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(RESEARCH ARTICLE)

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Fertilizer usage patterns among farmers of Saidabad Block, Prayagraj District, Uttar Pradesh, India

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Abstract

Fertilizers are the substances that contain essential nutrients required for plant growth and development. These can be natural or synthetic, straight or mixed depending on the requirement of crop. This research paper investigates the patterns and impact of fertilizer use among farmers in the Saidabad block of Prayagraj district, Uttar Pradesh. Based on field surveys, interviews, and direct observations, the study explores the current fertilizer usage practices among Saidabad farmers and assesses the factors influencing their choices. The study shows widespread use of chemical fertilizers, the emerging adoption of organic alternatives, and the implications for soil health and sustainable agriculture. The findings underline the urgent need for balanced fertilization practices, increased awareness among farmers, and support for sustainable agricultural initiatives to protect long-term productivity.

Key words: Fertilizer; Urea; DAP; Saidabad Block

1. Introduction

Agriculture remains the backbone of the rural economy in Uttar Pradesh (India), and the Saidabad block of Prayagraj district is no exception. Fertilizers, both chemical and organic, play a critical role in enhancing crop yields and ensuring food security (Stewart and Roberts, 2012). However, excessive and unbalanced use of chemical fertilizers can negatively impact soil health, crop yield and the environment. It has raised concerns regarding soil degradation, declining crop response, nutritional stress and environmental pollution (Bisht and Chauhan, 2020). The application of chemical fertilizer requires a balance between the goals of crop productivity and the long-term environmental sustainability (Bora, 2022). This study aims to understand the current fertilizer usage practices among Saidabad farmers, analyzes the factors influencing their choices, identifies challenges and limitations and suggests measures for improving soil health and crop productivity.

2. Materials and methods

2.1. Study Area

Saidabad block is situated in the eastern part of Prayagraj district, characterized by alluvial soils and a subtropical climate. The region supports intensive cultivation of major crops such as rice, wheat, pulses, and vegetables. Most farmers in the block are smallholders, with landholdings ranging from 0.5 to 2 hectares. Irrigation facilities, mainly through tube wells and canals, are well established, allowing for multiple cropping throughout the year. Fertilizers for agriculture in Saidabad Block, Prayagraj district, are likely available through a variety of channels, including government programs, private retailers, and cooperative societies. The district agriculture office or local

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agricultural extension services can provide information on fertilizer availability, recommended dosages for different crops, and the latest government schemes in Saidabad Block.

2.2. Methodology

The research was conducted through a stratified random sampling of 150 farmers from 10 villages in Saidabad block. Primary data were collected using structured questionnaires, personal interviews, and focus group discussions between June 2023 and October 2023. Secondary data were obtained from the Krishi Vigyan Kendras, government reports, and relevant scientific literatures. Data analysis involved the use of descriptive statistics and thematic content analysis to draw meaningful conclusions.

3. Results and discussion

Table 1 Descriptive Statistics of Farmers in Saidabad Block, Prayagraj District: Age, Farming Experience, LandholdingSize and Fertilizer Usage.

Variables	Description	Value
Sample Size	Total number of farmers surveyed	150 farmers
Average Age	Mean age of farmers	46 years
Average Farming Experience	Mean number of years in farming	18 years
Mean Landholding Size	Average size of landholding	2.6 acres
Fertilizer Usage (per acre)	Average amount of fertilizer used per acre	123 kg/acre
Standard Deviation (Fertilizer Usage)	Variation in fertilizer usage	29.5 kg/acre

The present study surveyed 150 farmers from the Saidabad block of Prayagraj district to understand fertilizer usage patterns. The descriptive statistics revealed that the average age of the farmers was approximately 46 years, with an average farming experience of 18 years, indicating a mature and experienced farming community. The mean landholding size was 2.6 acres, reflecting predominantly small and marginal farming practices. On average, farmers used about 123 kg of fertilizers per acre, with a standard deviation of 29.5 kg per acre, suggesting moderate variability in fertilizer application rates across farms (Table 1).

Table 2 Distribution of fertilizer types used by Farmers in Saidabad Block, Prayagraj district in survey sample.

Fertilizer Type Used	Number of Farmers	Percentage (%)
Urea	145	96.7%
DAP (Diammonium phosphate)	120	80.0%
MOP (Potash)	85	56.7%
SSP (Single Super Phosphate)	60	40.0%
Organic Fertilizers	48	32.0%
Biofertilizer	15	10%

The study found that almost all farmers in Saidabad heavily depend on chemical fertilizers, particularly urea and DAP. Urea, which provides a high concentration of nitrogen, is used by approximately 96.7% of the surveyed farmers, primarily for rice and wheat cultivation. DAP, rich in both nitrogen and phosphorus, is used by around 80% of the farmers, especially during the sowing stage of crops. Usage of MOP and SSP was comparatively lower. Muriate of Potash (MOP) is less commonly used but is preferred by farmers growing vegetables such as potatoes, tomatoes, and brinjals (Table 2).

In addition to major fertilizers, some farmers reported using zinc sulphate to correct micronutrient deficiencies, particularly in rice fields. However, the use of biofertilizers, remains limited to only about 10% of farmers, primarily due to lack of awareness and availability. Organic fertilizers such as farmyard manure (FYM), compost, and

vermicompost are used by around 32% of farmers, mostly by those practicing vegetable cultivation or having access to livestock.



Figure 1 Sources of fertilizer procurement among farmers in Saidabad Block, Prayagraj district in survey sample (n =150)

Table 3 Education level of farmers in Saidabad block in survey sample.

Education Level	Number of Farmers	Percentage (%)
Illiterate	30	20.0%
Primary School	45	30.0%
Secondary School	50	33.3%
Higher Secondary and Above	25	16.7%

The majority (60%) of farmers sourced fertilizers from government agencies, while 30% were depended on private dealers, indicating reliance on formal supply chains (Fig. 1). Education appeared to influence fertilizer usage patterns. Most farmers were literate (Table 3). Farmers with higher levels of education tended to use a greater diversity of fertilizers and applied them in more balanced proportions compared to illiterate farmers.

These findings suggest that although fertilizer usage is widespread, there is a need for better awareness regarding balanced fertilization practices, especially among less-educated and smallholder farmers. Policy interventions focusing on promoting organic inputs and improving access to quality fertilizers through government channels could further enhance sustainable agricultural practices in the region. The recent advances on nano fertilizers could be a boon to agriculture in addressing the challenges of nutrient management, sustainable agriculture, and increasing food production to meet the demands of a growing population (Yadav *et al.*, 2023).

3.1. Fertilizer Usage Patterns

Urea is a nitrogen-rich fertilizer, while DAP provides both nitrogen and phosphorus, which are crucial nutrients for plant growth. However, excessive use of urea fertilizer can disrupt the balance of nutrients in the soil, can contribute to soil acidification, can slow down or prevent seed germination and can also increase ammonia levels in the soil, which can be toxic to plants and soil organisms. Thus excessive use of urea must be avoided in agriculture and precautions must be taken while handling it to prevent skin, eye or respiratory irritation. Adverse impact of urea and DAP has been documented in different studies (Ramesh Bhat and Ramaswamy, 1993; Azizullah *et al.*, 2011; Kaboneka*et al.*, 2019; Kumar and Akhtar, 2022). Kumar and Dahiya (2024) found varied effect of chemical fertilizers, nano urea, and nano DAP on the growth and production of wheat crops and environment.

3.2. Factors Influencing Fertilizer Use

Several factors were found to influence the choice and application of fertilizers among Saidabad farmers. Economic considerations play a dominant role, with government subsidies making chemical fertilizers relatively affordable compared to organic inputs. Awareness levels also significantly affect fertilizer practices. Farmers who regularly attend training sessions organized by Krishi Vigyan Kendras (KVKs) or local agricultural officers are more likely to adopt balanced fertilization methods and use organic supplements. Crop type and market demand further influence fertilizer

use, with vegetable growers investing more in micronutrients and soil conditioners to improve product quality and fetch better prices. Notably, only about 12% of farmers had conducted soil testing in the past three years, indicating a general lack of scientific nutrient management.

3.3. Impact on Soil Health and Productivity

While chemical fertilizers have contributed to increased crop yields over the years, their indiscriminate use has begun to show adverse effects. Many farmers reported the need to apply higher quantities of fertilizers each season to maintain the same yield levels. This indicates that the soil's ability to provide essential nutrients to plants is diminishing, potentially due to factors like poor management practices, nutrient depletion, or environmental degradation. Soils in the region are increasingly showing signs of micronutrient deficiencies, especially in zinc and sulfur. Unbalanced fertilization as the cause of nutrient deficiency in soil and low response of crops to fertilizer input has been evaluated by Tan *et al.* (2005). Large scale application of nitrogen fertilizers can also cause harmful effect on ground water quality and health (Prasad, 2009). Mengel *et al.* (2001) suggested supply of sufficient fertilizer with appropriate ratio of required nutrients to maximize crop yield and optimize fertilizer use efficiency. The reduction in soil organic matter due to minimal use of organic amendments has also led to poor soil structure and lower water-holding capacity. Single large applications of organic amendments can accelerate initial reclamation and lead to self-sustaining net primary productivity (Larney and Angers, 2012). Moreover, some farmers observed a rise in pest attacks and disease incidences, particularly in intensively cultivated vegetable fields, which can partly be attributed to soil health deterioration.

3.4. Challenges and Limitations

The study identified several challenges faced by farmers in Saidabad regarding fertilizer usage. Over-reliance on chemical fertilizers, driven by short-term yield gains and lack of awareness, has resulted in long-term soil health issues. Extension services are insufficient, particularly in remote villages, limiting farmers' access to updated knowledge on integrated nutrient management. Although schemes like the Soil Health Card program exist, their reach and effectiveness in the block have been limited. Additionally, organic fertilizers, despite their benefits, are seen as labor-intensive and costly by small farmers who struggle with limited resources.

Recommendations

To address these challenges, the government and agricultural institutions should intensify efforts to promote soil testing and the use of soil health cards to guide fertilizer applications. Farmer training programs on balanced fertilization, organic farming practices, and the use of biofertilizers must be expanded and made accessible at the village level. Financial incentives and market support for organic produce could also encourage farmers to adopt more sustainable practices. Introducing mobile-based advisory services tailored to local soil conditions and crops could further help farmers make informed decisions regarding fertilizer use.

4. Conclusions

The study highlights significant patterns in fertilizer usage among farmers of the Saidabad block, Prayagraj district. The findings reveal that while chemical fertilizers like Urea and DAP are predominantly used, there is a slow but noticeable shift toward organic alternatives. Fertilizer application practices were found to vary based on landholding size, education level, and access to input sources, with government supply playing a crucial role. To ensure sustainable agricultural growth, there is a pressing need for targeted awareness programs promoting balanced fertilizer use and nutrient management, combining chemical fertilizers with organic and biofertilizers, to ensure long-term agricultural sustainability in the region. Strengthening supply chain mechanisms and enhancing farmer education can further optimize fertilizer usage, contributing to improved soil health and farm productivity in the region.

Compliance with ethical standards

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