



## **Sustainable Agriculture in India**

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### **ABSTRACT**

The paper presents the contents related to the topic of sustainable agriculture including its meaning in the context of the Indian agriculture, the problems and opportunities for sustainable agriculture in the country and the measures which should be taken for improving sustainability in agriculture. The agriculture sector in India is one of the most crucial sectors for the development of the economy and comes across some issues like climate change issues, Social as well as economic pressures, air and water pollution due to stubble burning as well as Over exploitation of water in Punjab, low productivity of land & soil, monsoon dependability, lack of indigenous technology and knowledge management, etc. In order to tackle with these various sustainable practices and methodologies have been practiced by India like organic farming, integrated pest management, agroforestry etc. The methodological part explains the way for collecting and analyzing data such as field analysis, questionnaires, arguments and findings from different literature. The paper discusses the current position of sustainable agriculture in India and see what has been achieved and what yet to be done. This paper also established that government's policies and interventions have central relevance with regard to intensified practices in sustainable agriculture. The paper provides a discussion of several key programmes including the National Mission for Sustainable Agriculture (NMSA), the Pradhan Mantri Krishi Sinchayee Yojana (PMKSY) and the like. To substantiate the argument about the positive outcomes of the implementation of the Financial situation of Indian Libraries, the paper provides the case studies from different regions of India. These case studies highlight innovative practices and community-driven efforts that have led to significant improvements in sustainability and productivity.

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### **Review of Literature**

Sustainable agriculture as a concept has particularly gained importance in relation to the current Indian agriculture and farming due to the growing demand and concern of economics, ecology and equitability. This paper will specifically review the literature on sustainable agriculture in India in order to identify the most important research findings, methods, and the missing links in the available literature. Sustainable agriculture in India faces challenges like water scarcity, soil degradation, and limited access to markets - N.H. Rao , Saroj kumar Singh and Ankita Parihar . Kumar et al. (2021) also proposed solutions like water-efficient irrigation and strengthening extension services but there are still gaps in understanding the social economic impact on of sustainable agriculture on smallholder farmers in india. Government initiatives, like the National Mission for Sustainable Agriculture (NMSA) ,aim to promote practices such as soil health management and water conservation (Sharma et al., 2019), there are Successful implementation (case studies) such as organic farming in sikkim documented by Jitendra Kumar (2018) which offer valuable insights , benefits , area covered , impact etc, and also successful implementation are Zero budget natural farming in Andhra pradesh by Sara duddigan , Agroforestry in Odisha by Mohapatra, S., Das, P., & Pattanaik, C. (2022). The data collection method used in studying sustainable agriculture includes surveys, field observations, and participatory approaches and secondary data collection providing both quantitative and qualitative insights.

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### **Objectives**

- To study the issues and challenges with status of the agriculture sector in India.
- Investigate various sustainable farming practices adopted by India and its status
- To find solutions for India.
- Examine Government initiatives and policies.
- Want to Protect and enhance the environment and natural resources.

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### **Introduction**

India, the world's second-most populated nation, has a large agricultural sector that contributes to the country's economic growth and food security. The agriculture sector forms the backbone of India's rural economy, employing more than 50% of the nation's workforce and contributing to India's

GDP. However, India's agriculture sector is facing a number of issues that pose a threat to its long-term success. The agricultural industry in India is divided among small and distributed landholdings. Most farmers depend on labour work and traditional farming methods. During the 1960s and 1970s, there was a Green Revolution that took place in India. This revolution involved the use of fertilizers, irrigation systems as well as different types of crops with high yielding seeds which greatly increased production levels but still India faces several challenges such as lack of clean water; environmental degradation due to pollution caused by industries etc. and an increasing gap between rich farmers who are few compared to poor ones that constitute majority part of population and water exploitation in Punjab and Haryana, dependency on monsoon, costly inputs of farmers, pollution due to stubble burning, climate change etc.

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### Importance Of Sustainable Agriculture

Sustainable agriculture is crucial for India's food security and environmental health. It minimizes chemical fertilizer and pesticide usage, saves water, and promotes soil fertility. Climate smart practices increase adaptive capacity of farmers to climate change and provide a buffer against extreme conditions. Integrating trees in the farm, in a systematic manner known as Agroforestry and conservation agriculture, all help in enhancing the biodiversity and carbon fixation. It enhances the longer-term results of farming besides maintaining environmental sustainability when farmers are educated on methods of sustainable farming. These practices help in the sustainable management of natural resources, undertake agricultural food security, and support the improvement of the rural standard of living. It can be therefore concluded that sustainable agriculture focuses on the relationship between productivity and the preservation of the ecology, an aspect that encompasses the economic and environmental rationalization.

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### Need for sustainable agriculture in India

India's rapidly increasing population and changing consumption patterns have put significant challenge on the country's agricultural sector, necessitating a shift towards sustainable farming practices. Overexploitation of natural resources, excessive use of chemical fertilizers and pesticides, and inefficient water management have contributed to soil degradation, groundwater depletion, and environmental pollution. To reduce dependence on excessive input use and achieve long-term food security and sustainable agriculture the following practices are recommended in India: implementation of Integrated Pest Management practices; organic farming; crop diversification; improved irrigation techniques. Also, integrating agroforestry, conservation agriculture and climate smart agriculture practices will also assist in reducing vulnerability of agriculture to climate change. There is the need to invest more in the research on agricultural practices, to increase the access to extension services, as well as educate more farmers. Fulfilling these needs through coordinated efforts of policymakers, researchers, and farmers is critical in attaining sustainable agriculture in the country.

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### Overview of Indian Agriculture

In India, agriculture is one crucial sector from which 17% to 18% of GDP is contributed, while it is also the sector where half of the country's population works. Agricultural production was valued approximately at 4 percent for the 2022-23 period, and the first estimated figure for 2023-24 is anticipated to be 5 percent. India has emerged as one of the major producers across several crop segments having rice, wheat, pulses, oilseeds, coffee, sugarcane, jute, and tea as its important productions. In 2022-23, around 1374 million tonnes of Indian tea production took place. 20 million tonnes in cocoa which easily equates to the coffee production which is 352 million tonnes. As to exports of agriculture in India, they reached 52 billions of US dollars. Higher than all-time which is ₹5 billion for the financial year 2022-23 signifying an impressive foreign exchange for agro-exports. Most important export items are rice, marine products, and spices, with rice export only bringing around USD 11 billion to the country's in 2022-23.

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### Issues and Challenges in Indian Agriculture

Although being one of the most important sectors of the country's economy, India's agriculture faces number of challenges that block its development and sustainability.

- Small and fragmented land holdings - Many farmers in India have small and fragmented land holdings which lowers the productivity.
- Improve productivity - The main problem is to improve the productivity of land and soil in India due to use of chemical fertilisers and pesticides the production will increase but in long run the productivity of land will decrease so, the major task is to improve productivity in agriculture.
- Slow adoption of modern technology - The pace of adoption of modern technology in India is slow and only the 32% of farmers adopted the technology.
- Water Scarcity - One of the biggest challenges is water scarcity more than 60% of India's agricultural land is affected by water scarcity. The growing need for water from the industrial and commercial sectors makes it even more difficult for farmers to water their crops.
- Lack of Awareness and education - Uneducated farmers have lack of awareness about the agriculture market economy in India there are many farmers still using the traditional methods for farming, they are not aware about the modern techniques in farming practices which helps them to increase the production of crops and productivity of the land.
- Costly inputs - The increasing in the cost of inputs of farmers is also a main problem like increase in price of seeds, fertilisers, pesticides, etc. affect the incomes of the farmer which makes difficult for them to maintain a normal standard of living.

- Pollution due to stable burning - The burning of stable leads to air pollution in the country, especially in winter months because farmers burn them which damage the environment and also puts farmer's families and the people of the country at risk of serious health problems .

- Overexploitation of Water - Overexploitation of water is also becomes the major problem in Punjab and haryana due to increase in ground water level , it spoils the crops and which also cause sinking of land.

- Dependency on monsoon - There is still in many regions the farmers depends on the monsoon season farmers are not well equipped with modern methods of manual irrigation. They are still dependent on monsoon rains for irrigating their crops.

- Market Access - Limited market Access and having limited bargaining power leads to lower income of farmers .

And Some of the basic issues for development of Indian agriculture sector are revival of cooperative institutions, human resource development, trade and export promotion, Generate employment, provide a source of income to the poor segments of population.

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### **Solutions to Overcome Some Challenges**

#### •Bio-Enzymes for Increased Production and Soil Fertility:

Using bio-enzymes can enhance soil fertility and which also helps in increased productivity.

These enzymes can improve nutrient availability, soil structure, and overall crop health.

#### •Conversion of Stable Waste into Bio-Ethanol and Other Products:

Processing stable waste into powder form and spraying it on land can improve and enhance soil fertility.

This waste can also be used to produce to make bio-ethanol, cardboards, and packaging materials.

#### •Environmental Benefits and Pollution Reduction:

Spraying bio-ethanol on stable waste can quicken decomposition, turning it into valuable manure in a short period.

This practice reduces pollution caused by burning stable waste, which contribute in cleaner environment.

#### •Educating Farmers on Sustainable Practices:

Government should conduct awareness campaigns and educational camps on sustainable agriculture practices which can help farmers adopt to sustainable agricultural practices

Providing training on efficient resource management, organic farming techniques, and waste utilization can lead to long-term benefits.

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### **Status and Practices of Sustainable Agriculture adopted by India**

Sustainable agriculture practices have gained increasing importance in India in recent years due to concerns over environmental degradation, declining soil fertility, water scarcity, and the need to enhance food security . sustainable agriculture practices adopted by india are :

Integrated Pest Management (IPM) refers to the management of pests and diseases affecting crops by using generic methods that encompass bio-, cultural- and chemical control techniques. The survey carried out by Indian council of agricultural research- ICAR showed that the awareness level on the adoption of Integrated Pest Management practices in Indian varies from 5-10% for various crops in different regions. Rather the ASFM approach that is the agriculture system without the chemical fertilizer and pesticides input that is the organic farming which is slowly gaining the ground in India. The total area under organic cultivation in India was around 2.78 million hectares in 2020-21, constituting about 2.5% of the total cultivated area. Conservation agriculture in one that which minimum soil disturbance is done, and the crops residues and crop rotation is practised at the present time in India is to improve soil health and water management. Interestingly, another study conducted by Indian Council of Agricultural Research (ICAR) also pointed out that the extent of participation of farmers in CA was not very high in India which was identified at 1.5 million hectares in 2018 despite the fact it only comprised very small proportion of total cultivated area . Irrigation technology, with the help of such mechanisms as satellites, GPS, and moisture sensors for the soil, known as precision farming, is also being implemented in India for the better use of inputs. However, precision farming is not very popular at the moment due to the high cost of implementing ACP, as well as, the necessary skills. Zero Budget Natural Farming (ZBNF) is a low-cost, ecological farming methodology where farmers do not use synthetic fertilizers, pesticides, or other purchased farm inputs. It was first introduced by a farmer of India, Subhash Palekar and has been embraced in different states of India in recent past. In brief, the strategies adopted under ZBNF embraces the use of cow dung and urine-based formulations which include Beejamrit and Jivamrit for nutrient management, mulching with crop residues and improving soil health through microorganisms. ZBNF seeks to bring down cost of production by avoiding fertigation and other inputs that must be outsider sourced. According to a report by the Indian Council of Agricultural Research (ICAR) around 1.6 million farmers were adopting ZBNF in 2020-21 which covering an area of approximately 2.8 million hectares (ICAR, 2021). However, other estimate suggest that the area under ZBNF could be higher, ranging from 4-6 million hectare.

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## Government Initiatives and Policies on Sustainable Agriculture in India

### Pradhan Mantri Krishi Sinchayee Yojana:

It has made an endeavor and is committed to accord high priority to water conservation and its management. Towards this the PMKSY has been each out with the vision of coverage of irrigation 'Har Khet ko pani' as well as 'More crop per drop' with an end to end solution on source creation, the distribution, its management and usage as well as the extension works. This scheme has been approved by the Cabinet Committee on Economic Affairs with the Hon'ble Prime Minister as the chairperson in its meeting on 1st July, 2015.

Per Drop More Crop is being implemented by DA & FW which has been launched from 2015-16 financially in the Country. The Per Drop More Crop scheme is mainly directed at use efficiency of water at farm level through Micro Irrigation (Drip and Sprinkler Irrigation System). PDMC has been launched under RKVY from the year 2022-23.

### National Mission For Sustainable Agriculture (NMSA)

Also in India, the National Mission for Sustainable Agriculture (NMSA) is under implementation in the country with the objectives of increasing agricultural productivity and/of rainfed agricultural lands through integrated farming, water use efficiency, soil health management and resources conservation. B. National Mission for Sustainable Agriculture Association As the outcome of the Sustainable Agriculture Mission under the National action plan on Climate change NMSA aims at promotion of sustainable agriculture through better seeds developed in regard to crops water use efficiency pest management, nutrient management, agricultural insurance and market promotion. The mission draws together into a single focus ongoing and new sustainable agriculture programmes focusing on soil and water conservation and the communally based management of resources.

PKVY geared up for farming on organic system to control the use of chemical inputs for soil health agriculture. PGS-India: By granting permits and certification, it scopes a system of mutual trust in the organic certification. The scheme is 60:40 Centrally and State sponsored to facilitate the proposals to additional 6,00,000 hectare area for organic farming by 2025-26. While PKVY helps farmers in adopting integrated accept farming system and reduction of cost of agriculture inputs, using eco friendly farming practices, providing chemical free food products to consumer's protecting environment and providing institutional support, market development linkages.

### Soil Health Card Scheme

A Soil Health Card is used to report the current status of the health of the soil and, when used from different periods, compare the change in the health of the soil due to land management. A Soil Health Card presents soil health indices and related qualitative terms. These are usually derived from farmers' best practices and their understanding of the local resource base. It gives an account of the relative measures of soil health that can be evaluated without the use of sophisticated tools or laboratory equipments.

### Parampragat Krishi Vikas Yojana:

The Parampragat Krishi Vikas Yojana (PKVY) financially supports the adoption of organic farming as a way to enhance the land health. For certification, it applies the PGS-India that is participatory and volitional; involving both producers and consumers, which relies on the principles of trust. It is essential to understand that this system does not fall within the well-known concept of third party certification. The funding is split 60:40 of its amount between the Central and State Governments, the ratios for the Northeastern, Himalayan States and UTs are relatively higher. The initiative, of late, has a vision to target 600000 hectare of organic farming for the fiscal year 2025-26.

Among the focuses on that are set on by PKVY are the development of agricultural products that can be produced without any chemical inputs while being nutritious value; attaining these goals through environmentally friendly, cost effective technologies. The major stream emphasis areas include enhancing and establishing climate change resilience agriculture systems, and decreasing farming costs, demising the threats of hazardous chemicals to the environment, and supporting farmers forums establishment of clusters and groups. It also means to make farmers become entrepreneurs through providing direct linkage between them and the local and national markets as well as the help of various and cheap services of the local and national agricultural research experts.

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## SUCCESSFUL IMPLEMENTATION (CASE STUDIES)

### Sikkim India's first organic state

Sikkim received many awards and was recognized as the first region with a 100 percent sustainable agriculture through United Nations FAO Future Policy Award Gold Prize in 2018. Its policies aim at discouraging the use of chemicals with strict measures put on the ban of chemical pesticides and fertilizers as well as the restriction on the sale of these products. This aspect has had a positive social impact in as much as benefiting approximately sixty-six thousand farming families. Apart from agriculture, Sikkim links agrotourism, culture, health adventurous education, rural upliftment, and sustainable tourism under one policy which can be termed as concretization of sustainable charter in the constitution of Sikkim.

An excellent example of this quest is the Directorate of Handicrafts and Handloom (DHH) which was established in 1957 to promote arts and crafts across the country. As a learning institution, the DHH has branch training center 32, which undertakes government launched scheme such as “Cane Conservation and Promotion of Cane Handicraft” in the Dzongu Tribal Reserve Area. This project has also promoted research and capacity development and provided skills development for 100 farmers on clone production of rattan and local artisans on the process of value addition.

Another effort given for local hand making is Sikkim Industrial Development and Investment Corporation Ltd (SIDICO), which was built in 1977, supplies funds and subsidy. Thus, in the year 2003, a new agency called Sikkim Handloom and Handicrafts Development Corporation Limited (SHHC) was born with an objective of improving the woven products. These resources enable local artisans to innovate for better produce and also create employment.

Concerning arts and crafts, the state accomplishes quality and extraordinary workmanship which remarkably contributed to the progression of tourism; the number of tourists increases from 2014-2017. The Handicrafts and Handloom sectors of Sikkim, despite their awareness of the environmental trends, are able to sustain the sector by innovatively changing their modes of production, thus establishing the up fondness of Sikkim as a pro-progressive state that indeed understands the recommendations of the environment.

### **Zero Budget Natural Farming in Andhra Pradesh**

In the year 2016, the government of Andhra Pradesh brought in a new conception known as Zero Budget Natural Farming (ZBNF) RySS as a replacement for chemical and capital oriented farming. Hence, coming to the point of ZBNF which is to transform agriculture from a mere unprofitable profession to a lucrative venture, the strategy to use affordable and weather-resilient methods of farming is imperative.

Kumar, fundamental to RySS, noted the formation of RySS in 2014 and linking it to the natural farming program for farmers. In November 2016 the goal was set by the state to extend natural farming from one million to six million farmers by 2024. Specific targets included the eradication of cost on cultivation, improvement in fertility of soil and food production, and construction of crop resistance to water stress and excess rainfall. ZBNF practices implemented by RySS were conceived by Maharashtrian farmer Subhash Palekar while the Chief Minister was co-chairing RySS and Vijay Kumar was overseeing the implementation with the Chief Minister.

Vegetables produced from 615 pilot gram panchayats of the program are grown by farmers, who engage in chemical-free farming. These farmers assisted in the development of technical calibrate and provided supervision and monitoring on the ground to the RySS staff.

### **Agroforestry in Odisha**

Agroforestry in odisha: grarian is one of the traditional occupation of Orissa it has huge tract of land specially in rural area. this region is blessed with large natural resource base, it is endowed with a variety of agro- edaphic sites, highly endowed with bio-diversity, has a variety of sizes and types of land holdings, a variety of Socio-Cultural communities based on economic status. Therefore, agroforestry has had to develop many kinds of systems and practices of agriculture. Of all these SSF, the agroforestry systems so prevalent in the state are broadly in the agro forestry class which includes agrisilviculture, silvi cultivation and agrisilvi cultivation. Podu/Jhum cultivation, multipurpose trees on farm lands, multiple species tree gardens and agroforestry for fuel wood are the major agrisilvicultural systems in operation. Some of the more particular SPS are trees on pastures, fodder trees and shrubs on forest land and living fence of fodder trees and shrubs. The agrihortisilvicultural system which used be in practice in the state long prior to this period is homegarden. Orissa University of Agriculture and Technology, along with the help of several government and non-government organizations, has attempted and succeeded in bringing out some of the improved agroforestry methods in the recent years. Some of the advanced practices that have been mentioned are Acacia mangium based mixed cropping, guava based mixed cropping, coconut based groves, Eucalyptus clones based mixed cropping, shelterbelts, timber tree based mixed cropping, Sesbania grandiflora based mixed cropping, Acacia mangium based forestry-pastoralism, mangium-guava based forestry-pastoralism, improved homestead gardens, commercial planting.

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## **CONCLUSION**

India’s agricultural industry is a critical component of the nation’s GDP and an essential provider of food, but it also has some major issues that arise from changes in climate conditions, water deficit, declining soil quality, and the reliance on chemical fertilizers. Which is why adopting sustainable agriculture measures is quite important in countering these problems and maintaining sustainable productivity and land usage.

These includes the National Mission for Sustainable Agriculture (NMSA), Paramparagat Krishi Vikas Yojana (PKVY), Soil Health Card scheme and the Pradhan Mantri Krishi Sinchayee Yojana (PMKSY) inter alia aim to increase the resilience of agriculture to climate change practices, increase water use efficiency, reduce reliance on chemical inputs including chemical fertilizers besides improving the health of the soil. Yet, the level of uptake of sustainable farming practices among the farmers demanding for environmentally-friendly practices is minimal more awareness and knowledge on sustainable agriculture practices and resources.

Hearing the success stories, such as the state of Sikkim shifting to 100% organic farming and the application to the ZBNF in Andhra Pradesh, etc, illustrates that sustainable agriculture is achievable in India. In the process of overcoming such challenges, as well as in terms of progressing towards increasing the adoption of sustainable practices, it is essential to continue this multifaceted approach involving policymakers, researchers, services for extension and farmers. This paper has shown that further investment in the research on these seeds, infrastructure, and training of farmers is paramount

in ensuring adequate production of food, protection of the environment, and the welfare of the people in the rural areas. By embracing sustainable agriculture, India can pave the way for a more resilient, productive, and eco-friendly agricultural sector, contributing to the nation's economic growth and environmental sustainability.

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