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# Economic Benefits of Sustainable Agricultural Practices: Insights from Farmers' Experiences

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**Abstract**
The increasing use of synthetic fertilizers and pesticides has raised concerns regarding environmental sustainability, soil health, and rising production costs. This study aimed to analyze the adoption of alternative agricultural practices and the cost savings achieved by farmers through the use of eco-friendly technologies. A descriptive research design was employed using primary data collected from 25 farmers. The study focused on four sustainable practices: compost, farmyard manure (FYM), neem oil, and yellow sticky traps. The findings revealed that compost and neem oil were the most widely adopted practices, each used by 84% of farmers, while FYM and yellow sticky traps were adopted by 16% and 28% of farmers, respectively. Most farmers adopted two or more practices simultaneously, indicating a preference for integrated sustainable farming approaches. The economic analysis showed that farmers achieved an average saving of Rs. 12,204, with total savings amounting to Rs. 305,100. Fertilizer cost reductions contributed the largest share of total savings. The study concludes that eco-friendly agricultural practices enhance profitability, reduce dependence on synthetic inputs, and promote sustainable agricultural development.

**Keyword:** Sustainable Agriculture, Eco-Friendly Farming Practices, Cost Savings, Farmers

## 1. Introduction
Agriculture remains one of the most important sectors for ensuring food security, rural employment, and economic development, particularly in developing countries where a large proportion of the population depends on farming for their livelihoods. However, the increasing dependence on synthetic fertilizers and pesticides over the past several decades has created significant environmental, economic, and social challenges. While chemical inputs have contributed substantially to increased agricultural productivity, their excessive and continuous use has led to soil degradation, declining biodiversity, water contamination, pest resistance, and rising production costs. Consequently, there is growing interest in promoting sustainable and environmentally friendly agricultural practices that can maintain productivity while reducing the negative impacts associated with chemical-intensive farming systems (Serebrennikov *et al*., 2020; Tittonell *et al*., 2020; Li *et al*., 2024; Manzoor *et al*., 2024).

Sustainable agriculture emphasizes the efficient use of natural resources, environmental protection, and economic viability. It promotes farming systems that maintain soil fertility, protect ecosystems, reduce pollution, and improve the resilience of agricultural production. In recent years, researchers and policymakers have increasingly recognized the value of alternative agricultural practices such as compost application, farmyard manure (FYM), botanical pesticides, biological pest management, and integrated pest management strategies. These practices are considered essential components of sustainable farming because they improve soil health, enhance nutrient cycling, and reduce dependence on synthetic agrochemicals (Shahzad *et al*., 2025; Matisic *et al*., 2024; Zaini *et al*., 2023).

Among the various sustainable farming approaches, compost has gained considerable attention due to its ability to improve soil structure, increase organic matter content, enhance microbial activity, and provide essential nutrients to crops. Compost is produced through the controlled decomposition of organic materials such as crop residues, livestock manure, and household organic waste. Research has shown that compost contributes significantly to improved soil fertility, water retention, nutrient availability, and long-term agricultural productivity. Furthermore, composting agricultural waste offers an environmentally sound solution for waste management while reducing the need for synthetic

fertilizers (Ahmed *et al*., 2023; Lhaj *et al*., 2024; Li *et al*., 2024).

Farmyard manure (FYM) is another important organic amendment widely used in sustainable agriculture. FYM contains decomposed animal dung, urine, bedding materials, and other organic residues that improve soil physical, chemical, and biological properties. Studies have demonstrated that FYM increases soil organic carbon, enhances nutrient availability, improves moisture retention, and contributes to higher crop yields. As concerns regarding soil degradation and declining fertility continue to increase, organic amendments such as FYM are becoming increasingly important in sustainable soil management strategies (Singh *et al*., 2024; Matisic *et al*., 2024; Manzoor *et al*., 2024).

Similarly, eco-friendly pest management practices are receiving increasing attention as alternatives to synthetic pesticides. Neem oil, derived from the neem tree (Azadirachta indica), is one of the most widely used botanical pesticides in sustainable agriculture. The active compound azadirachtin disrupts insect growth, feeding, and reproduction, making neem oil effective against a wide range of agricultural pests. Unlike conventional pesticides, neem-based products are generally biodegradable, environmentally friendly, and less harmful to non-target organisms. Consequently, neem oil has emerged as an important component of integrated pest management programs aimed at reducing chemical pesticide use while maintaining effective pest control (Adusei *et al*., 2022; Pascoli *et al*., 2020; Zaini *et al*., 2023).

Another increasingly adopted pest management tool is the use of yellow sticky traps. These traps attract and capture flying insects such as aphids, whiteflies, thrips, and leaf miners, allowing farmers to monitor pest populations and reduce pest pressure without relying heavily on chemical pesticides. Yellow sticky traps are environmentally safe, affordable, and easy to use, making them suitable for sustainable farming systems. Their role in integrated pest management has become increasingly important because they support early pest detection and informed decision-making regarding pest control interventions (Böckmann *et al*., 2021; Nagaraj *et al*., 2025; Zaini *et al*., 2023).

The adoption of sustainable agricultural practices not only generates environmental benefits but also produces significant economic gains for farmers. Rising prices of fertilizers and pesticides have increased production costs worldwide, placing financial pressure on farming households. Alternative agricultural practices can reduce expenditure on external inputs by utilizing locally available organic resources and environmentally friendly pest management techniques. Several studies report that sustainable farming systems can lower input costs, improve resource-use efficiency, and enhance long-term farm profitability. Economic benefits play a crucial role in encouraging farmers to adopt and continue using sustainable technologies (Vittis *et al*., 2021; Serebrennikov *et al*., 2020; Li *et al*., 2024; Manzoor *et al*., 2024).

Despite the documented advantages of sustainable agricultural practices, adoption levels vary considerably across farming communities. Factors such as awareness, education, extension services, access to resources, perceived profitability, and farm characteristics influence farmers' decisions regarding the adoption of eco-friendly technologies. Understanding how farmers adopt these practices and the economic benefits they realize is essential for developing effective agricultural policies and extension strategies. Therefore, empirical studies focusing on farmers' adoption patterns and cost savings are necessary to provide evidence-based recommendations for promoting sustainable agriculture (Serebrennikov *et al*., 2020; Shahzad *et al*., 2025; Li *et al*., 2024; Zaini *et al*., 2023).

Against this background, the present study entitled "Descriptive Analysis of Alternative Agricultural Practices and Cost Savings among Farmers" aims to examine the adoption of eco-friendly farming practices, including compost, FYM, neem oil, and yellow sticky traps, as alternatives to synthetic fertilizers and pesticides. The study further assesses the extent of input reduction and evaluates the economic benefits obtained by farmers through the adoption of these sustainable agricultural practices. By providing descriptive evidence on adoption patterns and cost savings, the study contributes to a better understanding of the role of sustainable agriculture in enhancing farm profitability and environmental sustainability.

## 2. Objectives

i. To identify and describe the eco-friendly farming practices adopted by farmers for reducing the use of synthetic fertilizers and pesticides.
ii. To assess the extent of reduction in synthetic fertilizer and pesticide use through the adoption of compost, FYM, neem oil, and yellow sticky traps.
iii. To analyze the economic benefits and cost savings achieved by farmers through the adoption of eco-friendly farming practices.

### 2.1 Research Questions

1. Which eco-friendly agricultural practices are most commonly adopted by farmers?
2. To what extent have synthetic fertilizers and pesticides been reduced?
3. What economic benefits and cost savings have been achieved through the adoption of eco-friendly practices?

## 3. Review of Literature

Sustainable agriculture has emerged as a critical approach for addressing the environmental and economic challenges associated with intensive agricultural production systems. Modern agriculture has significantly increased food production through the extensive use of synthetic fertilizers and pesticides; however, excessive dependence on chemical inputs has resulted in soil degradation, water contamination, biodiversity loss, and increasing production costs. In response to these concerns, researchers and policymakers have emphasized the adoption of environmentally friendly agricultural practices that enhance productivity while maintaining ecological sustainability. Sustainable farming practices aim to improve resource-use efficiency, preserve natural ecosystems, and ensure long-term agricultural productivity. Studies have shown that the adoption of sustainable agricultural technologies contributes to environmental conservation and improved farm profitability.

One of the most widely promoted sustainable agricultural practices is the use of organic amendments such as compost. Compost is produced through the decomposition of organic materials, including crop residues, animal manure, and household organic waste. It serves as a valuable source of nutrients and organic matter, contributing to improved soil fertility and productivity. According to Ahmed *et al*. (2023), microbial compost enhances soil biological activity, nutrient

availability, and plant growth while reducing dependence on synthetic fertilizers. Similarly, Lhaj *et al*. (2024) reported that composting agricultural waste improves soil health, increases water retention capacity, and supports sustainable agricultural production. The use of compost has therefore become an important strategy for restoring soil fertility and promoting environmentally friendly farming systems.

In addition to compost, farmyard manure (FYM) plays a significant role in sustainable soil management. FYM is composed of decomposed animal dung, urine, bedding materials, and farm residues and has been used traditionally by farmers to improve soil fertility. Organic amendments such as FYM contribute to the enhancement of soil structure, nutrient availability, and microbial activity. Matisic *et al*. (2024) emphasized that organic amendments including FYM improve soil organic matter content, water-holding capacity, and nutrient retention, thereby enhancing overall soil quality. Likewise, Singh *et al*. (2024) concluded that FYM serves as an effective source of essential plant nutrients and reduces dependence on chemical fertilizers. The incorporation of FYM into farming systems not only improves crop productivity but also contributes to sustainable soil conservation practices.

Recent advancements in sustainable agriculture have highlighted the importance of biofertilizers and organic nutrient management practices. Biofertilizers consist of beneficial microorganisms that improve nutrient availability and promote plant growth through biological processes. These technologies contribute to climate-smart agriculture by reducing the environmental impacts associated with synthetic fertilizers. Shahzad *et al*. (2025) reported that biofertilizers enhance nutrient cycling, stress tolerance, and soil biological activity while improving crop productivity. The increasing interest in biofertilizers reflects a growing recognition of the need for alternative nutrient management strategies capable of reducing production costs and environmental degradation. Consequently, the adoption of organic nutrient sources has become an integral component of sustainable agricultural development.

Apart from soil fertility management, sustainable agriculture also emphasizes environmentally friendly pest management strategies. Conventional pesticide use has raised concerns regarding environmental contamination, human health risks, and pest resistance. As a result, researchers have explored botanical pesticides as safer alternatives to synthetic chemicals. Neem oil, extracted from *Azadirachta indica*, has gained widespread recognition as an effective biopesticide. Adusei *et al*. (2022) identified neem as a promising biological control agent due to its insect growth-regulating properties and low environmental toxicity. Similarly, Pascoli *et al*. (2020) demonstrated that neem oil-based formulations effectively control agricultural pests while minimizing adverse environmental impacts. These findings suggest that neem oil can serve as an environmentally sustainable alternative to conventional pesticides.

Integrated Pest Management (IPM) strategies have further promoted the adoption of non-chemical pest control techniques such as yellow sticky traps. Yellow sticky traps are designed to attract and capture flying insect pests, enabling farmers to monitor pest populations and reduce unnecessary pesticide applications. Böckmann *et al*. (2021) highlighted the importance of yellow sticky traps in supporting efficient pest monitoring and decision-making within IPM systems. Furthermore, Nagaraj *et al*. (2025) reported that yellow sticky traps effectively contribute to the management of pests such as aphids, whiteflies, thrips, and leaf miners while reducing dependence on chemical pesticides. Their low cost, simplicity, and environmental safety have made yellow sticky traps increasingly popular among farmers adopting sustainable farming practices.

The economic benefits associated with sustainable agricultural practices have also received considerable attention in the literature. Increasing prices of chemical fertilizers and pesticides have placed financial pressure on farming households, encouraging the search for cost-effective alternatives. Sustainable farming practices help farmers reduce expenditures on purchased inputs while maintaining productive agricultural systems. Vittis *et al*. (2021) found that environmentally sustainable agricultural systems can lower production costs while improving resource-use efficiency. Similarly, Serebrennikov *et al*. (2020) reported that economic motivations significantly influence farmers' decisions to adopt sustainable agricultural technologies. Reductions in fertilizer and pesticide expenditures often create incentives for farmers to continue using environmentally friendly farming practices.

Farmer adoption of sustainable agricultural practices is influenced by various socioeconomic and institutional factors. Studies suggest that education, access to information, extension services, resource availability, and perceived profitability play important roles in determining adoption decisions. Serebrennikov *et al*. (2020) observed that farmers with greater environmental awareness and better access to agricultural knowledge are more likely to adopt sustainable practices. Furthermore, policy support and extension programs contribute significantly to promoting environmentally friendly technologies among farming communities. The success of sustainable agriculture therefore depends not only on the effectiveness of the technologies themselves but also on farmers' willingness and capacity to adopt them.

Overall, the reviewed literature indicates that alternative agricultural practices such as compost, FYM, neem oil, and yellow sticky traps provide substantial environmental and economic benefits. These practices improve soil fertility, reduce dependence on chemical inputs, enhance pest management, and lower production costs. Although previous studies have extensively documented the advantages of sustainable agricultural technologies, there remains a need for location-specific evidence on farmer adoption patterns and associated economic benefits. Therefore, the present study seeks to contribute to the existing body of knowledge by providing a descriptive analysis of alternative agricultural practices and cost savings among farmers

Although previous studies have examined the environmental and economic benefits of sustainable agricultural practices, limited evidence exists on the adoption patterns and cost savings achieved by farmers in the study area. Therefore, this study addresses this gap by providing a descriptive analysis of alternative agricultural practices and their economic benefits among farmers.

## 4. Methodology

Research methodology employed to achieve the objectives of the study entitled Descriptive Analysis of Alternative Agricultural Practices and Cost Savings among Farmers. The methodology explains the research design, data source, study population, sampling procedure, variables used, data collection process, and statistical techniques adopted for data analysis. The selection of an appropriate methodology is

important because it ensures the reliability and validity of research findings. Descriptive research methods are commonly used in agricultural studies to examine farmers' adoption behavior, sustainable agricultural practices, and economic outcomes associated with technology adoption (Serebrennikov *et al*., 2020; Vittis *et al*., 2021).

### 4.1 Research Design

The study adopted a descriptive research design. A descriptive research approach is suitable when the objective is to describe existing phenomena and summarize observed characteristics without manipulating variables. The present study focuses on examining the adoption of eco-friendly agricultural practices and the resulting cost savings among farmers. Descriptive studies are widely used in sustainable agriculture research because they help explain patterns of technology adoption, input utilization, and economic performance of farming households (Serebrennikov *et al*., 2020; Tittonell *et al*., 2020).

The descriptive design was selected because the study aimed to identify the alternative agricultural practices adopted by farmers, assess reductions in synthetic fertilizer and pesticide use, and evaluate cost savings achieved through these practices. No experimental treatments or interventions were applied during the study. Instead, existing farmer data were analyzed to provide a comprehensive understanding of current adoption patterns and economic benefits.

### 4.2 Data Source

The study utilized primary data collected from farmers who adopted eco-friendly agricultural practices. Information was obtained regarding the use of compost, farmyard manure (FYM), neem oil, and yellow sticky traps as alternatives to synthetic fertilizers and pesticides. Data included information on practices adopted, input categories, quantities used, area covered, and cost savings achieved by farmers.

The collected information provided the basis for examining how alternative agricultural practices contribute to reducing agricultural input costs and improving farm profitability. Similar studies have emphasized the importance of collecting farmer-level information to assess sustainable farming technologies and their economic impacts (Shahzad *et al*., 2025; Matisic *et al*., 2024).

### 4.3 Study Population and Sample Size

The population of the study consisted of farmers implementing eco-friendly agricultural practices in the study area. A total of 25 farmers were included in the sample. Since the available dataset contained complete information regarding the adoption of alternative agricultural practices, all farmers recorded in the dataset were included in the analysis.

The selected farmers represented individuals who had adopted at least one sustainable agricultural practice such as compost, FYM, neem oil, or yellow sticky traps. These technologies are increasingly recognized as environmentally friendly alternatives that contribute to sustainable crop production and reduced dependence on chemical inputs (Ahmed *et al*., 2023; Adusei *et al*., 2022).

### 4.4 Variables Used in the Study

To achieve the research objectives, several variables were identified and classified into independent, dependent, and descriptive variables.

**Independent Variables:** The independent variables consisted of eco-friendly agricultural practices adopted by farmers:

- Compost
- Farmyard Manure (FYM)
- Neem Oil
- Yellow Sticky Traps

These practices are widely promoted as sustainable alternatives to synthetic fertilizers and pesticides because they improve soil fertility and support environmentally friendly pest management (Ahmed *et al*., 2023; Nagaraj *et al*., 2025).

**Dependent Variables**

The dependent variables measured the outcomes associated with practice adoption:

- Fertilizer Cost Reduction (Rs.)
- Pesticide Cost Reduction (Rs.)
- Total Amount Saved (Rs.)

The selection of these variables was based on literature indicating that sustainable agricultural technologies often lead to reductions in production costs and improved farm profitability (Vittis *et al*., 2021; Shahzad *et al*., 2025).

**Descriptive Variables**

Additional descriptive variables included:

- Farmer Name
- Farmer Code
- Number of Practices Adopted
- Acres Used

These variables were used to describe the characteristics of participating farmers and summarize adoption patterns.

### 4.5 Data Analysis Techniques

The collected data were organized, cleaned, coded, and analyzed using descriptive statistical techniques. Descriptive statistics provide effective tools for summarizing and presenting agricultural data in a meaningful manner (Serebrennikov *et al*., 2020; Singh *et al*., 2024).

The following statistical measures were employed:

**Frequency Analysis**

Frequency analysis was used to determine the number of farmers adopting each eco-friendly agricultural practice.

$$Frequency = Number\ of\ Farmers\ Adopting\ a\ Practice$$

The frequency distribution helped identify the most commonly used alternative agricultural technologies among farmers.

**Percentage Analysis**

Percentages were calculated to facilitate comparisons among different agricultural practices.

$$Percentage = \frac{Frequency}{Total\ Number\ of\ Farmers} \times 100$$

This method was used to determine the proportion of farmers adopting compost, FYM, neem oil, and yellow sticky traps.

**Mean**
The arithmetic mean was calculated to determine the average amount saved by farmers through the adoption of sustainable agricultural practices.

$$Mean = \frac{\sum X}{N}$$

Where:
- $X$= Total Amount Saved
- $N$= Number of Farmers

**Median**
The median was used to identify the central value of savings among farmers when data were arranged in ascending order.

**Minimum and Maximum Values**
Minimum and maximum values were calculated to determine the lowest and highest levels of cost savings observed among farmers.

**Total Savings**
Total savings were computed by aggregating all savings achieved through fertilizer and pesticide cost reductions.

$$Total\ Savings = \sum Amount\ Saved$$

These statistical measures enabled the study to evaluate the economic benefits generated through the adoption of eco-friendly agricultural practices.

**4.6 Ethical Considerations**
The study ensured confidentiality and appropriate handling of farmer information. Data were used exclusively for academic research purposes, and analysis was conducted objectively without altering the original information. Findings were presented in aggregate form to maintain the privacy of individual farmers.

**5.Results and Discussion**
This section presents the descriptive results obtained from the analysis of primary data collected from 25 farmers regarding the adoption of eco-friendly agricultural practices compost, farmyard manure (FYM), neem oil, and yellow sticky traps and the associated cost savings achieved through reduced use of synthetic fertilizers and pesticides. Results are presented in accordance with the study objectives and are discussed in relation to the existing literature reviewed in Section 2.

**5.1 Adoption of Eco-Friendly Agricultural Practices**
The first objective of the study was to identify and describe the eco-friendly farming practices adopted by farmers. Table 1 presents the frequency and percentage distribution of farmers adopting each practice. Since farmers could adopt more than one practice simultaneously, the percentages do not sum to 100%.

**Table 1:** Frequency and Percentage Distribution of Eco-Friendly Practices Adopted (n = 25)

| Practice | Frequency (No. of Farmers) | Percentage (%) |
|---|---|---|
| Compost | 21 | 84.0 |
| Farmyard Manure (FYM) | 4 | 16.0 |
| Neem Oil | 21 | 84.0 |
| Yellow Sticky Traps | 7 | 28.0 |

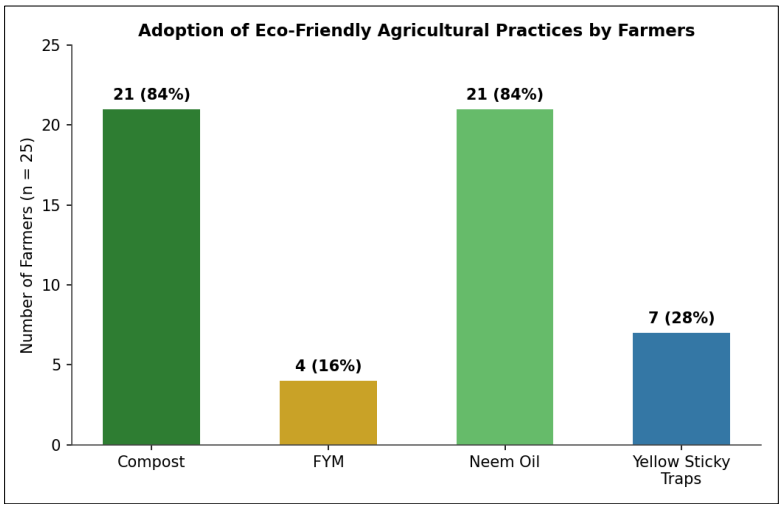



**Fig 1:** Adoption of Eco-Friendly Agricultural Practices by Farmers

The results show that compost and neem oil were the most widely adopted practices, each used by 21 out of 25 farmers (84.0%). This finding is consistent with Ahmed *et al*. (2023) and Lhaj *et al*. (2024), who reported compost as one of the most accessible and widely promoted organic amendments due to its low cost and ease of preparation from locally available materials. The high adoption rate of neem oil similarly supports Adusei *et al*. (2022) and Pascoli *et al*. (2020), who identified neem-based biopesticides as an effective and widely accepted alternative to synthetic pesticides among smallholder farmers.
In contrast, FYM was adopted by only 4 farmers (16.0%), the lowest among all four practices. This relatively low adoption may reflect limited access to livestock manure, higher labour requirements for collection and application, or a preference among farmers for the more readily available

compost. Yellow sticky traps were adopted by 7 farmers (28.0%), suggesting moderate uptake. Although Böckmann *et al*. (2021) and Nagaraj *et al*. (2025) emphasize the usefulness of yellow sticky traps for pest monitoring within integrated pest management systems, their comparatively lower adoption in this sample may be attributed to lower awareness or limited availability relative to compost and neem oil.

### 5.2 Extent of Adoption: Number of Practices Used per Farmer

To assess how extensively farmers combined different eco-friendly practices, farmers were grouped according to the number of practices they adopted simultaneously. Table 2 and Figure 2 present this distribution.

**Table 2:** Distribution of Farmers by Number of Eco-Friendly Practices Adopted (n = 25)

| Number of Practices Adopted | Number of Farmers | Percentage (%) |
|---|---|---|
| 1 | 4 | 16.0 |
| 2 | 14 | 56.0 |
| 3 | 7 | 28.0 |
| Total | 25 | 100.0 |

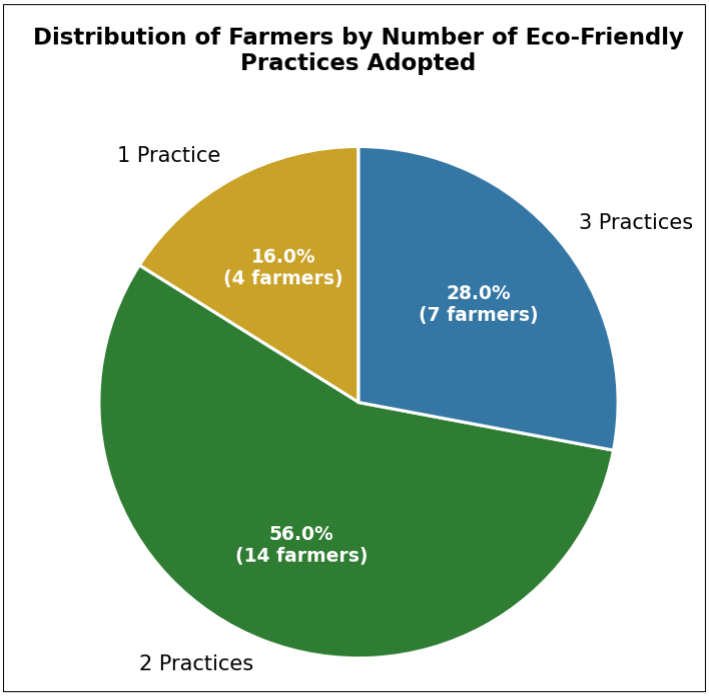



**Fig 2:** Distribution of Farmers by Number of Eco-Friendly Practices Adopted

More than half of the sample (56.0%) adopted two eco-friendly practices simultaneously, while 28.0% adopted all three of compost, neem oil, and yellow sticky traps together, and only 16.0% relied on a single practice. This pattern indicates that most farmers in the study area did not rely on a single alternative input but combined organic fertilization (compost or FYM) with botanical or physical pest control methods (neem oil and/or yellow sticky traps), reflecting an integrated approach to reducing synthetic input use consistent with the integrated pest management framework described by Böckmann *et al*. (2021).

### 5.3 Economic Benefits and Cost Savings

The third objective examined the economic benefits achieved by farmers through reduced expenditure on synthetic fertilizers and pesticides. Descriptive statistics mean, median, minimum, maximum, and total were computed separately for fertilizer cost reduction, pesticide cost reduction, and total amount saved. Results are presented in Table 3.

**Table 3:** Descriptive Statistics of Cost Savings Achieved by Farmers (Rs.)

| Statistic | Fertilizer Cost Reduced (Rs.) | Pesticide Cost Reduced (Rs.) | Total Amount Saved (Rs.) |
|---|---|---|---|
| Mean | 10,080.0 | 2,124.0 | 12,204.0 |
| Median | 12,000.0 | 2,000.0 | 14,000.0 |
| Minimum | 5,500.0 | 0.0 | 6,000.0 |
| Maximum | 19,000.0 | 4,900.0 | 19,000.0 |
| Std. Deviation | 3,613.3 | 1,586.1 | 3,918.0 |
| Total (Sum, n = 25) | 252,000.0 | 53,100.0 | 305,100.0 |

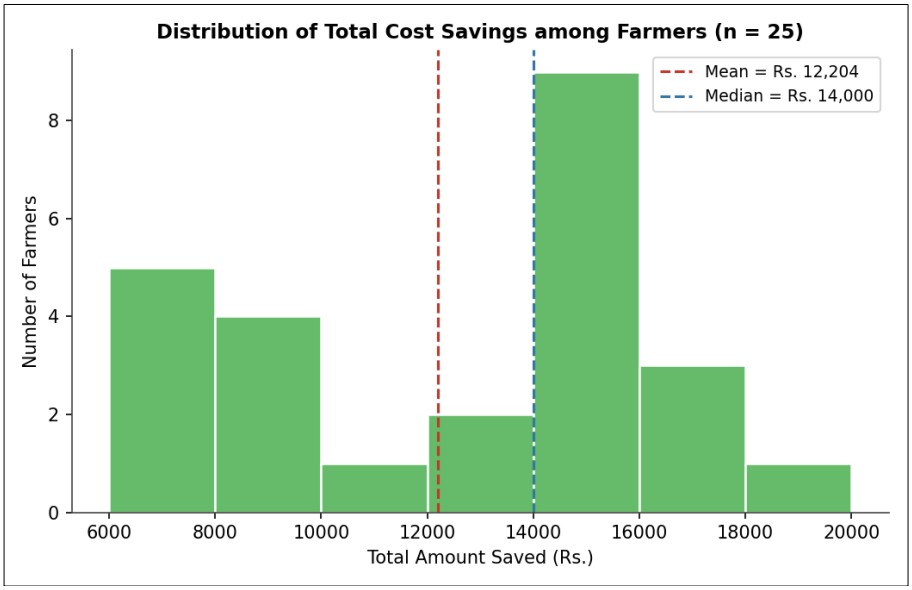



**Fig 3:** Distribution of Total Cost Savings among Farmers (n = 25)

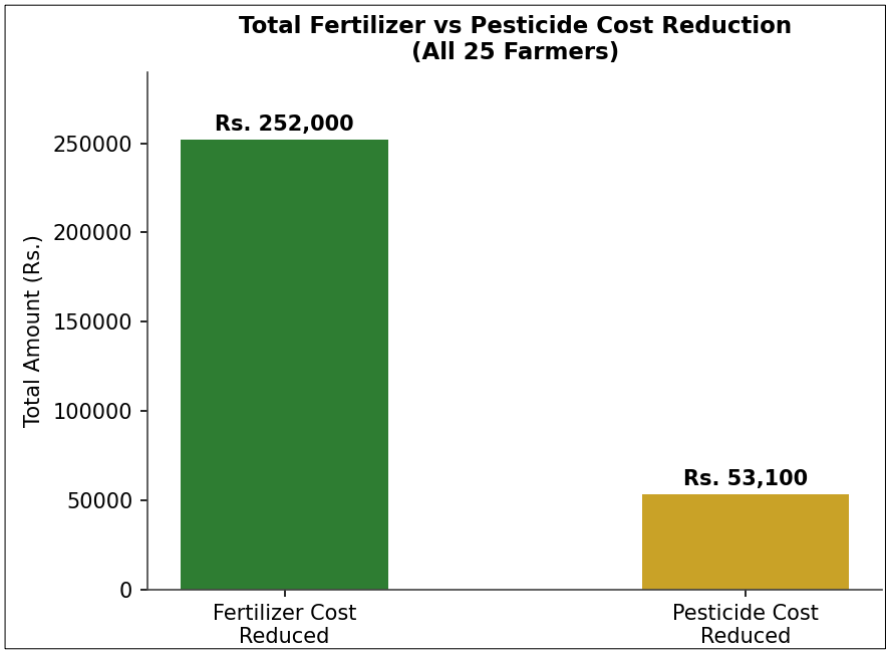



**Fig 4:** Total Fertilizer vs. Pesticide Cost Reduction (All Farmers Combined)

On average, each farmer saved Rs. 12,204 through the adoption of eco-friendly agricultural practices, with savings ranging from a minimum of Rs. 6,000 to a maximum of Rs. 19,000. The median savings (Rs. 14,000) exceeded the mean, indicating that savings were somewhat left-skewed the majority of farmers achieved savings above Rs. 12,000, while a smaller number of farmers with lower adoption levels recorded comparatively lower savings, pulling the mean downward. Collectively, the 25 sampled farmers achieved total savings of Rs. 305,100 through reduced fertilizer and pesticide expenditure. These findings are consistent with Vittis *et al.* (2021) and Serebrennikov *et al.* (2020), who reported that sustainable agricultural practices meaningfully lower input costs and improve farm-level profitability.

A comparison of the two cost components shows that fertilizer cost reduction (Rs. 252,000; 82.6% of total savings) contributed substantially more to overall savings than pesticide cost reduction (Rs. 53,100; 17.4%). This is expected given that organic amendments such as compost and FYM directly substitute for relatively expensive synthetic fertilizers, whereas neem oil and yellow sticky traps typically supplement rather than fully replace pesticide use. This result reinforces the findings of Ahmed *et al.* (2023) and Singh *et al.* (2024), who emphasized the substantial role of organic fertility amendments in reducing dependence on costly chemical fertilizers.

### 5.4 Relationship between Extent of Adoption and Cost Savings

To provide further descriptive insight, the total amount saved by each farmer was examined against the number of eco-friendly practices they had adopted (Figure 5).

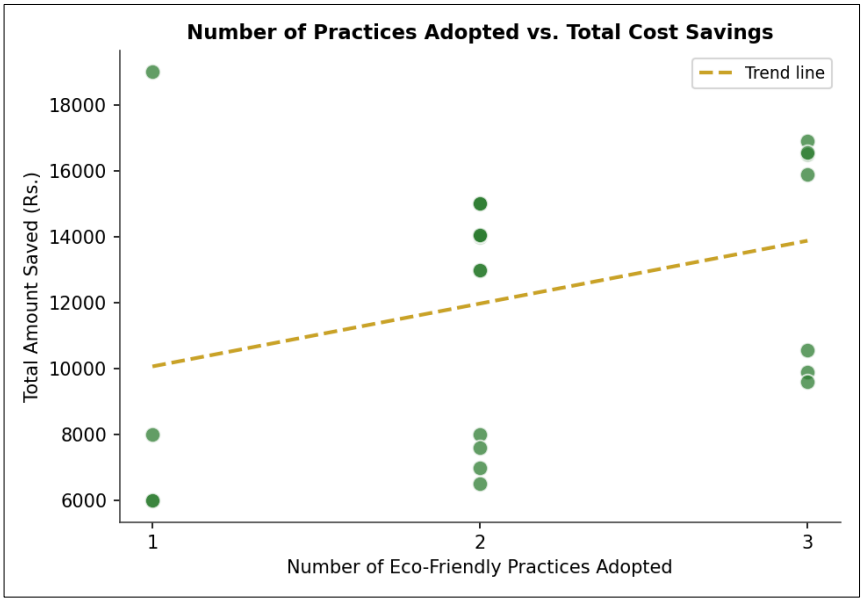



**Fig 5:** Number of Practices Adopted vs. Total Cost Savings per Farmer

The data show a broadly positive association: farmers who adopted three practices tended to report higher total savings on average than those who adopted only one or two, and the overall trend line slopes upward. However, considerable variation exists within each group — for example, some farmers who adopted only one practice (compost alone) recorded relatively high individual savings (up to Rs. 19,000), most likely reflecting larger fertilizer cost reductions on their farms. As this study followed a purely descriptive design without inferential statistical testing, this pattern should be interpreted as an observed trend rather than a statistically confirmed relationship. Nonetheless, it lends descriptive support to the view that combining organic fertility management with botanical and physical pest control tends to generate greater overall cost savings, in line with the integrated, multi-practice approach to sustainable agriculture emphasized by Shahzad *et al.* (2025) and Matisic *et al.* (2024).

### 5.5 Summary of Findings

Overall, the results indicate that eco-friendly agricultural practices particularly compost and neem oil were widely adopted among the sampled farmers, with the majority combining two or more practices. The adoption of these practices translated into measurable economic benefits, with an average saving of over Rs. 12,000 per farmer and combined savings exceeding Rs. 300,000 across the sample, driven predominantly by reductions in fertilizer expenditure. These findings support the study's objectives and are broadly consistent with prior research documenting both the environmental and economic value of sustainable agricultural practices (Serebrennikov *et al.*, 2020; Vittis *et al.*, 2021; Shahzad *et al.*, 2025).

## 6. Recommendations

Based on the findings of the study, the following recommendations are proposed:

### 6.1. Promote the Wider Adoption of Compost and Neem Oil

Since compost and neem oil were the most widely adopted practices and contributed significantly to reducing synthetic fertilizer and pesticide use, agricultural extension agencies should encourage their wider adoption through awareness campaigns, field demonstrations, and farmer training programs.

### 6.2 Strengthen Farmer Training on Sustainable Agricultural Practices

Regular training and capacity-building programs should be organized to improve farmers' knowledge regarding the preparation, application, and benefits of compost, FYM, neem oil, and yellow sticky traps. Increased awareness can enhance the adoption of eco-friendly technologies and improve their effectiveness.

### 6.3 Encourage the Use of Farmyard Manure (FYM)

The study revealed that FYM had the lowest adoption rate among farmers. Therefore, extension workers should educate farmers about the soil fertility benefits of FYM and provide technical guidance on its efficient collection, storage, and application.

### 6.4 Increase Awareness of Yellow Sticky Traps

The adoption of yellow sticky traps was relatively low despite their effectiveness in pest monitoring and management. Awareness campaigns, demonstration plots, and farmer field schools should be used to promote the role of yellow sticky traps in integrated pest management.

### 6.5 Support Integrated Use of Multiple Eco-Friendly Practices

The findings indicated that farmers adopting two or more eco-friendly practices tended to achieve greater cost savings. Farmers should therefore be encouraged to combine organic nutrient management techniques with botanical and physical pest control methods to maximize economic and environmental benefits.

### 6.6 Provide Financial and Technical Support

Government departments, NGOs, and agricultural development organizations should provide subsidies, incentives, and technical assistance to facilitate the adoption of sustainable agricultural technologies, particularly among small-scale farmers.

### 6.7 Strengthen Agricultural Extension Services
Agricultural extension services should be strengthened to ensure continuous dissemination of information regarding eco-friendly farming practices. Extension personnel can play a key role in demonstrating the economic benefits associated with reducing synthetic fertilizer and pesticide use.

### 6.8 Promote Sustainable Input Production at Community Level
Local communities should be encouraged to establish composting units and produce organic inputs using locally available agricultural residues. This will reduce input costs and increase the availability of eco-friendly alternatives.

### 6.9 Conduct Further Research with Larger Samples
Future studies should include larger sample sizes and multiple geographic locations to generate more comprehensive evidence regarding the adoption and economic impact of sustainable agricultural practices.

### 6.10 Include Additional Socioeconomic Variables in Future Studies
Future research should incorporate variables such as farmers' age, education, farming experience, landholding size, income level, and crop type to better understand the factors influencing the adoption of eco-friendly agricultural practices.

## 7. Conclusion
This study examined the adoption of eco-friendly agricultural practices and the cost savings achieved by farmers through the use of compost, farmyard manure (FYM), neem oil, and yellow sticky traps as alternatives to synthetic fertilizers and pesticides. The findings revealed that compost and neem oil were the most widely adopted practices, while FYM and yellow sticky traps showed comparatively lower adoption rates. Most farmers adopted two or more practices simultaneously, indicating a growing preference for integrated sustainable farming approaches. The study also demonstrated that eco-friendly practices generated significant economic benefits, with average savings of Rs. 12,204 per farmer and total savings of Rs. 305,100. Fertilizer cost reduction accounted for the largest share of savings. Overall, the results confirm that sustainable agricultural practices can reduce production costs, improve farm profitability, and contribute to environmentally sustainable agricultural development.

Acharya Iswarkrishna ‘Duḥkhatrayābhighātāt’ by this term mean that “Tatra na tābada duḥkhaṃ nāsti nāpi Ajihāsitaṃ”. There is sorrow in the two of the six things, and it is possible to get rid of it, says “Duḥkhatrayābhighātāt” In this vast world there can be controversy over the existence of all present objects but there can be no controversy over the existence of sorrow. Perfect sorrow cannot be denied by all. Self-pity for grief is also un animus. “Duḥkhānāṃtrayaṃ” hearing such a sentence, it may seem that there are three sorrow and Iswarkrishna started the kārikā and first kārikā is “Duḥkhatraya” this word seem that there are three sorrows, but that is not the case. From time to time there are new

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