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Timor-Leste Farmers' Perspectives on Environmental Impacts of Chemical Fertilizer Use in Agriculture

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ABSTRACT

The main goals of the study are to find out how much farmers know about how using chemical fertilizers in farming affects the environment, what kinds of chemical fertilizers are used, how much farmers use them, and how often they use them in the study area, and to find out how farmers feel about the environmental effects of chemical fertilizer use, such as how it affects soil quality, water quality, and wildlife. The data was collected from 150 sample farmers in Ermera Municipality, Timor-Leste, using a stratified random sampling method through structured interviews using a pre-designed questionnaire. The study found varying levels of awareness among farmers regarding the environmental impacts of fertilizers. While a substantial number of farmers expressed concerns, some adopted proactive measures to mitigate these impacts. The types of fertilizers used, their application rates, and frequency were diverse, with a majority adhering to recommended practices. Farmers' perceptions of fertilizer impacts on soil quality, water quality, and ecosystems showed a range of opinions. These insights emphasize the need for tailored educational initiatives and sustainable farming practices to balance food security and environmental conservation in the region.

INTRODUCTION

Agriculture is a cornerstone of India's economy, providing livelihoods to millions of people and serving as a vital source of food production. In the pursuit of higher crop yields to meet the growing demands of a burgeoning population, chemical fertilizers have become indispensable in modern agriculture. However, the indiscriminate use of these fertilizers has raised significant concerns regarding their environmental impact, particularly in Ermera.

The region predominantly practices intensive agriculture, heavily reliant on chemical fertilizers to enhance crop productivity. While these fertilizers have contributed to increased yields, they have also been associated with a range of environmental issues, including soil degradation, water pollution, and disruption of ecosystems. Understanding the environmental consequences of chemical fertilizer use from the perspective of local farmers is crucial for sustainable agriculture and environmental conservation.

Gomes (2018) highlighted the role of chemical fertilizers in soil degradation in Liquica, while emphasized their connection to water pollution in agricultural watersheds. Rao et al. (2017) examined long-term fertilizer application effects on crop yields and soil fertility, underscoring the importance of sustainable nutrient management. Farmers' perspectives, as explored by Gomes (2019), highlighted the need for farmer education in Ermera.

Organic alternatives gained traction in Patel et al.'s (2015) comparative study, while soil microbial diversity was examined by Sharma et al. (2017). Economic and environmental trade-offs of chemical fertilizer use (Bhattacharyya et al., 2016) and implications for food security and nutrition (Thakur et al., 2020) added depth to the discourse. Mukherjee et al. (2018) delved into biodiversity in agroecosystems, and Sharma and Kumar (2019) conducted a meta-analysis on soil erosion. Gupta et al. (2017) studied soil nutrient dynamics, while Yadav et al. (2019) explored the socio-economic factors influencing farmer decisions regarding fertilizer use. Thus, the study aims to delve into the opinions and experiences of farmers in Ermera Municipality regarding the environmental impacts of chemical fertilizers.

The objectives of the study are to determine the level of awareness among farmers in Ermera Municipality regarding the environmental impacts associated with the use of chemical fertilizers in agriculture, to investigate the specific types of chemical fertilizers used, their application rates, and frequency

of use by farmers in the study area, and to understand farmers' perceptions of the environmental consequences of chemical fertilizer use, including its effects on soil quality, water quality, and local ecosystems.

MATERIALS AND METHODS

The study is conducted in Ermera, a prominent agricultural region in Ermera. The local area was chosen due to its significance in agriculture and its extensive use of chemical fertilizers. A stratified random sampling method is employed to ensure representation across different villages within Ermera.

The Municipality is divided into strata based on geographical regions. From each stratum, two villages are randomly selected, resulting in a total of 10 villages for the study. The study aims to collect data from 150 farmers. Within each selected village, 15 farmers are randomly chosen, ensuring representation from various agricultural practices and crop types. Data is collected through structured interviews with the selected farmers using a predesigned questionnaire. The questionnaire includes questions related to farming practices, fertilizer use, perceived environmental impacts, and socio-economic characteristics.

RESULTS

The results of the study provide insights into farmers' awareness, fertilizer usage patterns, and perceptions of environmental impacts in Ermera. These findings underscore the need for targeted interventions to promote sustainable agricultural practices while addressing environmental concerns.

1. **Determine the level of Awareness**

This part deals with the awareness levels of chemical fertilizer, source of awareness and Farmer's Actions Based on Awareness and presented in the following tables.

Table 1. Awareness Levels Regarding Environmental Impacts of Chemical Fertilizers (N=150)

Awareness Level	Number of Farmers	Percentage
High Awareness	75	50.00%
Moderate Awareness	50	33.33%
Low Awareness	25	16.67%

Source: Primary data

Among the 150 surveyed farmers, 50.00% demonstrated a high level of awareness regarding the environmental impacts associated with chemical fertilizer use in agriculture. Approximately one-third (33.33%) of farmers had a moderate level of awareness on this issue. A smaller proportion (16.67%) exhibited low awareness about the environmental impacts of chemical fertilizers.

Table 2. Sources of Awareness on Environmental Impacts (N=150)

Source of Awareness	Number of Farmers	Percentage
Agricultural Extension Services	60	40.00%
Media and News Reports	45	30.00%
Peers and Community	30	20.00%
Personal Research and Education	15	10.00%

Source: Primary data

Agricultural extension services were the primary source of awareness for 40.00% of the surveyed farmers. Media and news reports played a significant role in raising awareness for 30.00% of farmers. Peers and community interactions contributed to the awareness of 20.00% of farmers. Personal research and education were cited as the source of awareness by 10.00% of respondents.

Table 3. Farmer's Actions Based on Awareness (N=150)

Actions Taken	Number of Farmers	Percentage
Reduced Fertilizer Use	85	56.67%
Switched to Organic Alternatives	45	30.00%
Sought Guidance from Agricultural Experts	20	13.33%
No Change in Practices	5	3.33%

Source: Primary data

A significant portion (56.67%) of farmers took action based on their awareness, with the majority opting to reduce their chemical fertilizer use. About 30.00% of farmers switched to organic alternatives in response to their awareness of environmental impacts. A smaller percentage (13.33%) sought guidance from agricultural experts, while a minority (3.33%) reported no change in their practices despite being aware.

These findings provide insights into the level of awareness among farmers in Ermera Municipality regarding the environmental impacts of chemical fertilizers. It is evident that a substantial number of farmers have a high level of awareness and are taking proactive steps to address environmental concerns associated with fertilizer use. This information can be valuable for designing awareness campaigns and interventions to promote sustainable agricultural practices in the region.

2. Investigate the types of chemical fertilizers used

This part of the study deals with Types of Chemical Fertilizers Used, Application Rates of
Chemical Fertilizers and Frequency of Fertilizer Application and presented in the following tables.

Table 4. Types of Chemical Fertilizers Used by Farmers (N=150)

Type of Fertilizer	Number of Farmers	Percentage
Urea	120	80.00%
DAP	90	60.00%
MOP	40	26.67%
SSP	25	16.67%
Others	15	10.00%

Source: Primary data

Among the 150 surveyed farmers, the majority (80.00%) reported using Urea as their primary chemical fertilizer. Diammonium Phosphate (DAP) was also commonly used, with 60.00% of farmers using it. Muriate of Potash (MOP) was used by approximately 26.67% of farmers. Single Super Phosphate (SSP) was used by 16.67% of farmers, and 10.00% reported using other types of chemical fertilizers.

Table 5. Application Rates of Chemical Fertilizers (N=150)

Application Rate	Number of Farmers	Percentage
Low (Below Recommended)	30	20.00%
Moderate (Recommended)	100	66.67%
High (Above Recommended)	20	13.33%

Source: Primary data

A majority of farmers (66.67%) reported applying chemical fertilizers at recommended rates, indicating adherence to established guidelines. Approximately 20.00% of farmers applied fertilizers at rates below the recommended levels, which may affect crop yields. A smaller percentage (13.33%) applied fertilizers at rates above the recommended levels, potentially posing environmental and economic risks.

Table 6. Frequency of Fertilizer Application (N=150)

Frequency	Number of Farmers	Percentage
Once a year	10	6.67%
Twice a year	30	20.00%
Thrice a year	90	60.00%
Four times a year	20	13.33%

Source: Primary data

A majority of farmers (60.00%) applied fertilizers thrice a year, indicating a frequent use pattern. Approximately 20.00% of farmers applied fertilizers twice a year, while a smaller proportion applied fertilizers either once a year (6.67%) or four times a year (13.33%).

These findings provide insights into the specific types of chemical fertilizers used, their application rates, and the frequency of use among farmers in the study area. The majority of farmers adhere to recommended application rates, with Urea and DAP being the most commonly used fertilizers. This information can be valuable for promoting sustainable fertilizer use practices and optimizing nutrient management in the region.

3. Understand farmers' perceptions of the environmental consequences

This part of the study deals with Farmers' Perceptions of Chemical Fertilizer Effects on Soil Quality, Chemical Fertilizer Effects on Water Quality, and Local Ecosystems and presented in the following tables.

Table 7. Farmers' Perceptions of Chemical Fertilizer Effects on Soil Quality (N=150)

Perception	Number of Farmers	Percentage
Harmful to Soil	65	43.33%
Neutral	50	33.33%
Beneficial to Soil	35	23.33%

Source: Primary data

Among the 150 surveyed farmers, 43.33% perceived chemical fertilizers as harmful to soil quality. Approximately one-third (33.33%) had a neutral perception, suggesting they did not see significant harm or benefit. A smaller proportion (23.33%) believed that chemical fertilizers were beneficial to soil quality.

Table 8. Farmers' Perceptions of Chemical Fertilizer Effects on Water Quality (N=150)

Perception	Number of Farmers	Percentage
Harmful to Water	80	53.33%
Neutral	45	30.00%
Beneficial to Water	25	16.67%

Source: Primary data

A majority (53.33%) of the surveyed farmers perceived chemical fertilizers as harmful to water quality. About 30.00% had a neutral perception, indicating uncertainty or lack of strong opinion. A smaller percentage (16.67%) believed that chemical fertilizers were beneficial to water quality.

Table 9. Farmers' Perceptions of Chemical Fertilizer Effects on Local Ecosystems (N=150)

Perception	Number of Farmers	Percentage
Harmful to Ecosystem	70	46.67%
Neutral	45	30.00%
Beneficial to Ecosystem	35	23.33%

Source: Primary data

A significant portion (46.67%) of farmers perceived chemical fertilizers as harmful to local ecosystems. About 30.00% had a neutral perception regarding their effects on ecosystems. A smaller proportion (23.33%) believed that chemical fertilizers were beneficial to local ecosystems.

CONCLUSION

In conclusion, this study sheds light on the complex landscape of chemical fertilizer use in agriculture in Ermera. Findings revealed varying levels of awareness among farmers regarding the environmental impacts of fertilizers. While a substantial number of farmers expressed concerns, some adopted proactive measures to mitigate these impacts. The types of fertilizers used, their application rates, and frequency were diverse, with a majority adhering to recommended practices. Farmers' perceptions of fertilizer impacts on soil quality, water quality, and ecosystems showed a range of opinions. These insights emphasize the need for tailored educational initiatives and sustainable farming practices to balance food security and environmental conservation in the region.

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