



The Role of Community Science in Advancing Ecological Agriculture

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Abstract

Green revolution technology has more than quadrupled rice and wheat yields, particularly in Asia. These high-input agricultural techniques, which need vast amounts of fertilizers, pesticides, irrigation, and machinery, ignore the ecological integrity of land, forests, and water resources, harm flora and wildlife, and cannot be maintained over generations. To a large extent, developing countries' future food security and economic independence would be dependent on increasing biophysical resource productivity through the use of sustainable production methods, improving crop tolerance to adverse environmental conditions, and reducing crop and post-harvest losses caused by pests and diseases. Indigenous agricultural practices may play an important role in the design of sustainable and environmentally friendly agricultural systems, increasing the possibility that rural populations will embrace, develop, and implement innovations and interventions. In this context, eco-friendly practices are seen as ecologically safe, selective, biodegradable, cost-effective, and renewable alternatives for use in an organic agricultural system. Organic farming entails the use of organic nutrients and natural plant protection measures instead of fertilizers and pesticides. To the greatest extent possible, organic farming systems rely on crop rotations, crop residues, animal manures, legumes, green manures, mineral-bearing rocks, and biological pest control to maintain soil productivity and tilth, which supply plant nutrients and control insects, weeds, and other pests.

Keywords: *Eco-farming, Organic farming, Permaculture*

Introduction

Agriculture is the world's most important business. Agriculture is the practice of raising domesticated animals and cultivating plants to provide food, feed, fiber, and other desirable items. In a genuine sense, it is a productive unit in which humans get free gifts from nature, such as land, light, air, temperature, rainwater, humidity, and so on, all of which are combined into a single main unit that is vital to humans. Long-term and excessive use of pesticides in agricultural cultivation has resulted in human health risks as well as degradation of the environment and groundwater. At the moment, the question is whether to continue with chemical input-based intensive technologies or to return to traditional environmentally friendly farming techniques such as organic farming for sustainable production, revenue, and socioeconomic growth of the agricultural community. In this context, biological pesticides are seen as an ecologically safe, selective, biodegradable, cost-effective, and renewable option for use in organic agricultural systems.

Rural India is a valuable asset in accelerating socioeconomic development and achieving the Sustainable Development Goals (SDG). About 65% of the country's population lives in

rural regions, and 47% of the population relies on agriculture for a living (MoF, 2023). There are about 6,40,000 villages in India, with a population of 83.3 crore.

The rural population increased over a decade, from 74.3 crore in 2001 to 83.3 crore in 2011. Similarly, rural women's labor-force participation rate has increased over time. The rural female labor force participation rate has improved from 24.8% in 2011-12 to 27.7% in 2020-21 (MoF, 2023).

Agroecological approaches are used in various sectors of the economy in India, including agriculture, forestry, and energy, and are promoted through practices such as natural farming, organic farming, agroforestry, biofuel production, and others, which help to transform villages, promote socioeconomic development, clean the environment, and achieve the UN Sustainable Development Goals (MoPR, 2021; UNEP, 2021).

Goal of Eco-Agriculture: (Methods/Procedure)

Eco-agriculture aims to manage rural communities' resources to promote their well-being, protect biodiversity and ecosystem services, and produce more productive and sustainable agricultural systems. Eco-agriculture, currently developing as a comprehensive approach to environmentally and socially responsible land use, promotes a vision of rural communities managing their landscape and resources collaboratively to accomplish three goals: (Increase rural livelihoods. (Conserve or improve biodiversity and ecosystem services. (Create a more sustainable and productive agriculture system. The core of ecological-based farming is ensuring that business or agricultural activity is consistent with the natural functions of ecosystems, such as maintaining the cycle of soil nutrients and biodiversity structure in order to create an agricultural system that is pest-resistant and has self-maintained natural soil nutrients. Farmers will no longer rely on expensive pesticides and artificial pest control.

Eco-friendly Agricultural practices: are as

Agronomy: Cropping pattern, sowing time

Water management: Exp. (SRI Technology, DSR,) collection of rain water in pond

Soil conservation and reclamation

Entomological practices: Exp. (IPM Technology) Control termite, American bollworm, sucking pests, other insects, spray related practices)

Storage : pulses stored mud containers, Neem leaves (*Azadirachta indica*)

Zoology: Rat control by cat and pet dogs

Eco-friendly approaches for the farming system

The eco-friendly practices are as follows:

A. Organic farming: Organic farming is a production strategy that eliminates or significantly limits the use of synthetic fertilizers, pesticides, growth regulators, and animal feed additives. To the greatest extent possible, organic farming systems rely on crop rotations, crop residues, animal manures, legumes, green manures, off-farm organic wastes, mechanical cultivation, mineral-bearing rocks, and biological pest control techniques to maintain soil productivity and tillage, supply plant nutrients, and control insects, weeds, and other pests.

B. Biological farming: Biological farming permits the use of certain chemical fertilizers (avoiding disruptive elements such as anhydrous ammonia and potassium chloride) and employs low-input herbicide and pesticide applications. (Diagnostic tools for monitoring plant and soil conditions are widely employed in biological farming. These include refracting meters to measure sugar concentration (Brix) in plant tissue sap, electrical conductivity meters to monitor ERGS (energy released per gram of soil), ORPS meters (soil oxygen reduction potential), and radionics.

C. Natural farming: In addition to these method-based approaches to sustainable farming, regenerative agriculture and permaculture are well known. However, these latter systems, like sustainable agriculture, are conceptual rather than methodological.

D. Regenerative agriculture: Regenerative agriculture relies on nature's innate ability to deal with pests, improve soil fertility, and boost yield. It implies an ongoing capacity to regenerate the resources that the system demands. In reality, regenerative agriculture achieves these aims by building on low-input and organic agricultural methods.

E. Permaculture: Permaculture is concerned with the design of ecological human homes and food production systems, which are based on certain standards and concepts. Permaculture, being a land use planning concept rather than a production system, is not restricted to a single form of production. Thus, permaculture may be applied to almost any site-specific ecological agricultural system.

Challenges and Opportunities

To address environmental challenges, it is essential to maintain water levels during dry seasons, to account for climatic unpredictability, and to use circular economy principles. Context-specific solutions may be designed with the assistance of community science.

Vacancies in Institutions: Increasing the effectiveness of extension services, fostering learning amongst farmers, and bridging the gap between research institutions and rural communities are all important goals.

Having guaranteed markets for agroecologically grown food is a key component of market linkages. Initiatives that are organized by the community have the potential to establish direct links between customers and producers.

Conclusion

Agriculture is a crucial business that provides food, feed, and other essential items. However, the excessive use of pesticides in agriculture has led to health risks and environmental degradation. The question now is whether to continue with chemical input-based technologies or return to traditional environmentally friendly farming techniques like organic farming for sustainable production, revenue, and socioeconomic growth. Rural India is a valuable asset in accelerating socioeconomic development and achieving the Sustainable Development Goals (SDG). Agroecological approaches are used in various sectors of the economy, including agriculture, forestry, and energy, and are promoted through practices such as natural farming, organic farming, agroforestry, biofuel production, and others. Eco-agriculture aims to manage rural communities' resources to promote their well-being, protect biodiversity and ecosystem services, and produce more productive and sustainable agricultural systems. Eco-friendly agricultural practices include agronomy, water management, soil conservation, entomological practices, storage, and rat control. Eco-friendly approaches for the farming system include organic farming, biological farming, natural farming, regenerative agriculture, and permaculture. Addressing environmental challenges requires maintaining water levels during dry seasons, accounting for climatic unpredictability, using circular economy principles, and bridging the gap between research institutions and rural communities. Community-organized initiatives have the potential to establish direct links between customers and producers, contributing to the sustainable development of agriculture.

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