



CURRENT AFFAIR

Technologies for Sustainable Agriculture Development

Agriculture is the backbone of the Indian economy, employing more than half of the country's population. On the other hand, traditional agricultural practices in India are frequently unsustainable and can negatively affect the environment and human health. Sustainable agricultural practices are required to ensure the long-term viability of agriculture in India.

Sustainable agriculture is a farming method that considers the soil, the environment, and the community's long-term health. It is critical to meet rising food demand while protecting natural resources for future generations. As the world has become more aware of the importance of environmental preservation, sustainable agriculture has received significant attention in recent years. Sustainable agriculture produces food, fiber, or other plant or animal products while preserving the environment, public health, human communities, and animal welfare. Natural resources such as soil, water, and air are conserved and regenerated for future generations through these practices.

Here are some ways in which technology can help in sustainable farming:

Precision Farming:

It involves sensors, GPS mapping, and data analytics to monitor and optimize crop performance. By using precision farming techniques, farmers can reduce the use of fertilisers and pesticides, improve water management, and increase yields. Precision farming is a relatively new concept in India, and its adoption varies by state depending on various factors such as the availability of technology, agricultural practices, and Government policies.

Agroforestry:

Agroforestry is a land-use integrated management system that combines trees and shrubs with crops and livestock to create a more sustainable and productive farming system. This approach can provide various benefits, including soil conservation, biodiversity conservation, and carbon sequestration.

Vertical Farming:

It cultivates crops in stacked layers, usually under controlled conditions. Vertical farming can potentially increase local food production while reducing water consumption and optimising resource utilisation, making it an appealing option for Indian urban agriculture.

This method can reduce the need for pesticides and herbicides while increasing crop yields and lowering transportation costs.

Hydroponics:

Hydroponics is gaining traction in various Indian states as sustainable farming method that allows for efficient water and nutrient use, year-round cultivation, and reduced dependence on traditional agricultural practices. Hydroponics involves growing plants in nutrient-rich water without soil. This approach can reduce water use, increase yields, and allow for year-round crop production. It can potentially revolutionise how we grow food in India, especially in urban areas with limited space and resources.

Renewable Energy-based:

Renewable energy technologies, such as solar and wind power, can be used to power farming operations. This can reduce greenhouse gas emissions and dependence on fossil fuels.

Robotics and Automation-based:

Robotics and automation technologies can help reduce labour costs, improve crop yields, and reduce the use of fertilisers and pesticides.

Climate Sustainable Agriculture

Some Initiatives of the Government of India towards achieving Climate-Smart Agriculture

- National Innovation on Climate Resilient Agriculture (NICRA)
- National Mission on Sustainable Agriculture (NMSA)
- National Adaptation Fund for Climate Change (NAFCC)
- Climate Smart Uillage
- Paramparagat Krishi Uikaj Vojna (PKUV)
- Biotech-KISAN
- Sub-Mission on Agro-forestry
- National Livestock Mission
- National Water Mission (NVUM)

Sustainable Agriculture Challenges and Way Forward

“Sustainable agricultural development is the management and conservation of the natural resource base and the orientation of technological and institutional change in such a manner as to ensure the attainment and continued satisfaction of human needs for present and future generations. Such development conserves land, water, plant, and animal genetic resources, is environmentally non-degrading, technically appropriate, economically viable, and socially acceptable”

1. Continuous production of crops.
2. Protection and conservation of natural resources like soil, water, etc.

3. Improve the social and economic well-being of the people.
4. Use state-of-the-art technology.
5. Require government support for the institutional changes in production, marketing, law enforcement, etc.

Some Major Sustainable Agriculture Practices:

- **Crop Rotation and Crop Diversity:** Crop Rotation is basically ditching the practice of monoculture, which degrades the soil and makes the yield more susceptible to pests. Planting a variety of crops can have many benefits, including healthier soil and improved pest control. Crop diversity practices include intercropping and complex multiyear crop rotations.
- **Water and Energy-efficient Irrigation Techniques:** Sustainable water use in agriculture is carried out through planting less water-consuming crop species and implementing smart irrigation techniques. For example, drip irrigation practice is much more water efficient than flood irrigation. Also, the use of solar power in pumping the water can reduce the dependence of farmers on petroleum and diesel.
- **Reducing or Eliminating Tillage:** Traditional ploughing prepares fields for planting and prevents weed problems, but it can cause soil loss. No-till or reduced-till methods, which involve inserting seeds directly into undisturbed soil, can reduce erosion and improve soil health.
- **Integrating Livestock and Crops:** The proper integration of crops and livestock serves two purposes: livestock can feed on the by-products of the farms, and crops can receive abundantly rich natural fertiliser and manure. A vast number of studies have proved that smart integration of crop and animal production can make farms more efficient and profitable.
- **Adopting Agroforestry:** Planting trees along with the crops not only conserves the soil cover and local water resources but also provides an additional source of income to the farmers.
- **Grow the Cover Crops:** By sowing cover crops off-season, farmers can protect their fields from soil erosion and soil degradation. These cover crops can build up organic matter, which acts as green manure for the crops and thus reduces the expenditure on fertilisers. Besides, cover cropping tackles weeds and retains soil moisture. Flowering cover crops naturally support the populations of bees and other pollinators and also act as an additional source of income for farmers.
- **Integrated Pest Management system:** This system aims at long-term protection of crop cover on farms by mitigating pest attacks. It reduces pest infestations by applying different agronomic techniques, which may include crop rotation, planting pest-resistant species, or pre-treated seeds. The major benefits of this system are reducing

the exposure of farmers to chemicals, saving soil from harsh elements like pesticide, and, reducing water, air, and soil pollution.

- Other methods include urban agriculture, polyculture, biofuels, etc.

Sustainable Agriculture and Use of Technology

Technological development and the rate of innovation have always have always influenced the stability and sustainability of agricultural production. Technology in the field of agriculture has affected the productivity of agriculture and thus acts as the backbone of sustainable agriculture. Technological advancement in agriculture involves.

- Development of nutrients,
- Development of Pest control methods,
- Development of genetically modified crops providing greater nutritional efficiency (more calories per yield, or more yield),
- Manipulation of natural pest control agents,
- Discovering efficient farm management techniques that focus on whole-farm productivity over time,
- The use of computational technology, combined with geographical location devices and remote sensing advancements will help the genetically modified seeds provide site-specific solutions,
- The Use of environment modelling along with risk management algorithms will assist farmers in combating the uncertainties related to drought, floods, etc.

Some key recommendations for the successful adoption of sustainable agriculture practices in India are

- Rainfed areas should be focused on as the area of primary gain because they are already performing low-resource agriculture.
- Authorities should prepare the full taxonomy for sustainable agriculture in India. It includes policies, guidelines, and legal frameworks.
- Proper focus should be kept on knowledge exchange and capacity building among farmers and agriculture extension workers.
- Authorities should extend short-term transition support to farmers liable to be adversely impacted by a large-scale transition to sustainable agriculture.
- Financial support should be provided for research in field of sustainable agriculture.

- Use of technology in this field in India is negligible. In order to support the formalization of agrotech, a proper system should be made for the leveraging of data and technology.

Organic Farming Status and Potential

Organic farming is considered a climate-friendly farming practice that promotes low external input usage, recycling, reuse, and reduced use of synthetics in farming. The Government's Paramparagat Krishi Vikas Yojana (PKVY) and Mission Organic Value Chain Development for North Eastern Region (MOVCDNER) schemes have led to significant increase in organic agriculture acreage.

From groundwater pollution to the overuse of fertilisers degrading soil fertility to the overload of pesticides in foodgrains, India has witnessed how measures to increase crop yield in the immediate term can harm farm productivity in the long term. Punjab and Haryana, known for their critical role in making the Green Revolution of the 1960s and 1970s a stupendous success and thus helping India transform from a foodgrain scarce country to a foodgrain-surplus country, have borne the brunt of this excessive use of fertilisers and pesticides. Investigations carried out under the All India Coordinated Research Project on 'Long Term Fertiliser Experiments' over five decades at fixed sites have indicated that continuous use of nitrogenous fertiliser alone has a deleterious effect on soil health and crop productivity, showing deficiencies of other major and micronutrients. Even with recommended doses of NPK and more, deficiency of micro and secondary nutrients has become a yield-limiting factor over the years. Deficient nutrients may also affect plant growth and cause plant physiological disorders. There is also the possibility of nitrate contamination in groundwater above the permissible limit of 10 mg NO₃-N/L due to excessive or overuse of nitrogenous fertilisers, particularly in light textured soils, which has consequences for human or animal health, if used for drinking purpose.

The Government of India had thus launched a National Mission on Soil Health Card to promote soil test-based, balanced, and judicious fertiliser application in the country. Similarly, the Government

has been promoting organic farming since 2015-16 through the schemes of Paramparagat Krishi Vikas Yojana (PKVY) and Mission Organic Value Chain Development for the North Eastern Region (MOVCDNER). Both schemes stress on end-to-end support for farmers engaged in organic farming, i.e., from production to processing, certification, marketing, and post harvest management support, including processing. PKVY is being implemented in all the states other than the North Eastern (NE) states, while the MOVCDNER scheme is implemented exclusively in the NE states.

Organic Farming: India and the World

The National Standard of Organic Production (NSOP) has defined organic agriculture as 'a system of farm design and management to create an ecosystem that can achieve sustainable productivity without the use of artificial off-farm inputs such as chemical fertilisers and pesticides.' Organic farming is considered a climate-friendly farming practice that promotes

low external input usage, recycling, reuse, and reduced use of synthetics in farming. The Indian Council of Agriculture Research (ICAR), under its All India Network Programme on Organic Farming, has developed a package of practices for organic production in cropping and farming systems mode.

Organic agriculture is practised in 187 countries, and 72.3 million hectares of agricultural land were managed organically by at least 3.1 million farmers worldwide, according to the 2021 FiBL survey, with the most organic agricultural land in Australia (35.69 m hectares), followed by Argentina (3.63 m hectares), and Spain (2.35 m hectares). The global sales of organic food and drinks reached more than 106 billion euros in 2019. On this global map, India holds a unique position among the 187 countries practising organic agriculture. India is home to 30% of total organic producers in the world: 27,59,660 total farmers (11,60,650 PGS and 15, 99,010 India Organic), 1703 total processors and 745 traders. However, organic farming is at a nascent stage in India. About 2.30 million hectares of farmland was under organic cultivation as of March 2019. This is two per cent of the 140.1 million ha net sown area in the country.

Salient features of PKVY and MOVCDNER schemes

- Under PKVY, farmers of various states are provided financial assistance of Rs. 50000/ha for 3 years, whereas under MOVCDNER, an assistance of Rs. 46,575/ha for 3 years is provided for creation of FPO, support to farmers for organic inputs, quality seeds/ planting material, training, hand holding, and certification.
- Under PKVY, farmers are provided financial assistance of Rs. 50000/ha for 3 years out of which, Rs. 31000/ ha for 3 years is provided directly to farmers through DBT for on-farm and off-farm organic inputs.
- Financial assistance of Rs. 20 lakh/ cluster of 1000 ha for 3 years is provided for value addition and infrastructure creation. Under the scheme, assistance is provided of Rs. 7500/ha for 3 years for training and capacity building whereas, Rs. 2700/ha for 3 years is provided for certification and residual analysis.
- Since 2015-16, under PKVY, an area of 11.85 lakh ha has been covered under organic farming by developing 32384 clusters involving 16.19 lakh farmers. In addition, eight states - Madhya Pradesh, Uttarakhand, Tamil Nadu, Jharkhand, Maharashtra, Punjab, Chhattisgarh, and Tripura - developed their own brands for organic products. So far, Rs. 1793.80 crore has been released under the scheme.
- Under MOVCDNER, there is provision of financial assistance of Rs. 10000/ha for 3 years for training, handholding, and ICS documentation, and farmers in the North Eastern states are provided assistance of Rs. 32500/ ha for 3 years for off-farm /on - farm organic inputs.
- Under the scheme, need-based assistance is provided for various components: an Integrated Processing Unit at Rs. 600 lakh, Collection, aggregation, and grading unit at Rs. 10 lakh, Integrated Pack house at Rs. 37.50 lakh, Refrigerated vehicle at Rs. 18.75 lakh, Pre-cooling, cold stores, and ripening chambers at 18.75 lakh and Transportation / 4-wheeler at Rs. 6 lakh.

- Since 2015-16, under MOVCDNER, 1.73 lakh ha of area has been covered under organic farming by developing 379 FPO/FPCs involving 1.89 lakh farmers. In addition, seven Northeastern states developed their own brands for organic products.
- So far, Rs. 886.16 crore has been released under the scheme. Altogether, 367 collection, aggregation, and grading units, custom hiring centres and 74 processing and packing house entities have been created under FPO/FPCs and private ownership.

