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Role of geo informatics in achieving sustainable agriculture and it's scenario in Haryana: An overview

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Abstract

Agricultural sustainability is founded on the belief that we must meet the demands of the present without affecting future generations' ability to fulfill their demands. Sustainable agriculture attempts to maintain equilibrium between the requirement for food production and the conservation of the ecosystem. Geo informatics technologies are helping in many ways like find out the current scenario of anything like cropping pattern, rotation, the land use and land cover and underground water quality and water table depth; it helps to analyses the finding and makes decisions in the way of achieving sustainable agriculture. Secondary data is collected from state agriculture policy (2021), Statistical abstract of Haryana (2021-22) and state budget 2023-24. The main aim of this study is to understand the current scenario of sustainable agriculture and what's the role of geo informatics in its development.

In Haryana, the agricultural sector remains to be very important to the state's economy, generating 14.5 percent of the state's GDP and employing 51 of the total workforce. Many programs and policies are made by Haryana govt. to conserve the water and soil resources and to achieve sustainable agriculture which is essential for the sustainable growth of state. Some current programs are like at least 72,000 acres were planted with direct-seeded rice in Kharif 2022, and farmers received financial aid total of 29 crores (at 4,000 per acre) to encourage direct-seeded rice cultivation, which uses less water that will be beneficial for the underground water resources. A new initiative called "precision agriculture," which encourages the careful use of fertilizers and pesticides as well as micro-irrigation will be introduced in Sirsa district and then expanded to other districts based on the lessons learned. Crop diversification is another excellent strategy for achieving the goal of sustainable agriculture. Crop diversification initiatives include Jal hi Jiven h, Direct Rice Seeding, Mera Pani Meri Virasat, and Crop Diversification in Haryana's Rice-Wheat Cropping System with Maize.

Keywords: Sustainable agriculture, geo- informatics, crop diversification

Introduction

Sustainable agricultural production is dependent on the wise use of natural resources (soil, water, livestock, plant genetics, fisheries, forest, climate, rainfall, and topography) in an acceptable technology management framework within the existing socioeconomic infrastructure. Sustainable agriculture provides a much-needed alternative to traditional input-intensive agriculture, which has long-term consequences such as degraded topsoil, diminishing groundwater levels, and decreased biodiversity. In a climate-constrained world, ensuring India's nutrition security is essential.

In contrast to traditional farming, which is largely driven by productivity and profits, sustainable agriculture employs a holistic approach that integrates the biological, chemical, physical, ecological, economic, and social sciences to create a modern, healthy farming practice that will not harm our ecosystem.

The National Mission for Sustainable Agriculture (NMSA) has been promoting sustainable agriculture in India since 2014-15. It comprises of many programs that concentrate on agroforestry, rainfed areas, managing water and soil health, addressing the effects of climate change, and adaptation. In addition to NMSA, the Pradhan Mantri Krishi Sinchai Yojana and the Integrated Watershed Management Plan encourage the use of precision agricultural methods like micro-irrigation.

Crop rotation is the most widely used SAPS (sustainable agriculture practices and systems) in India, accounting for around 30 million hectares (Mha) of land and 15 million farmers. Rainwater harvesting and agroforestry, which are popular among large cultivators, have relatively high coverage - 25 Mha and 20-27 Mha, respectively.

Organic farming currently accounts for only 2.8 Mha or 2% of India's net sown area of 140 Mha. Natural farming is the fastest-growing sustainable agricultural approach in India, with over 800,000 farmers practicing it. (Gupta N. 2021) ^[2].

Need of Sustainable agriculture

Agriculture would need to produce 60% more food globally in the same period to fulfill the increased food demand of the over nine billion people who will exist by 2050, as well as the predicted diet changes.

The current rate of agricultural production development is unsustainable due to the negative effects on natural resources and the environment. One-third of farm land is damaged, up to 75 percent of crop genetic variety has been lost and 22 percent of animal varieties are at risk. More than half of fish populations are fully exploited, and during the last decade, approximately 13 million hectares of forest per year have been converted to other land uses. (FAO, 2023)

Sustainable agriculture will aid in the conservation of natural resources, hence increasing natural resource productivity. Sustainable agriculture will be used to ensure the long-term viability of agricultural productivity, which is critical for all living things.

Role of Geo informatics in Sustainable agriculture

GIS may significantly aid in accurate crop yield estimations, soil amendment assessments, and erosion detection and rehabilitation. More accurate and dependable crop estimates help lessen uncertainty. Geospatial Information System (GIS), a vital foundational technology, is characterized as a powerful system that includes tools for collecting, storing, and retrieving data on demand, as well as analyzing, converting, and displaying geographical data for a given purpose. It is essential because it gives spatial context and information on several features, each of which is available as a data layer. Furthermore, it includes tools for manipulating spatial and non-spatial data and presenting it in accessible and informative map formats. Geographic information system (GIS), in combination with other partner technologies such as remote sensing, global positioning system, artificial intelligence, computational systems, and data analytics, has played a critical role in crop monitoring and the implementation of optimal and targeted management practices to improve crop productivity. (Ghosh, P. & Kumpatla, S. 2022) ^[9].

GIS can evaluate soil data to identify which crops should be grown and where and how to manage soil nutrition so that the plants benefit the most.

GIS in agriculture enables farmers to boost productivity while decreasing costs through improving land resource management. The risk of marginalization and vulnerability of small and marginal farmers, who account for approximately 85% of farmers worldwide, is also lowered.

Study area

4.42 million hectares or 1.4% of the country's total land area, comprise the state's whole geographic area. The cultivable area is 3.8 million hectares (ha), or 86% of the state's total land area, of which 3.62 million hectares (ha), or 96.2%, are plowed. Almost 80% of the state's entire geographical area is under cultivation, with around 84 percent irrigated.

Data source and Methodology

Secondary data is used in the present study and collected

from State Agriculture Policy (2021), Statistical Abstract of Haryana (2021-22), State Budget 2023-24 and Kisan Ayog report. Agriculture related data is collected from the above sources and analyzed and concluded according to the need of the study.

Results and Discussions

New initiatives regarding sustainable agriculture in Haryana in 2023

- Two training facilities have been set up at Gurukul in Kurukshetra and Gharaunda in Karnal for the 20,000 acres that will be converted to Natural farming which is chemical free farming and livestock based in 2023–2024.
- In India, Natural farming is promoted as Bhartiya Krishi Paddhati Programme under Parampragat Krishi Vikas Yojna.
- A new initiative called "precision agriculture," which encourages the careful use of fertilizers and pesticides as well as micro-irrigation will be introduced in Sirsa district and then expanded to other districts based on the lessons learned.
- Precision agriculture (PA) is a method of increasing average yields by using precise amounts of inputs. It is centered on sustainable agriculture and healthy food production, and it includes profitability and increased output, economic efficiency, and reduced environmental negative effects.
- Sustainable Precision agriculture is the most beneficial farm management innovation of the twenty-first century, based on the use of information and communication technologies (ICTs)
- At least 72,000 acres were planted with direct-seeded rice in Kharif 2022, and farmers received financial aid total of 29 crores (at 4,000 per acre) to encourage direct-seeded rice cultivation, which uses less water.
- The government has set a target of 1 lakh acres for summer moong cultivation and has guaranteed farmers that it will be purchased at the minimum support price (MSP). Summer moong cultivation improves soil fertility.

Programs on crop diversification that are helping in achieving Sustainable agriculture

Crop diversification is another excellent strategy for achieving the goal of sustainable agriculture. Crop diversification initiatives include Jal hi Jiven h, Direct Rice Seeding, Mera Pani Meri Virasat, and Crop Diversification in Haryana's Rice-Wheat Cropping System with Maize.

Jal hi Jiven h

The paddy-wheat cycle in Haryana is unsustainable and reducing the water table. The plan aims to diversify the area by growing maize and other crops in place of paddy in seven dark zones starting in kharif season. The State's water table is declining by around 1 m per year as a result of ongoing paddy cultivation. Crop diversification under the mentioned plan aims to support technical innovation in sustainable agriculture and give farmers the option to select other crops to boost productivity and profitability.

Direct Rice Seeding

DSR scheme was launched in 19 may, 2022. 12 district of Haryana are added in this scheme and these are Rohtak

(8000 hectare), Ambala, Karnal, Yamunanagar, Khurukshetra, Panipat, Sonapat, Kaithal, Jind, Sirsa, Fatehabad and Hisar. In this scheme 4000 per acre incentives will be given to farmers.

Mera Pani Meri Virasat (2022)

The "Mera Pani Meri Virasat" crop diversification program aims to replace paddy with maize, cotton, bajra, legumes, fruits, and vegetables on one lakh hectares in selected blocks where paddy is cultivated on 1.8 lakh hectares and another four blocks where the water table is below 35 meters. The new initiative, which is essential for sustainable agriculture, motivates farmers to switch from water-intensive paddy to the growth of maize, legumes, fruits, and vegetables.

Crop Diversification in Haryana's Rice-Wheat Cropping System with Maize

In Haryana, rice is the main crop; from 1966–1967 to 2020–21, its area increased from 1.92 to 14.22 lakh ha, and its production rose from 2.23 to 45.23 lakh tones. This scheme was launched to transfer the paddy cultivated area into maize cultivated area.

Conclusion

The global shift to sustainable food and agriculture will need significant improvements in resource use efficiency, environmental protection, and system resilience. Sustainable agriculture needs a global governance structure that prioritizes food security issues in trade regimes and trade policies, as well as revisiting agricultural policy to support local and regional agricultural markets.

The goal of achieving sustainable growth in agriculture will be attained through ensuring everyone has access to adequate amounts of food, nutrition, employment, and means of subsistence; connecting farmers to markets to increase their income; promoting sustainable agriculture and environmental security; and placing a high priority on enhancing the state's land and soil resources.

Future Outlook

- Technically sound, socially acceptable, economically viable location specific soil and water conservation measures need to be evolved.
- To reduce the soil degradation to a minimum level incorporation of crop residues and replenish the nutrients removed by the crops.
- Extensive awareness extension programme for the farmers should be followed for soil conservation to ensure "Khet Ki Mitti Khet me and Khet Ka Pani Khet main".
- The most effective technique for boosting and maintaining agricultural expansion in Haryana must be natural resource management. The State's natural resource-induced primary vulnerabilities and threats to sustainable growth are related to soil health, water shortages and quality, growing threats from climate change, and biodiversity management

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