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A Review Study on the Effect of Organic Manure and Chemical Fertilizers on Crop Fields in Lakhanpur, Jaunpur

Riya Maurya and Rajkumar Yadav

Department of Botany, T.D.P.G. College, Jaunpur Affliated to VBSP University, Jaunpur (U.P.) 222002.

ABSTRACT

Nutrient management techniques play a major role in agricultural output in rural areas like Lakhanpur (Jaunpur district, Uttar Pradesh, India). This review looks at how crop output, soil health, and sustainability are affected by chemical fertilizers and organic manure. While chemical fertilizers increase output and provide instant nutrient availability, organic manures boost soil structure, microbial activity, and long-term fertility. On the other hand, overuse of chemical fertilizers can damage the environment and deteriorate soil quality. The most sustainable strategy is integrated nutrition management (INM), which combines organic and inorganic inputs. In addition to offering suggestions for sustainable agricultural production, this study summarizes regional and worldwide research findings pertinent to circumstances comparable to those in eastern Uttar Pradesh.

KEYWORDS
Crop yield, soil fertility, chemical fertilizers, organic manure, sustainable agriculture, Jaunpur

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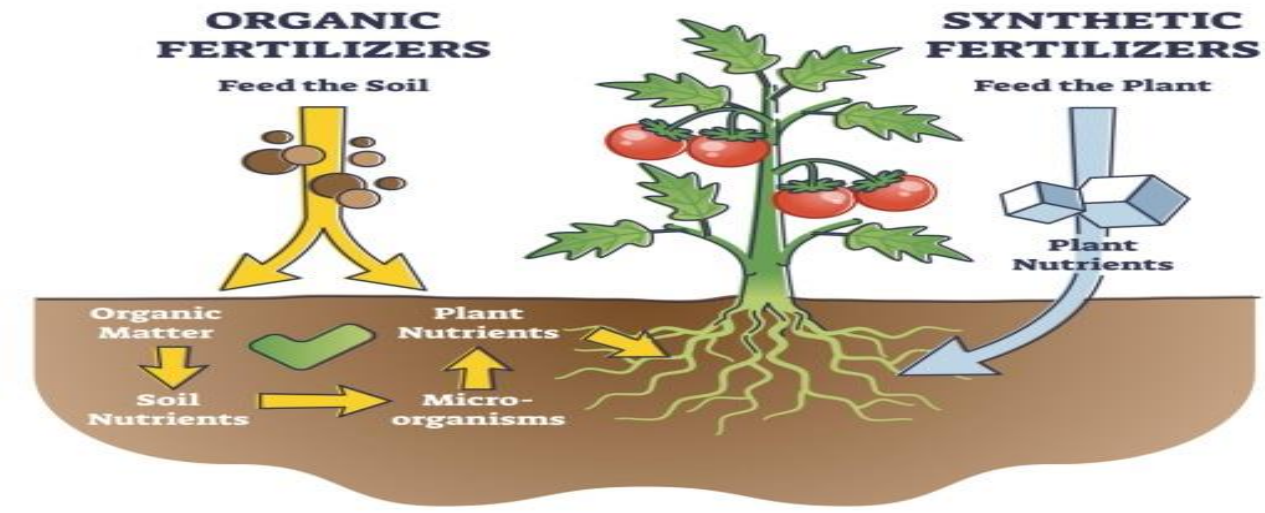
1. Introduction

Nearly half of India's population depends on agriculture, which also makes a substantial contribution to the country's food security, making it the foundation of the country's economy. Fertile soils, ideal weather, and vast irrigation systems make agriculture a major industry in regions like Uttar Pradesh. The majority of farmers in the Jaunpur district, which includes rural communities like Lakhanpur, rely on crop agriculture for their livelihood. The district is known for its intense agricultural methods. Part of the Indo-Gangetic plains, the area is renowned for its high agricultural output, especially in cropping systems like oilseeds, rice-wheat, and pulses (Pandey et al., 2009; Pathak et al., 2011).

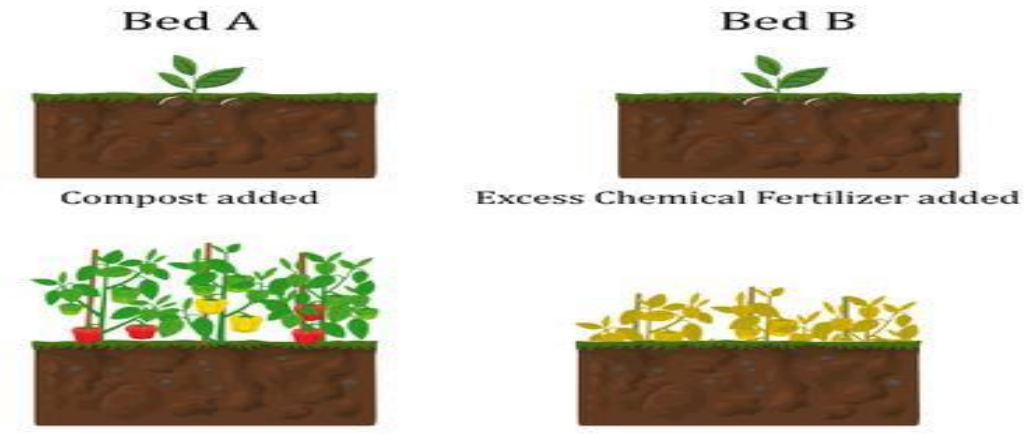
Over the past few decades, agricultural production has increased due to the fast population expansion and rising food demand. With the introduction of high-yielding crop types and increasing irrigation and chemical fertilizer use, the Green Revolution signaled a sea change in Indian agriculture. By providing nutrients in easily accessible forms, chemical fertilizers—in particular, nitrogen (N), phosphorus (P), and potassium (K)—have significantly increased crop output (Tilman et al., 2002; Prasad, 2009). India became self-sufficient in the production of food grains as a result. However, long-term agricultural productivity, environmental sustainability, and soil health have become major issues due to the persistent and excessive use of chemical fertilizers.

Several studies have demonstrated that excessive and unbalanced chemical fertilizer application causes nitrogen imbalance, soil deterioration, and a decrease in soil organic matter (Bhatt et al., 2019; Lal, 2004). Soil acidification, decreased microbial activity, and elevated greenhouse gas emissions are the outcomes of excessive usage of nitrogenous fertilizers, especially urea (Tilman et al., 2002). Furthermore, chemical fertilizers are frequently linked to nutrient leaching, which pollutes the environment and contaminates groundwater (UNEP, 2019). In densely farmed areas like eastern Uttar Pradesh, where farmers mostly depend on synthetic inputs to sustain agricultural production, these difficulties are more noticeable.



On the other hand, organic manure has long been an essential part of India's traditional farming techniques. In addition to supplying vital nutrients, organic sources like farmyard manure (FYM), compost, vermicompost, and green manure also enhance the physical, chemical, and biological characteristics of soil (Ramesh et al., 2005; Brady & Weil, 2010). By increasing aggregation and porosity, organic manure improves soil structure and promotes greater root development and water infiltration. Additionally, it improves the soil's ability to retain water, strengthening crops' resistance to drought. Additionally, by boosting cation exchange capacity and buffering soil pH, organic matter is essential for preserving soil fertility (Lal, 2004).

However, organic manure has long been a crucial component of traditional farming methods in India. Organic sources such as farmyard manure (FYM), compost, vermicompost, and green manure not only provide essential nutrients but also improve the physical, chemical, and biological properties of soil (Ramesh et al., 2005; Brady & Weil, 2010). Organic manure enhances soil structure and encourages more root growth and water infiltration by enhancing aggregation and porosity. It also increases the soil's capacity to hold onto water, enhancing crops' tolerance to drought. Additionally, organic matter is crucial for maintaining soil fertility by increasing cation exchange capacity and buffering soil pH (Lal, 2004).
A balanced approach to nutrient management is becoming increasingly recognized due to the limits of both organic and inorganic food sources. In order to maximize crop yield while preserving soil health, integrated nutrient management (INM), which combines the use of chemical fertilizers with organic manure, has become a viable approach (Singh et al., 2018). Through the combined effects of organic and inorganic inputs, INM seeks to improve soil fertility, decrease environmental consequences, and increase nutrient usage efficiency. According to long-term research, applying fertilizers and organic manure together improves soil organic carbon, boosts microbial activity, and boosts crop output as compared to using either source alone (Swarup, 2010; Meena et al., 2013).



Sustainable nutrient management techniques are very crucial in the setting of Lakhanpur, Jaunpur. Reduced soil fertility, growing input costs, and environmental stress are some of the issues that farmers in this area must deal with. Soil productivity has gradually decreased as a result of an over-reliance on chemical fertilizers and insufficient usage of organic matter. The issue is made worse by the fact that smallholder farmers frequently lack access to resources and information about balanced fertilizer use.
Therefore, it is crucial to assess how chemical fertilizers and organic manure affect crop fields, especially in areas like Lakhanpur where agriculture is the main source of income. Developing successful strategies for sustainable farming can be aided by an understanding of the relative benefits and drawbacks of different nutrient sources. The purpose of this review study is to compile the body of knowledge

regarding the effects of chemical and organic fertilizers on crop productivity, soil health, and environmental sustainability. The report aims to offer insights into nutrient management best practices that can improve agricultural productivity while guaranteeing long-term soil health by examining results from multiple studies.

Methodology

1. Data Collection

Keywords like these were used to gather pertinent literature: • Soil fertility from organic manure

- Crop output from chemical fertilizers
- Integrated management of nutrients

International publications, Indian agricultural reports, and graduate theses were among the sources (ICAR, 2016; Kumar, 2015).

2. Selection Criteria

The selection of studies was based on:

- Pertinence to agricultural yield and soil fertility
- A comparison between inorganic and organic fertilizers
- Extended experimental investigations

3. Data Analysis

The gathered information was examined under: • Crop yield response

- Physical characteristics of soil
- Chemical characteristics of soil
- Biological activity in the soil

Finding patterns and connections between research was made easier by comparative analysis (Saha et al., 2010).

4. Limitations

- Lakhanpur's primary field data is lacking • Variability in research settings
- Reliance on published works

Review studies offer a trustworthy synthesis of current information despite its limitations (OECD, 2019).

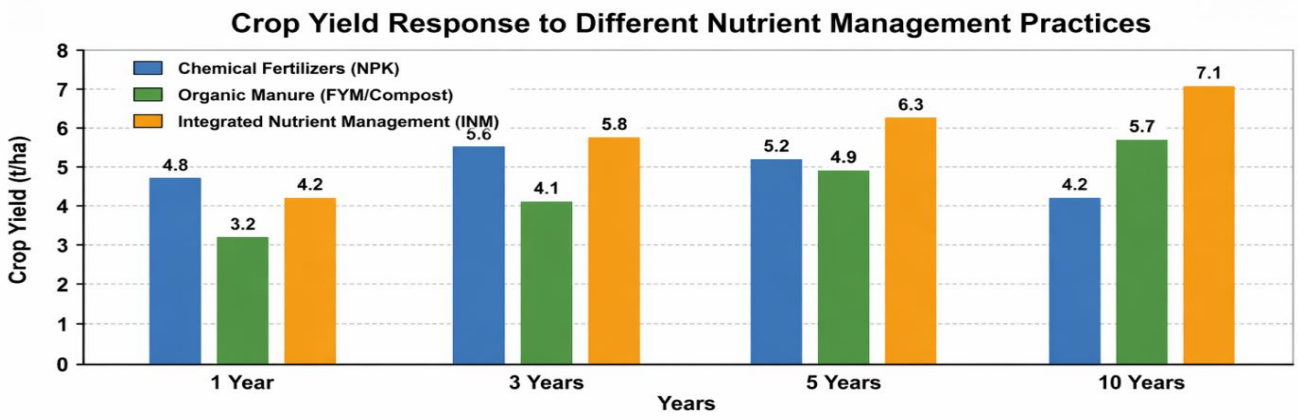
Results

The results show that chemical fertilizers and organic manure differ significantly.

1. Crop Yield

Because chemical fertilizers provide nutrients instantly, they boost output quickly (Prasad, 2009). Long-term research, however, indicates that yield decreases with continual use.

By increasing soil fertility and nutrient cycling, organic manure progressively increases yield (Ramesh et al., 2005). Organic manure enhances yield sustainability, according to studies (Gong et al., 2020).



Crop Yield (t/ha) Under Different Nutrient Management Practices				
Nutrient Management Practice	1 Year	3 Years	5 Years	10 Years
Chemical Fertilizers (NPK)	4.8	5.6	5.2	4.2
Organic Manure (FYM/Compost)	3.2	4.1	4.9	5.7
Integrated Nutrient Management (INM)	4.2	5.8	6.3	7.1

Key Observations:
- Chemical fertilizers show higher yield in the initial years due to quick nutrient availability.
- Organic manure shows gradual improvement and gives stable yields in the long term.
- Integrated Nutrient Management (INM) gives the highest and most sustainable yield over the years.

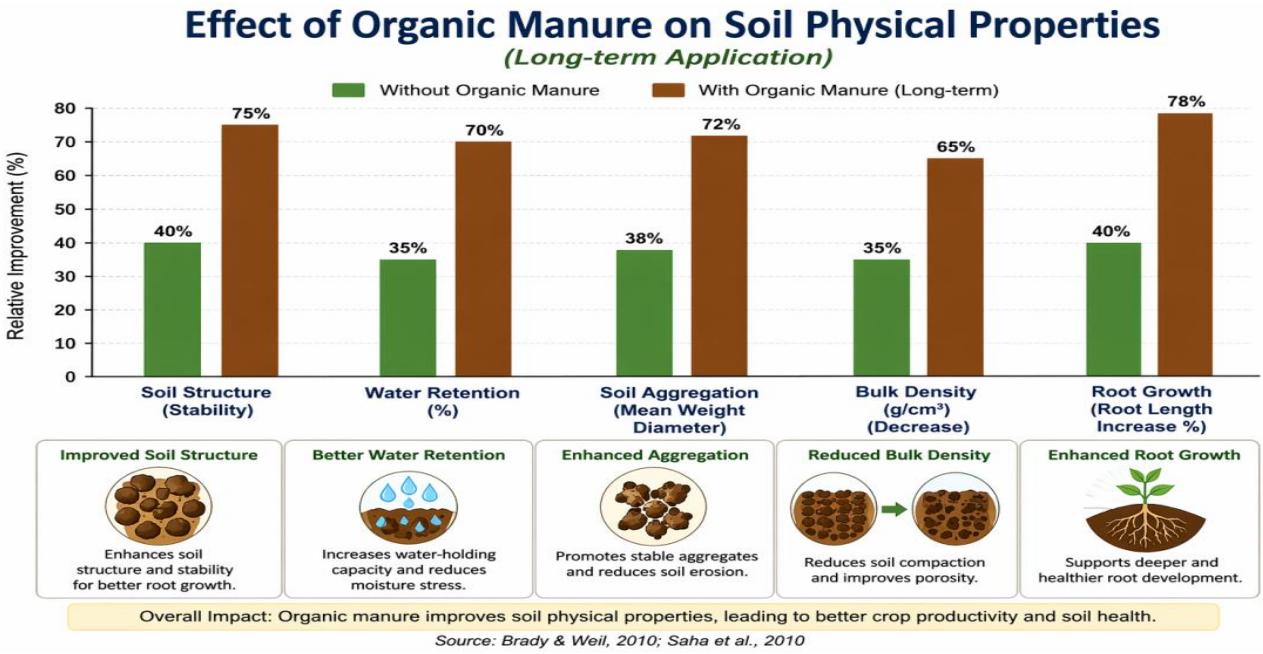
Source:
Prasad, (2009); Ramesh et al., (2005); Gong et al., (2020); Tilman et al., (2002)

2. Soil Physical Properties

Organic manure enhances: The structure of the soil

- Retention of water
- Combination

Long-term treatment improves root growth and decreases bulk density.

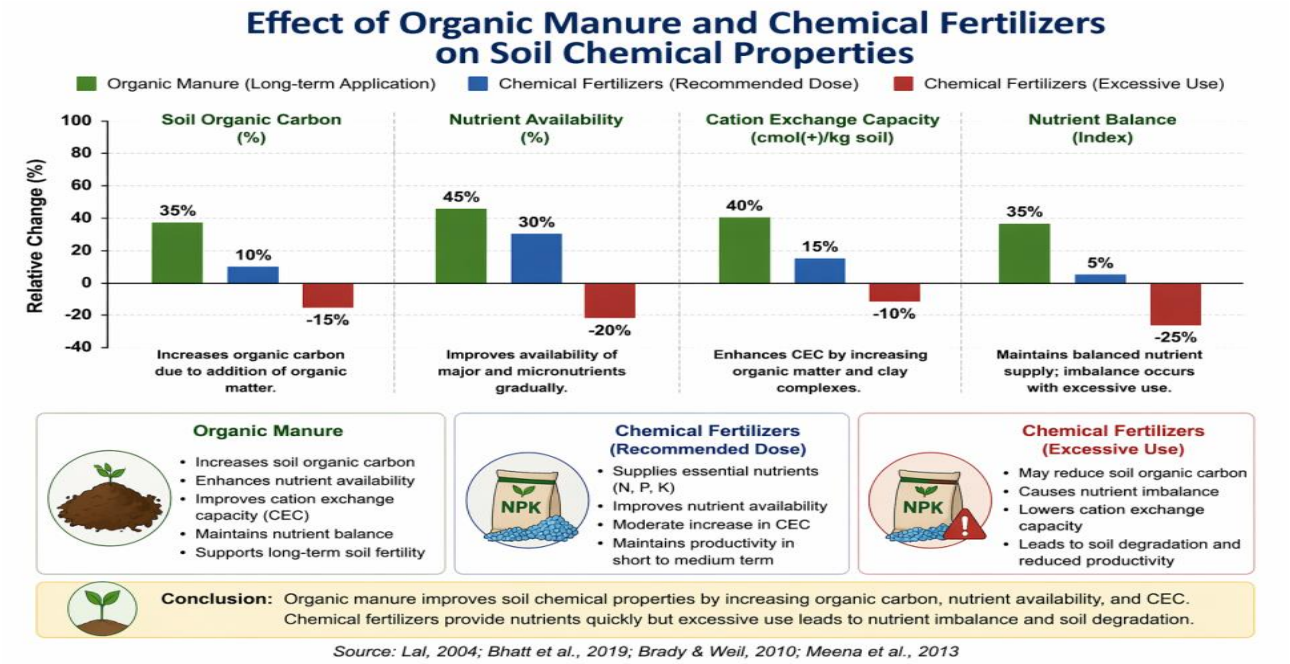


3. Soil Chemical Properties

Increases in organic manure

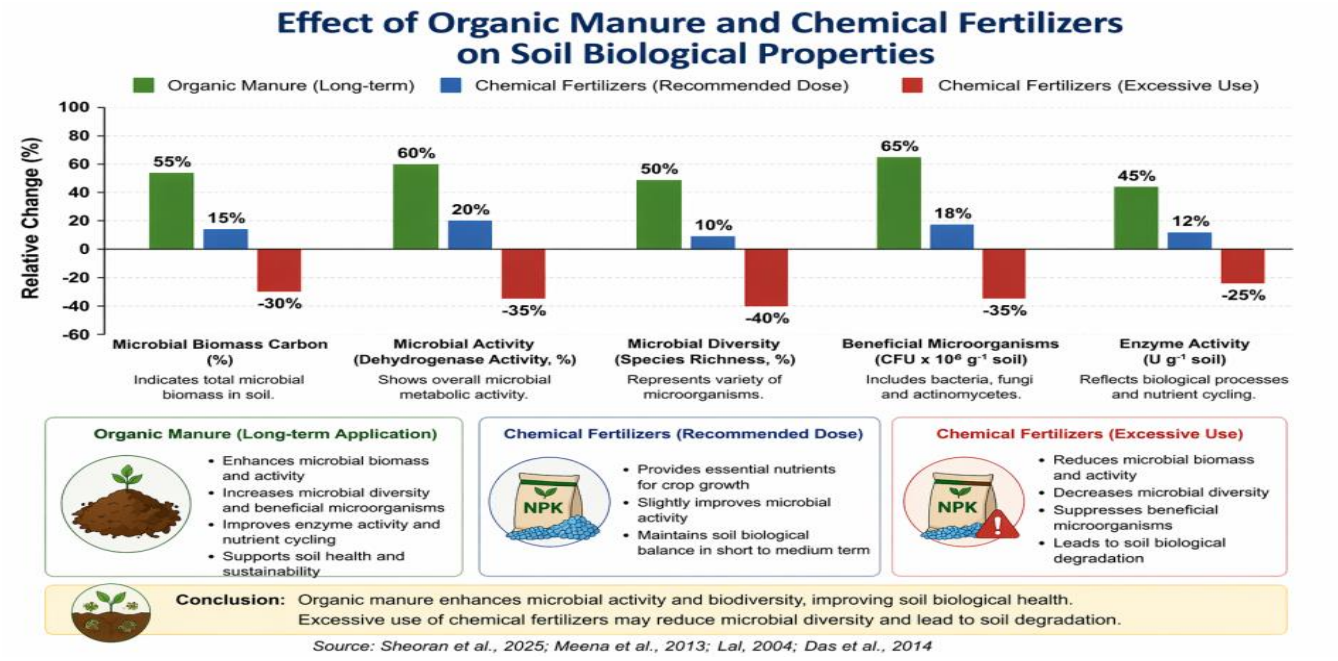
- Organic carbon in soil
- Availability of nutrients

Although chemical fertilizers offer nutrients, over usage of them might lead to imbalance (Bhatt et al., 2019).



4. Soil Biological Properties

Microbial activity and biodiversity are increased by organic manure (Sheoran et al., 2025). Overuse of chemical fertilizers might lead to a decrease in microbial diversity.



5. Integrated Nutrient Management

When combined, use improves:

- Crop productivity

The fertility of the soil

- Efficiency of nutrients

Chemical and organic fertilizers enhance the microbial community and soil quality.

Discussion

The findings imply that chemical fertilizers and organic manure by itself cannot guarantee sustainable agriculture.

Although chemical fertilizers are necessary to address short-term nitrogen demands, they degrade soil over time (Tilman et al., 2002). Sustainability is impacted by continuous use, which lowers soil organic matter (Bhatt et al., 2019).

By increasing structure, microbial activity, and nutrient cycling, organic manure enhances soil health. However, because of its sluggish nutrient release, it is unable to supply crop nutrient demands on its own (Gong et al., 2020).

A well-rounded strategy is offered by integrated nutrient management. It raises yield, promotes microbial activity, and improves soil organic carbon (Singh et al., 2018; Sheoran et al., 2025).

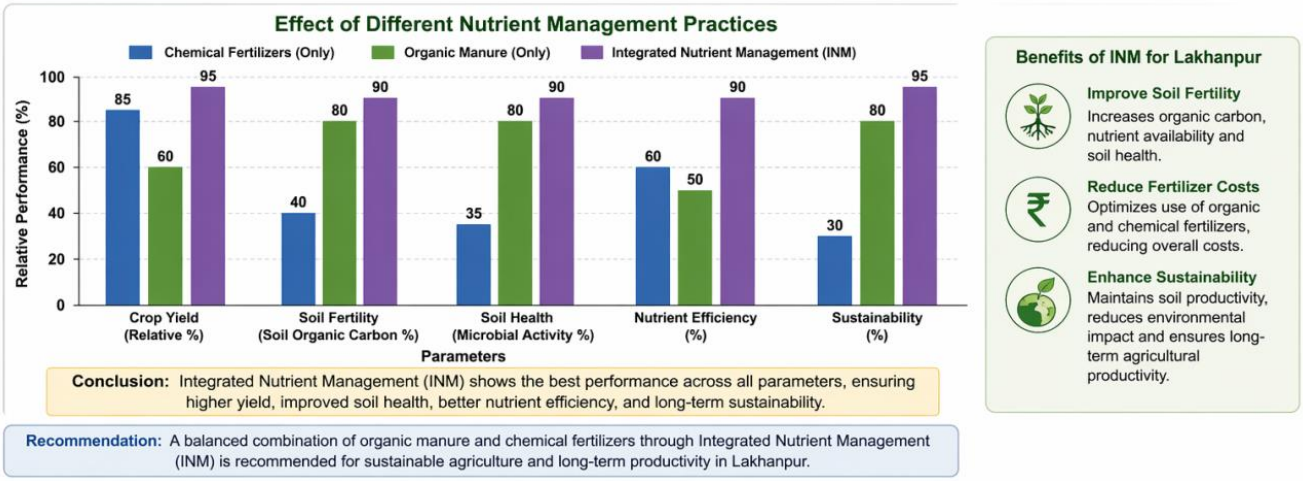
Adopting INM for Lakhanpur can: Boost the fertility of the soil

- Lower the price of fertilizer
- Improve sustainability

Therefore, for long-term agricultural output, a balanced mix of chemical and organic fertilizers is advised.

Comparative Summary of Fertilizer Management Practices

Management Practice	Crop Yield	Soil Fertility (Soil Organic Carbon)	Soil Health (Microbial Activity)	Nutrient Efficiency	Sustainability	Key Findings
Chemical Fertilizers (Only)	↑ High in short term	↓ Decreases over time	↓ Reduces microbial diversity	↑ High initially but declines with continuous use	✗ Low (Causes long-term soil degradation)	• Meets immediate nutrient demand • Continuous use reduces soil organic matter and sustainability (Tilman et al., 2002; Bhatt et al., 2019)
Organic Manure (Only)	↑ Moderate, gradual increase	↑ Increases soil organic carbon	↑ Enhances microbial activity and diversity	→ Lower (slow nutrient release)	✓ High (Improves soil structure and health)	• Improves soil structure, microbial activity, and nutrient cycling • Cannot meet crop nutrient demand alone (Gong et al., 2020)
Integrated Nutrient Management (INM) (Organic + Chemical)	↑ High and sustainable increase	↑ Improves soil organic carbon	↑ Enhances microbial activity and biodiversity	↑ High (Balanced nutrient release and uptake)	✓ High (Sustainable soil health and productivity)	• Balanced approach improves soil quality, microbial community, and yield • Most effective for long-term agricultural sustainability (Singh et al., 2018; Sheoran et al., 2025)



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