looking up. Organic agriculture has grown out of the conscious efforts by inspired people to create the best possible relationship between the earth and men. Since it beginning the sphere surrounding organic agriculture has become considerably more complex. A major challenge today is certainly its entry into the policy making arena, its entry into anonymous global market and the transformation of organic products into commodities. During the last two decades, there has also been a significant sensitization of the global community towards environmental preservation and assuring of food quality. Ardent promoters of organic farming consider that it can meet both these demands and become the mean for complete development of rural areas. After almost a century of development organic agriculture is now being embraced by the mainstream and shows great promise commercially, socially and environmentally. While there is continuum of thought from earlier days to the present, the modern organic movement is radically different from its original form. It now has environmental sustainability at its core in addition to the founders concerns for healthy soil, healthy food and healthy people. To provide a focused and well directed development of organic agriculture and quality products, Ministry of Commerce and Industry, Government of India launched the National Programme on Organic Production (NPOP) in the year 2000, which was formally notified in October 2001 under the Foreign Trade and Development Act (FTDR ACT).

The national programme involves the accreditation programme for certification bodies, norms for organic production, promotion of organic farming etc. The NPOP standards for production and accreditation system have been recognized by European Commission and Switzerland as equivalent to their country standards. Similarly, USDA has recognized NPOP conformity assessment procedures of accreditation as equivalent to that of US. With these recognitions, Indian organic products duly certified by the accredited certification bodies of India are accepted by the importing countries.

Recently, NPOP has also been notified under Agricultural Produce (Grading and Marking) Act, 1937 (APGMC) as Organic Agricultural Produce Grading and Marking Rules, 2008 with Agricultural Marketing Advisor (AMA) in Department of Agriculture and Cooperation as its controller. Under these programmes a mechanism has been launched to authorize/accredit certification and inspection agencies for certification of organically produced agricultural goods.

India is bestowed with lot of potential to produce a variety of organic products. In several parts of the country, the inherited tradition of organic farming is an added advantage. These holds promise for the organic producers to tap the market which is growing steadily in the domestic market related to the export market. Currently, India ranks 33rd in terms of total land under organic cultivation and 88th position for agriculture land under organic crops to total farming area. The cultivated land under certification was around 2.8 million ha in 2007-08 which increased to 4.43 million ha during 2010-11. This also includes the forest area (wild collection). India produced around 3.88 million MT of certified organic products which includes all varieties of food products namely Basmati rice, Pulses, Honey, Tea, Spices, Coffee, Oil Seeds, Fruits, processed food, Cereals, Herbal medicines and their value-added products. The production is not limited to the edible sector but also produces organic cotton fiber, garments, cosmetics, functional food products, body care products, etc. India exported 86 items last year (2010-11) with the total volume of 69837 MT. The export realization was around 157.22 million US $ registering a 33% growth over the previous year. Organic products are mainly exported to EU, US, Australia, Canada, Japan, Switzerland, South Africa and Middle East. Oil Crops (except Sesame) leads among the products exported (17966 MT).

3.9 Some Other forms of Organic Management Close to Nature and Tradition:

3.9.1 Biodynamic Agriculture:

Biodynamic agriculture is a method of farming that aims to treat the farm as a living system which interacts the environment, to build healthy, living soil and to produce food that nourishes and vitalizes and helps to develop mankind. The underlying principle of biodynamics is making life-giving compost out of dead material. The methods are derived from the teachings of Rudolf Steiner and subsequent practitioners. The important components of biodynamic farming are as follows:

- Turning in plant materials such as green crops and straw
- Not using chemical fertilizers and pesticides
- Avoiding soil compaction by machinery or animals, particularly in wet weather
- Keeping soil covered by pasture, crops or mulch not destroying the soil structure by poor farming practices such as excessive use of rotary hoe or cultivation in unsuitable weather (too wet or too dry)
- Fallowing the land by planting deep-rooting permanent pasture species or using green crops f. Use of preparations BD-500 and BD-501
- Compost made with preparations BD-502 – BD-507
- Liquid manure made with preparations BD-502 – BD-507
- Cowpat pit manure made with preparations BD-502 – BD-507

These biodynamic preparations named BD-500 to BD-507 are not food for the plants, but they facilitate the effective functioning of etheric forces. They are also not the usual compost starters, but can stimulate compost organisms in various ways. In short, they are biologically active dynamic preparations which help in harvesting the potential of astral and ethereal powers for the benefit of the soil and various biological cycles in the soil. So far 9 biodynamic preparations have been developed, named as formulation 500 to 508. Out of these, formulation-500 (cow horn compost) and formulation-501 (horn-silica) are very popular and are being used by large number of organic farmers. Formulations-502 to 507 are compost enrichers and promoters, while formulation 508 is of prophylactic in nature and helps in control of fungal diseases.

3.9.2 Rishi Krishi:

Drawn from Vedas, the Rishi Krishi method of natural farming has been mastered by farmers of Maharashtra and Madhya Pradesh. In this method, all on-farm sources of nutrients including composts, cattle dung manure, green leaf manure and crop biomass for mulching are exploited to their best potential with continuous soil enrichment through the use of Rishi Krishi formulation known as "Amritpani" and virgin soil. 15 kg of virgin rhizosperic soil collected from beneath of Banyan tree (Ficus bengalensis) is spread over one acre and the soil is enriched with 200 l Amritpani. It is prepared by mixing 250 g ghee into 10 kg of cow dung followed by 500 g honey and diluted with 200 l of water. This formulation is utilized for seed treatment (beej sanskar), enrichment of soil (bhumi sanskar) and foliar spray on plants (padap sanskar). For soil treatment it needs to be applied through irrigation water as fertigation. The system has been demonstrated on a wide range of crops i.e. fruits, vegetables, cereals, pulses, oilseeds, sugarcane and cotton.

Panchgavya Krishi Panchgavya is a special bio enhancer prepared from five products obtained from cow; dung, urine, milk, curd and ghee. Dr. Natrajan, a medical practitioner and scientist from Tamilnadu Agricultural University, has further refined the formulation suiting to the requirement of various horticultural and agricultural crops. Panchgavya contains many useful microorganisms such as fungi, bacteria, actinomycetes and various micronutrients. The formulation act as tonic to enrich the soil, induce plant vigour with quality production. Physico-chemical studies have revealed that panchgavya possess almost all macro and micronutrients and growth hormones (IAA, GA) required for plant growth. Predominance of fermentative microorganisms such as yeasts and Lactobacillus helps improve the soil biological activity and promote the growth of other microorganisms.

For foliar spray 3-4% panchgavya solution is quite effective. Four to five sprays ensure optimum growth and productivity: (a) two sprays before flowering at 15 days' interval, (b) two sprays during flowering and pod setting at 10 days' interval and (c) one spray during fruit/pod maturation. Application of panchgavya has been found to be very effective in many horticultural crops such as mango, guava, acid lime, banana, spice turmeric, flower-jasmine, medicinal plants like Coleus, Ashwagandha, vegetable like cucumber, spinach, okra, radish and grain crops such as maize, green gram and sunflower. Panchgavya has also been found to be reducing nematode problem in terms of gall index and soil nematode population. As due to application of panchgavya a thin oily film is formed on the leaves and stem, it reduces evaporation losses and ensures better utilization of applied water.

3.10 Organic Production Requirements:

The important organic production requirements as per national standards for organic production developed by APEDA are reproduced below:

3.10.1 Crop Production and Animal Husbandry in General:

A. Conversion Requirements:

Organic agriculture means a process of developing a viable and sustainable agroecosystem. The time between the start of organic management and certification of crops and/or animal husbandry is known as the conversion period. The whole farm, including livestock, should be converted according to the standards over a period of three years. For a sustainable agro-ecosystem to function optimally, diversity in crop production and animal husbandry must be arranged in such a way that there is interplay of all the elements of the farming management. Conversion may be accomplished over a period of time. A farm may be converted step by step. The totality of the crop production and all animal husbandry should be converted to organic management. There should be a clear plan of how to proceed with the conversion. This plan shall be updated if necessary and should cover all aspects relevant to these standards. The certification programme should set standards for different farming systems so that they can be clearly separated in production as well as in documentation, and the standards should determine norms to prevent a mix up of input factors and products. The standards requirements shall be met during the conversion period. All the standards requirements shall be applied on the relevant aspects from the beginning of the conversion period itself. If the whole farm is not converted, the certification programme shall ensure that the organic and conventional parts of the farm are separate and inspect able. Before products from a farm/project can be certified as organic, inspection shall have been carried out during the conversion period. The start of the conversion period may be calculated from the date of application of the certification programme or from the date of last application of unapproved farm inputs provided it can demonstrate that standards requirements have been met from that date of implementation. Simultaneous production of conventional, organic, in conversion and/or organic crops or animal products which cannot be clearly distinguished from each other, will not be allowed. To ensure a clear separation between organic and conventional production, a buffer zone or a natural barrier should be maintained. The certification programme shall ensure that the requirements are met. A full conversion period is not required where de facto full standards requirements have been met for several years and where this can be verified through several means and sources. In such cases inspection shall be carried out with a reasonable time interval before the first harvest.

a. Genetically Engineered Cultivars or Plant Materials Are Not Permitted in Organic Production:

- The seed for raising a crop should either be organically produced or if organic seed is not available, conventional seed without any chemical treatment may be used.
- Whole farm including the livestock should be converted to organic in a step-by-step manner.

- If the whole farm is not converted, the certification programme shall ensure that the organic and conventional parts of the farm are separate and inspect able.
- Before products from a farm/project can be certified as organic, inspection shall be carried out during the conversion period.
- To ensure a clear separation between organic and conventional production, the certification programme (agency) shall inspect, where appropriate, the whole production system.
- Plant products produced can be certified organic when the national standards requirements have been met with during the conversion period of at least two years before sowing for annual crops or in the case of perennial crops other than grassland, at least three years before the first harvest of products.
- Biodegradable material of microbial plant or animal origin shall form the basis of the fertilization programme.
- Manures containing human excreta (faeces and urine) cannot be used on vegetation for human consumption.
- Mineral fertilizers shall only be used in a supplementary role to carbon-based materials. Permission for use shall only be given when other fertility management practices have been optimized.
- Chilean nitrate and all synthetic nitrogenous fertilizers, including urea, are prohibited.
- Mineral fertilizers shall be applied in their natural composition and shall not be rendered more soluble by chemical treatment.
- Products used for pest, disease and weed management, prepared at the farm from local plants, animals and microorganisms, are allowed.
- The use of synthetic herbicides, fungicides, insecticides and other pesticides is prohibited.
- In case of reasonable suspicion of contamination, the certification programme shall make sure that an analysis of the relevant products and possible sources of pollution (soil and water) shall take place to determine the level of contamination.
- For protected structure coverings, plastic mulches, fleeces, insect netting and silage rapping, products based only on polyethylene and polypropylene or other polycarbonates are allowed. These shall be removed from the soil after use and shall not be burnt on the farmland. The use of polychloride based products such as PVC film is prohibited.

B. Maintenance of Organic Management:

Organic certification is based on continuance. The certification programme should only certify production which is likely to be maintained on a long-term basis. Converted land and animals shall not get switched back and forth between organic and conventional management.

Landscape Organic farming should contribute beneficially to the ecosystem. Areas which should be managed properly and linked to facilitate biodiversity:

- Extensive grassland such as moorlands, reed land or dry land
- In general, all areas which are not under rotation and are not heavily manured

- Extensive pastures, meadows, extensive grassland, extensive orchards, hedges, hedgerows, groups of trees and/or bushes and forest lines
- Ecologically rich fallow land or arable land
- Ecologically diversified (extensive) field margins
- Waterways, pools, springs, ditches, wetlands and swamps and other water rich areas which are not used for intensive agriculture or aqua production
- Areas with ruderal flora. The certification programme shall set standards for a minimum percentage of the farm area to facilitate biodiversity and nature conservation.

The certification programme shall develop landscape and biodiversity standards.

C. Crop Production:

a. Choice of Crops and Varieties:

All seeds and plant material should be certified organic. Species and varieties cultivated should be adapted to the soil and climatic conditions and be resistant to pests and diseases. In the choice of varieties genetic diversity should be taken into consideration. When organic seed and plant materials are available, they shall be used. The certification programme shall set time limits for the requirement of certified organic seed and other plant material. When certified organic seed and plant materials are not available, chemically untreated conventional materials shall be used. The use of genetically engineered seeds, pollen, transgene plants or plant material is not allowed.

b. Duration of Conversion Period:

The establishment of an organic management system and building of soil fertility requires an interim period, the conversion period. The conversion period may not always be of sufficient duration to improve soil fertility and reestablish the balance of the ecosystem but it is the period in which all the actions required to reach these goals are started.

The duration of the conversion period must be adapted to:

- The past use of the land
- The ecological situation Plant products produced can be certified organic when the national standards requirements have been met during a conversion period of at least two years before sowing or in the case of perennial crops other than grassland, at least three years (thirty-six months) before the first harvest of products. The accredited inspection and certification agency may decide in certain cases (such as idle use for two years or more) to extend or reduce the conversion period in the light of previous status of the land but the period must equal or exceed twelve months. The conversion period can be extended by the certification programme depending on, e.g., past use of the land and environmental conditions. The certification programme may allow plant products to be sold as "produce of organic agriculture in process of conversion" or a similar description during the conversion period of the farm. For the calculation of inputs for feeding, the feed produced on the farm unit during the first year of organic management,

may be classified as organic. This refers only to feed for animals which are themselves being reared within the farm unit and such feed may not be sold or otherwise marketed as organic. Feed produced on the farms in accordance with the national standards is to be preferred over conventionally grown / brought-in feeds.

c. Diversity in Crop Production:

The basis for crop production in gardening, farming and forestry in consideration of the structure and fertility of the soil and surrounding ecosystem and to provide a diversity of species while minimizing nutrient losses.

Diversity in crop production is achieved by a combination of:

- a versatile crop rotation with legumes
- an appropriate coverage of the soil during the year of production which diverse plant species

appropriate, the certification programme shall require that sufficient diversity is obtained in time or place in a manner that takes into account pressure from insects, weeds, diseases and other pests, while maintaining or increasing soil, organic matter, fertility, microbial activity and general soil health. For non-perennial crops, this is normally, but not exclusively, achieved by means of crop rotation.

d. Fertilization Policy:

Sufficient quantities of biodegradable material of microbial, plant or animal origin should be returned to the soil to increase or at least maintain its fertility and the biological activity within it. Biodegradable material of microbial, plant or animal origin produced on organic farms should form the basis of the fertilization programme.

Fertilization management should minimize nutrient losses. Accumulation of heavy metals and other pollutants should be prevented. Non synthetic mineral fertilizers and brought in fertilizers of biological origin should be regarded as supplementary and not a replacement for nutrient recycling.

Adequate pH levels should be maintained in the soil. Biodegradable material of microbial, plant or animal origin shall form the basis of the fertilization programme.

The certification programme shall set limitations to the total amount of biodegradable material of microbial, plant or animal origin brought onto the farm unit, taking into account local conditions and the specific nature of the crops.

The certification programme shall set standards which prevent animal runs from becoming over-manured where there is a risk of pollution.

Brought-in material (including potting compost) shall be in accordance with standards.

Manures containing human excreta (faeces and urine) shall not be used.

Mineral fertilizers shall only be used in a supplementary role to carbon-based materials. Permission for use shall only be given when other fertility management practices have been optimized. Mineral fertilizers shall be applied in their natural composition and shall not be rendered more soluble by chemical treatment. The certification programme may grant exceptions which shall be well justified. These exceptions shall not include mineral fertilizers containing nitrogen. The certification programme shall lay down restrictions for the use of inputs such as mineral potassium, magnesium fertilizers, trace elements, manures and fertilizers with a relatively high heavy metal content and/or other unwanted substances, e.g. basic slag, rock phosphate and sewage sludge. Chilean nitrate and all synthetic nitrogenous fertilizers, including urea, are prohibited.

3.11 Pest, Disease and Weed Management including Growth Regulators:

Organic farming systems should be carried out in a way which ensures that losses from pests, diseases and weeds are minimized. Emphasis is placed on the use of a balanced fertilizing programme, use of crops and varieties well adapted to the environment, fertile soils of high biological activity, adapted rotations, companion planting, green manures, etc. Growth and development should take place in a natural manner. Weeds, pests and diseases should be controlled by a number of preventive cultural techniques which limit their development, e.g. suitable rotations, green manures, a balanced fertilizing programme, early and pre-drilling seedbed preparations, mulching, mechanical control and the disturbance of pest development cycles.

The natural enemies of pests and diseases should be protected and encouraged through proper habitat management of hedges, nesting sites etc. Pest management should be regulated by understanding and disrupting the ecological needs of the pests. An ecological equilibrium should be created to bring about a balance in the pest predator cycle.

Products used for pest, disease and weed management, prepared at the farm from local plants, animals and microorganisms, are allowed. If the ecosystem or the quality of organic products is likely to be jeopardized, the Procedure to Evaluate Additional Inputs to Organic Agriculture and other relevant criteria shall be used to judge if the product is acceptable.

Branded products must always be evaluated. Thermic weed control and physical methods for pest, disease and weed management are permitted. Thermic sterilization of soils to combat pests and diseases is restricted to circumstances where a proper rotation or renewal of soil cannot take place. Permission may be given by the certification programme only on a case-by-case basis. All equipment's from conventional farming systems shall be properly cleaned and free from residues before being used on organically managed areas.

The use of synthetic herbicides, fungicides, insecticides and other pesticides is prohibited.

The use of synthetic growth regulators and synthetic dyes is prohibited.

The use of genetically engineered organisms or products is prohibited.

3.11.1 Contamination Control:

All relevant measures should be taken to minimize contamination from outside and from within the farm. In case of risk or reasonable suspicion of risk of pollution, the certification programme should set limits for the maximum application levels of heavy metals and other pollutants. Accumulation of heavy metals and other pollutants should be limited.

In case of reasonable suspicion of contamination, the certification programme shall make sure that an analysis of the relevant products to detect the possible sources of pollution (soil and water), shall take place to determine the level of contamination.

For protected structure coverings, plastic mulches, fleeces, insect netting and silage rapping, only products based on polyethylene and polypropylene or other polycarbonates are allowed. These shall be removed from the soil after use and shall not be burnt on the farmland. The use of polychloride based products is prohibited.

3.11.2 Soil and Water Conservation:

Soil and water resources should be handled in a sustainable manner.

Relevant measures should be taken to prevent erosion, salination of soil, excessive and improper use of water and the pollution of ground and surface water.

Clearing of land through the means of burning organic matter, e.g. slash-and burn, straw burning shall be restricted to the minimum.

The clearing of primary forest is prohibited.

Relevant measures shall be taken to prevent erosion.

Excessive exploitation and depletion of water resources shall not be allowed.

The certification programme shall require appropriate stocking rates which do not lead to land degradation and pollution of ground and surface water. Relevant measures shall be taken to prevent salination of soil and water.

3.11.3 Collection of Non-Cultivated Material of Plant Origin and Honey:

The act of collection should positively contribute to the maintenance of natural areas.

When harvesting or gathering the products, attention should be paid to maintenance and sustainability of the ecosystem.

Wild harvested products shall only be certified organic if derived from a stable and sustainable growing environment. Harvesting or gathering the product shall not exceed the sustainable yield of the ecosystem, or threaten the existence of plant or animal species.

Products can only be certified organic if derived from a clearly defined collecting area, which is not exposed to prohibited substances, and which is subject to inspection. The collection area shall be at an appropriate distance from conventional farming, pollution and contamination. The operator managing the harvesting or gathering of the products shall be clearly identified and be familiar with the collecting area in question.

3.11.4 Animal Husbandry:

A. Animal Husbandry Management:

Management techniques in animal husbandry should be governed by the physiological and ethological needs of the farm animals in question. This includes:

- That animals should be allowed to conduct their basic behavioural needs.
- That all management techniques, including those where production levels and speed of growth should be concerned, for the good health and welfare of the animals. For welfare reasons the herd or flock size should not adversely affect the behavioural patterns of the animal.

The certification programme shall ensure that the management of the animal environment takes into account the behavioural needs of the animals and provides for:

- Sufficient free movement
- Sufficient fresh air and natural daylight according to the needs of the animals
- Protection against excessive sunlight, temperatures, rain and wind according to the needs of the animals
- Enough lying and/or resting area according to the needs of the animal. For all animals requiring bedding, natural materials shall be provided.
- Ample access to fresh water and feed according to the needs of the animals
- Adequate facilities for expressing behaviour in accordance with the biological and ethological needs of the species.

No compounds used for construction materials or production equipment shall be used which might detrimentally affect human or animal health.

All animals shall have access to open air and/or grazing appropriate to the type of animal and season taking into account their age and condition, to be specified by the certification programme.

The certification programme shall allow exceptions in cases where:

- The specific farm or settlement structure prevents such access provided animal welfare can be guaranteed
- Areas where feeding of animals with carried fresh fodder is a more sustainable way to use land resources than grazing, provided animal welfare is not compromised.

Restrictions shall always include a time limit which shall be set for each exception. Poultry and rabbits shall not be kept in cages. Landless animal husbandry systems shall not be allowed.

When the natural day length is prolonged by artificial lighting, the certification programme shall prescribe maximum hours respective to species, geographical considerations and general health of animals. Herd animals shall not be kept individually.

The certification programme may allow exceptions, e.g., male animals, smallholdings, sick animals and those about to give birth.

3.11.5 Length of Conversion Period:

The establishment of organic animal husbandry requires an interim period, the conversion period.

The whole farm, including livestock, should be converted according to the standards set out in this document.

Conversion may be accomplished over a period of time.

Replacement poultry should be brought onto the holding at the start of the production cycle.

Animal products may be sold as "product of organic agriculture" only after the farm or relevant part of it has been under conversion for at least twelve months and provided the organic animal production standards have been met for the appropriate time.

The certification programme shall specify the length of time by which the animal production standards shall be met. With regard to dairy and egg production, this period shall not be less than 30 days.

Animals present on the farm at the time of conversion may be sold for organic meat if the organic standards have been followed for 12 months.

Brought-in Animals All organic animals should be born and raised in the organic holding. Organic animal husbandry should not be dependent on conventional raising systems.

When trading or exchanging livestock, it should preferably take place between organic farms or as part of a long-term cooperation between specific farms.

When organic livestock is not available, the certification programme shall allow brought-in conventional animals according to the following age limits:

- 2-day old chickens for meat production
- 18-week-old hens for egg production
- 2 weeks old for any other poultry

- piglets up to six weeks and after weaning
- calves up to 4 weeks' old which have received colostrum and are fed a diet consisting mainly of full milk. Certification programmes shall set time limits (not exceeding 5 years) for implementation of certified organic animals from conception for each type of animal.

Breeding stock may be brought in from conventional farms at an annual rate not exceeding 10% of the adult animals of the same species in the organic farm. For brought-in breeding stock the certification programme shall allow a higher yearly maximum than 10% in the following cases and with specific time limits:

- Unforeseen severe natural or manmade events
- Considerable enlargement of the farm
- Establishment of a new type of animal production on the farm
- Small holdings

3.12 Breeds and Breeding:

Breeds should be chosen which are adapted to local conditions. Breeding goals should not be at variance with the animal's natural behaviour and should be directed towards good health.

Breeding shall not include methods which make the farming system dependent on high technological and capital-intensive methods. Reproduction techniques should be natural.

The certification programme shall ensure that breeding systems are based on breeds that can both copulate and give birth naturally. Artificial insemination is allowed. Embryo transfer techniques are not allowed in organic agriculture.

Hormonal heat treatment and induced birth are not allowed unless applied to individual animals for medical reasons and under veterinary advice. The use of genetically engineered species or breeds is not allowed.

3.12.1 Mutilations:

The animals' distinctive characteristics should be respected. Species shall be chosen which do not require mutilation. Mutilations shall be allowed only in exceptional cases and shall be kept to the minimum. Mutilations are not allowed.

The certification programme shall allow the following exceptions:

- Castrations
- Tail docking of lambs
- Dehorning
- Ringing
- Mulesing Suffering shall be minimized and anesthetics used where appropriate.

3.13 Conclusion:

Organic farming in India holds immense promise as a sustainable agricultural approach. Leveraging potential technologies such as precision farming, organic inputs, and innovative pest management, the sector can enhance productivity while preserving environmental health. The way forward involves widespread adoption of organic practices, government support through subsidies and awareness campaigns, and collaboration between farmers, researchers, and policymakers. By prioritizing ecological balance and long-term soil fertility, organic farming not only addresses food security but also contributes to a resilient and environmentally conscious agricultural landscape in India.