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I N D E X

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1. ORGANIC FARMING FOR SUSTAINABLE AGRICULTURAL DEVELOPMENT	3
2. NATURAL RESOURCE MANAGEMENT AND BIO DIVERSITY CONSERVATION	5
3. STATUS, POTENTIAL AND NEW TECHNOLOGIES IN ORGANIC FARMING..	8
4. BIOFERTILIZERS AND GREEN MANURING	9
5. ROLE OF NABARD IN ORGANIC FARMING	11



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1. ORGANIC FARMING FOR SUSTAINABLE AGRICULTURAL DEVELOPMENT

What is the concept of Organic Farming?

- The system of organic farming is based on an intimate understanding of nature's laws and rules.
- In today's terminology, it is a method of a 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 and other biological materials along with beneficial microbes (bio fertilizers).
- They release nutrients for increased sustainable production of crops.
- 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.

What are the principles of Organic Agriculture?

- The Principle of Health: Organic farming should sustain and enhance the health of soil, water, air, environment, animal, human and plant as one and indivisible.
- The Principle of Ecology: Organic agriculture should be based on living ecological systems and cycles, work with them, emulate them and help sustain them on nature's laws.
- The Principle of Fairness: Organic practices should build on relationships that ensure fairness with regard to the common environment and life opportunities.
- The Principle of Care: Organic farming should be managed in a precautionary and responsible manner to protect the health and well-being of current and future generations and the overall environment.

What are the characteristics of Organic Farming?

- Protecting the long term fertility of soils by maintaining organic matter levels, encouraging soil biological activity, and careful mechanical intervention.
- Providing crop nutrients indirectly using relatively insoluble nutrient sources which are made available to the plant by the



action of soil micro-organisms.

- Self-sufficiency in Nitrogen through the use of legumes and biological nitrogen fixation, as well as effective recycling of organic materials including crop residues and livestock manures.
- Weed, disease and pest control by relying primarily on crop rotations, natural predators, diversity, organic manuring, resistant varieties, and limited (preferably minimal) thermal, biological and chemical intervention.
- The extensive management of livestock, paying full regard to their evolutionary adaptations, behavioral needs, and animal welfare issues with respect to nutrition, housing, health, breeding and rearing.
- Careful attention to the impact of the farming system on the wider environment and the conservation of wildlife and natural habitats.

What are the components of Organic Farming for Sustainable Agriculture Development?

- **Crop Rotation:** It is a systematic arrangement for the growing of various crops in a more or less regular sequence on the same land covering a period of two years and more.
- A mixed cropping, pasture and livestock system is desirable or even essential for the success of sustainable agriculture.

- **Crop Residue:** There is a great potential for utilization of crop residues/straw of some of the major crops.
- About fifty percent of the crop residues are utilized as animal feed, the rest could be very well utilized for recycling of nutrients.
- **Manure:** The organic manure is derived from biological sources like the plant, animal and human residues.
- Organic manure acts in many ways in augmenting crop growth, crop protection, and soil productivity.
- The direct effect of organic manure relates to the uptake of humic substances or its decomposition products affecting favorably the growth and yield of plants.
- **Waste: Industrial Waste:** Among the industrial byproducts, spent wash from distillery, molasses and press mud from industry have good manure value. This industrial waste manure can be used after proper decomposition.
- **Municipal and Sewage Waste:** Sewage sludge, particularly from industrialized cities, is contaminated with heavy metals and these pose hazards to plants, animals and human beings.
- **Bio fertilizers:** Bio fertilizer is microorganism's culture capable of fixing atmospheric nitrogen when suitable crops are inoculated with them.
- The main inputs are microorganisms,



which are capable of mobilizing nutritive elements from non-usable form to usable form through a biological process.

- **Bio-Pesticide:** Bio-pesticides are natural plant products that belong to the secondary metabolites, which include thousands of alkaloids, terpenoids, phenolics, and minor secondary chemicals.
- These substances have usually no known function in photosynthesis, growth or other basic aspects of plant physiology.
- **Vermicompost:** Vermiculture has a component in biological farming, which is found to be effective in enhancing soil fertility and producing large numbers of agricultural crops.
- It is organic manure produced by the activity of earthworms that generally live in soil, eat biomass and excrete it in digested form.

2. NATURAL RESOURCE MANAGEMENT AND BIO DIVERSITY CONSERVATION

What are the opportunities in Organic Farming?

- **Soil fertility stability:** The degraded soil quality is an important constraint in agricultural productivity in our country.
- Despite continuous use of synthetic fertilizers, driven by soil quality degradation and nutrient mining, the agricultural productivity in India reduced

from about 234.5 million tons in 2008-09 to about 218.2 million tons in 2009-10.

- Adding Green manures help in mobilizing nutrients, enhancing growth promoting substances, suppress soil borne pathogens and support crops to out compete weed and prevent soil erosion.
- **Biodiversity Conservation:** Organic farming is now seen as a potential solution towards reducing the loss of biodiversity.
- As organic farm practices are largely intrinsic and enhance food resource, habitat heterogeneity (management of field margins and non-crop habitats), prey-predation relationships, and reduce toxic influences (prohibited use of chemical pesticides/ inorganic fertilizers), these are expected to support species vulnerable to otherwise conventional farm practices.
- **Carbon sequestration:** Knowledge of C-storage relative to flux in agro-ecosystems is essential for predictive geosphere - biosphere modeling and for reducing the excess of atmospheric CO₂ levels through C-sequestration.
- As per the IPCC (2007), the soil carbon sequestration is cost effective and may contribute to 89% of total C mitigation.
- Our country with almost all major climatic zones and range of land usage has vast opportunities for soil C-sequestration.



- Compared to the carbon stored in a forest, the SOC in agricultural soils can effectively benefit food production and improve agricultural sustainability.
- **Reduced energy dependence:** The conventional farm systems require more overall energy inputs than do the organically managed systems.
- Fossil fuel energy input is required in farm machinery, transport, production of synthetic fertilizer and pesticides, etc.
- Synthetic fertilizers, used in conventional systems, are produced employing fossil fuel energy whereas cattle manure, legumes, etc., with very low energy needs, are used in organic practices.
- Reduced energy use in organic farms thus not only reduce economic load but also share to solve environmental problems such as climate change.
- **Export orientation:** The Indian organic produce market is export-oriented.
- It involves hidden costs such as transport and has risks to local food security.
- Policies considering local demands/markets are needed for a rational balance of trade.
- **Market risk:** Concentrating on specific commodities is vulnerable to market risks.
- A disproportional sweep in the international market may lead Indian

farmers to risk. As a WTO signatory, the government is bound to open its economy to the global market and thus, unable to protect the farmer's Interest in this respect.

- **Employment:** The organic farming system, being labor-intensive can help overcome rural employment.
- **Cost-benefit analysis:** Agriculture forms the base of economic policies and poverty alleviation in many countries including India.
- Model estimates show that organic farming can reduce pesticide use by 50% to 65% without compromising crop yields and quality together with 50% less expenditure on the fertilizer and energy use.

What are the constraints in Organic Farming?

- **Water quality:** Accumulation of heavy metals in agricultural crops depends on soil processes and properties, plant and soil physical factors, mobilization of metals, concentrations of heavy metals in soil and in irrigation water.
- Wastewater is increasingly being used for irrigation in urban and peri-urban areas of the developing countries due to easy availability and scarcity of unpolluted water.
- Irrigation of crops with wastewater may cause heavy metal accumulation and



degrade soil quality.

- For the success of organic farming, efforts should be made to ensure the availability of contamination-free fresh waters. In this context, a massive drive to manage surface and ground waters for irrigation and other usage is essential.
- **Atmospheric deposition:** High atmospheric deposition and accumulation of heavy metals in crops and vegetables have also been reported in India.
- Atmospheric deposition of heavy metals has been shown to lead multifold accumulation in eggplant, tomato, spinach, carrot, amaranthus and radish and cause damage to microbial activity in organically amended soil.
- Thus, the atmospheric deposition of heavy metals may constrain compromising organic farming with respect to its ability to stabilize soil fertility and provide toxin-free produce.
- **Resource need :** Livestock resources play important role in strengthening agricultural practices for large masses in India.
- With the advent of technology, the livestock population in our country has declined sharply.
- Between 1997 and 2003, cattle population in India declined by 10.23% and those of mules, camel and donkey the declines

were 20.36, 30.70% and 26.30 respectively.

- Improved pasture and rangelands are essential for supporting livestock and restoring C-pool, nutrient cycling and soil quality.
- The natural pasture cover in India is rapidly declining and the problem is more acute in dry regions.
- **Certification:** Problems associated with certification, for instance, a time lag of three-years (conversion stage), often constrain small landholders from adopting organic farming.
- The certification is essential to authenticate organic produce and to validate the price margin in the market.
- Lack of knowledge and access to certification discourage the small farm holders in India.
- To overcome these issues, training and institutional demonstration with fiscal incentives is being provided to encourage small farm holders.
- **Social acceptance:** The increasing demand for organic produce is viewed as a new opportunity to aspire the economic boom with lucrative export markets.
- However, the majority of small farm holders depend on government incentives and are striving for a profit margin in the indigenous market.



- Therefore, small farm holders in our country are apprehensive towards adopting organic farming.
- Major issues that need to be resolved to encourage acceptance in small farm holdings include access to certification, lack of local market, cost-benefit anomalies, lack of appropriate knowledge to RMPs and non-availability of organic supplements.

3. STATUS, POTENTIAL AND NEW TECHNOLOGIES IN ORGANIC FARMING

Why Organic Farming?

- Enhancement and maintenance of system productivity and resource quality is essential for sustainable agriculture.
- It is believed that organic farming can solve many of these problems as this system is believed to maintain soil productivity and effectively control pest by enhancing natural processes and cycles in harmony with environment.
- Organic farming is defined as a production system which largely excludes or avoids the use of fertilizers, pesticides, growth regulators, etc. and relies mainly on organic sources to maintain soil health, supply plant nutrients and minimize insects, weeds and other pests.
- It was felt that organic farming may solve all these problems and has been considered as one of the best options for protecting/sustaining soil health, and is

gaining lot of importance in present day agriculture.

What is the present status of Organic Farming?

- India holds a unique position among 172 countries practicing organic agriculture: it has 6,50,000 organic producers, 699 processors, 669 exporters and 7,20,000 hectares under cultivation.
- But, with merely 0.4 per cent of total agricultural land under organic cultivation, the industry has a long journey ahead.
- India produced around 1.35 million MT (2015-16) of certified organic products which includes all varieties of food products.
- The production is not limited to the edible sector but also produces organic cotton fiber, functional food products etc.
- As per the latest available cross-country statistics, in the year 2015, India ranked first in terms of the number of organic producers among over 170 countries and ninth in terms of the area under organic agriculture.
- India ranked 11th in organic product exports in 2015.
- India is home to 30 per cent of the total organic producers in the world, but accounts for just 2.59 per cent (1.5 million hectares) of the total organic cultivation



area of 57.8 million hectares.

- However, it has been observed that when it comes to the area under certified organic cultivation, India contributes only 2.59%, i.e., 1.5 million hectares of the total organic cultivation area of 57.8 million hectares.
- Thus, amongst the regions with the largest areas of organically managed agricultural land, India ranks 9th.

What are the New Technologies / package of practices in Organic Farming in India?

- There are few organic technologies presently in practice in large scale organic farming, among which Biodynamic Farming and Inhana Rational Farming Technology are prominent.
- Apart from that in most of the cases different organic inputs are used to make different organic package of practice for different crops.
- These combinations can be broadly divided in 4 to 5 category of POP's.
- These are (i) Vermi compost (soil management) + different herbal concoctions (plant management);
- (ii) Indigenous compost/manure (viz. FYM etc) + different herbal concoctions;
- (iii) Vermi / indigenous compost + Bio fertilizers (soil management) + different herbal concoctions;

- (iv) Vermi / Indigenous compost + Bio fertilizers (soil management) + different herbal concoctions / Bio pesticides and
- (v) Vermi / Indigenous compost + different herbal concoctions / Bio pesticides.

4. BIOFERTILIZERS AND GREEN MANURING

What are Biofertilizers?

- Biofertilizers are products of beneficial microorganisms which increase agricultural production by way of nutrient supply especially nitrogen and phosphorus.
- Biofertilizers can fix atmospheric nitrogen for plant use and can mobilize unavailable phosphorous pool which can be used by plants.
- These biofertilizers are inexpensive, simple to use and have no problem of environmental pollution.
- Use of biofertilizers not only help in sustaining productivity and soil health but also in reducing subsidy burden on the government by reducing the consumption of chemical fertilizers.

What are the benefits of applications of different biofertilizers?

- Biofertilizers provide various nutrients to plants like N, P, K, etc. either by fixing the elemental form (N) or by solubilizing the unavailable nutrients like B K and Zinc.



- VAM (AM) fungi benefit plants by mobilizing the nutrients from a larger root area.
- Azolla not only fixes N but also add organic matter to the soil.
- Biofertilizers not only provide nutrients to plants but also protect plants from plant diseases as they secrete many antibiotic compounds which suppress the growth of disease-causing Pathogens.
- Besides providing nutrients and suppressing diseases, biofertilizers also secrete some plant growth promoting hormones like auxins and gibberellic acid which makes plant healthy.
- Many biofertilizers like VAM and PGPR also help plants in avoiding water stress by secreting some polysaccharide which helps in soil aggregation and conserving moisture for longer times.
- Once the biofertilizers are established in the field after 2-3 years of continuous application, the dose of biofertilizers may be reduced.

What are the constraints in this regard?

- The foremost constraint in the popularization of biofertilizers in the country is the timely supply of cultures in remote corners of the country where organic agriculture is practiced.
- Lack of knowledge of the farmers about these biofertilizers and proper measures

taken by the extension departments in demonstrating the benefits of inoculants to farmers.

- Though mechanisms exist under Fertilizer Control Order (FCO L985) to look after the quality control of biofertilizers, the persons involved in the quality control are not versed with the proper tools and techniques of handling biofertilizers samples.

What is Green Manuring?

- Green manuring - a Practice of ancient origin- can be defined as a practice of ploughing or turning into the soil undecomposed green plant tissues grown in-situ or cut and brought in for incorporation for the purpose of improving physical structure as well as the fertility of the soil.
- In another way, green manuring is the practice of growing lush plants on the site into which you want to incorporate organic matter, then turning into the soil while it is still fresh.
- The plant material used in this way is called green manure.
- Green manuring is usually done in the lean period available between the two main crops.
- However it can be practiced in between crop rows also eg. in-situ green manuring of Sunnhemp / Sesbaniain between maize rows.



What are its advantages?

- Following degradation, it adds organic matter to the soil which helps in maintaining the activity of the beneficial soil microorganisms.
- The green manuring crops improve the physical structure of the soil by increasing humus and organic matter content of the soil.
- Increase in organic matter also improves the water holding capacity of soil thus reducing the run-off and soil erosion.
- Leguminous green manuring crops like dhaincha, add nitrogen to the soil for the succeeding crop besides increasing the availability of nutrients like phosphorus, potassium, calcium, magnesium and iron.

What are its disadvantages?

- If not properly decomposed, the green manure crop may hamper the germination and growth of subsequent crops by immobilization of plant nutrients.
- Decomposition is not proper especially under rainfed conditions in the absence of good rainfall.
- An increase of diseases, insects and nematodes is possible if the green manure crop is not properly decomposed before sowing of next crop.

5. ROLE OF NABARD IN ORGANIC FARMING

What is the impact of Organic Farming on Economy?

- Many farmers are turning to organic or "low input" farming as a strategy for economic survival.
- During the past 20 years, farmers have shown steadily increasing interest in organic farming.
- Many farmers who adopted organic farming methods early in this period were motivated by reasons relating to the health and safety of their families, consumers, and livestock, and by idealistic convictions about soil and land stewardship.
- More recently, as costs of chemicals and credit have increased and commodity prices have stagnated, thousands of conventional farmers have begun to search for ways to decrease input costs, "Low input farming" is the new, socially-acceptable term for organic farming, and economic survival is the motivation for many young farmers.

What are the advantages of Organic Farming over Traditional Farming?

- There are solid bases of studies that suggest organic is equal to or more profitable than conventional farming.
- Part of that competitive edge comes from the premium price - driven by consumer demand - which organic farmers can get



for their products.

- One of the most persistent myths the studies consistently debunk is that organic systems are incapable of reaching the same yields as conventional systems.
- After a transitional period of 3 to 5 years, organic systems can produce up to 95 percent of conventional yields.
- Additionally, organic farming is less dependent on fossil fuels, expensive inputs, and annual loans, making it less vulnerable to financial market fluctuations.
- Organic is a low-waste system that emphasizes quality over quantity, meaning it uses less land for the same profit.
- Conventional crop subsidies exacerbate the problem, incentivizing farmers to grow more than they can sell, which causes excess pollution, overuse of resources, and food waste.
- Adding organic matter to the soil each year (a foundational organic practice) increases the soil's ability to store carbon dioxide.
- Organic matter in the soil also increases the soil's water holding capacity, reducing pressure on water resources and making organic farms more resilient to drought.
- Since water costs money, drought tolerant farming systems mean cheaper food production over time.

- A diverse crop system means a succession of blooms that can feed insect populations (and provide them with habitat) year-round.
- These beneficial insects help to keep down populations of harmful insects, reducing or eliminating the need for pesticides, and providing pollination services to increase harvest yields.
- Genetic diversity on organic vegetable and seed farms acts as a well-endowed gene bank for potential new varieties that will be resilient against future environmental changes, insect populations, and diseases a service that is essential to global food security with tasty food.

What is capital investment subsidy scheme for commercial production units for organic/ biological inputs?

- The increasing and indiscriminate use of synthetic fertilizers and pesticides and deteriorating soil health and productivity is concerning people all over the world.
- Growing awareness for safe and healthy food has underlined the importance of organic farming, which is a holistic system based on the basic principle of minimizing the use of external inputs and avoiding the use of synthetic fertilizers and pesticides.
- In view of these challenge, there is a need in the country to augment the infrastructure for production of quality organic and biological inputs.



- Accordingly, under National Project on Organic Farming a Capital Investment Subsidy Scheme for Commercial Production Units for organic/biological inputs has been introduced.
- The scheme is being implemented by the Department of Agriculture, Cooperation & Farmers' Welfare through National Centre of Organic Farming (NCOF) in collaboration with NABARD or National Cooperative Development Corporation (NCDC).
- The scheme is being implemented since 2004-05.
- Making organic inputs, such as bio fertilizers, bio pesticides and fruit & vegetable market waste compost available and thereby generate better return for the produce.
- To increase agricultural productivity while maintaining soil health and environmental safety.
- To reduce total dependence on chemical fertilizers and pesticides by increasing the availability and improving the quality of bio fertilisers, bio pesticides and composts in the country.
- To convert organic waste into plant-nutrient resources.
- To prevent pollution and environment degradation by proper conversion and utilization of organic waste.

What are the Objectives?

- To promote organic farming in the country.