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Assessing farmers' awareness of pollution causes and effects in agricultural systems: Insights and implications

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Abstract

Agricultural activities significantly impact the environment, with consequential effects on both agricultural practices and ecosystem sustainability. This study investigates farmers' awareness of environmental pollution caused by agricultural practices in Thrissur and Palakkad districts, Kerala, which are pivotal regions for rice, banana, and vegetable production. The primary objective was to assess farmers' understanding of pollution causes and effects and to identify gaps in knowledge that could impact the adoption of sustainable practices. A sample of 120 participants, including 90 farmers and 30 stakeholders, was selected using random sampling and interviews. Data were collected through pre-tested questionnaires, with statements evaluated on a 5-point scale for causes and a 4-point scale for effects of pollution. Awareness indices were calculated to gauge the extent of understanding among the farmers. The findings reveal that 60% of farmers have a medium awareness of pollution causes, while 21% demonstrate high awareness, and 19% exhibit low awareness. On the effects of pollution, 82% of farmers were highly aware, indicating a strong recognition of pollution impacts on crop yield, livestock health, and overall agricultural productivity. Despite this, there is a notable gap in understanding the sources of pollution, such as industrial sludge, waste disposal, and aquaculture impacts. The study highlights the need for targeted educational initiatives to bridge the knowledge gap regarding pollution causes. Economic constraints, lack of access to sustainable technologies, and insufficient support are major barriers to translating awareness into effective practice. The study emphasizes the importance of collaborative efforts involving local governance, NGOs, and development agencies to provide practical solutions and support. By addressing these issues, it is possible to enhance sustainable farming practices, mitigate environmental impacts, and ensure food security for future generations.

Keywords: Environmental pollution, sustainable farming, awareness, pollution causes and effects

Introduction

Agricultural activities have a profound impact on the environment, and these environmental changes, in turn, affect agricultural practices. This intricate relationship has become increasingly important as both sectors influence each other in significant ways. Over time, agriculture has played a vital role in driving economic development, particularly in low- and middle-income countries, where it remains a central part of the economy. However, as nations progress, the significance of agriculture within the national economy tends to decrease, shifting the focus toward industrial and service sectors. Despite its declining share in the global economy, agriculture remains crucial for the livelihoods of many people, particularly in developing countries, where it contributes significantly to employment and GDP (Alston & Pardey, 2014; World Bank, 2021) ^[1, 8]. In recent decades, intensive agricultural practices have been linked to various environmental issues, including deforestation, soil degradation, water pollution, and the loss of biodiversity. These practices have altered ecosystems and contributed to global environmental challenges such as climate change. The shift in agricultural priorities—from merely increasing productivity to incorporating sustainability—reflects the growing awareness of these environmental impacts (Bryant *et al.*, 2020; Lamichhane, 2017) ^[2, 5]. While increasing agricultural output is essential

to meet the food demands of a growing global population, the issue of food security is not solely about production; it also involves efficient distribution and reducing waste. The U.N. Food and Agriculture Organization (FAO, 2021) ^[6] highlights that approximately one-third of the food produced globally is wasted, underscoring the need for a more efficient food system. The bidirectional relationship between agriculture and the environment is particularly evident in the context of climate change. Shifting climate patterns, rising temperatures, and extreme weather events pose significant threats to agricultural productivity. These changes affect crop yields, livestock health, and the availability of natural resources, which are critical for agriculture (IPCC, 2019; FAO, 2018) ^[4, 7]. Additionally, agriculture is a major contributor to greenhouse gas (GHG) emissions, accounting for a significant share of global methane, carbon dioxide, and nitrous oxide emissions (Crippa *et al.*, 2022) ^[3]. These emissions further exacerbate climate change, creating a feedback loop that impacts agriculture.

Given the intricate relationship between agriculture and environmental pollution, there is a pressing need to study farmers' awareness and perceptions of the environmental effects of their practices. Understanding farmer's awareness of these issues is crucial for developing effective strategies to mitigate environmental impacts and promote sustainable

agricultural practices. By raising awareness and providing education on the long-term benefits of sustainable farming, we can encourage farmers to adopt practices that protect the environment while ensuring food security for future generations.

Methodology

This study selected Thrissur and Palakkad districts for their high density of farmers and significant contributions to Kerala's rice, banana, and vegetable production. The research targeted specific crops, focusing on Puzhakkal Kole Panchayath in Thrissur and Alathur in Palakkad for rice cultivation systems. For banana and vegetable farming, Puthur and Pananchery Panchayaths in Thrissur were chosen for bananas, while Nadathara and Madakkathara Panchayaths were selected for vegetables. The study involved interviews with 30 farmers from each Panchayath, totaling 15 from each location, along with 30 additional stakeholders, such as administrators, development personnel, local governance members, the general public, and NGOs. This resulted in a total sample size of 120 participants, with farmers selected randomly in collaboration with local agricultural officers. This method allowed for an in-depth analysis of soil pollution impacts and the perspectives of various stakeholders in these crucial agricultural areas. Following a pre-test, eight statements were finalized on a 5-point continuum to measure the awareness of farmers about pollution causes in agricultural systems. Additionally, eight statements were finalized on a 4-point continuum to assess farmers' awareness of pollution causes in agricultural systems.

$$\text{Index of each respondents} = \frac{\text{Total score of each respondent}}{\text{Maximum score of each respondent}} \times 100$$

Results

Table 1 and figure 1 present the distribution of farmers based on their awareness of the causes of pollution within the agricultural systems. The results show that the majority of the farmers, accounting for 60.00%, fall into the medium awareness category, with an awareness index range of 45.07 to 79.09. A smaller proportion of the farmers, 21.11%, exhibited a high level of awareness, with an index greater than 79.09. Meanwhile, 18.89% of the farmers were classified under low awareness, with indices falling below 45.07. The mean awareness score among the farmers was 62.08, with a standard deviation of 17.01, indicating variability in their understanding of pollution causes. The awareness items used for this assessment included industrial sludge discharge into water bodies, pollution from aquaculture practices, the impact of plastic and domestic waste on water bodies, soil erosion from wind and floods, groundwater contamination from biomedical waste, chemical pesticide and fertilizer container disposal, domestic waste dumping, and pollution from fishing debris.

Table 1: Distribution of farmers based on their awareness about the causes of pollution (n=120)

Sl. No.	Categories of awareness	Range of indices	Percentage
1	Low	<45.07	18.89
2	Medium	45.07-79.09	60.00
3	High	>79.09	21.11
Mean- 62.08 SD- 17.01			

Items used to measure awareness: The industrial sludge let into water bodies cause environmental pollution, Water quality is hampered due to fish wastes and uneaten feed from aquaculture practice, The plastic/domestic wastes dumped by civilians into water bodies causes pollution, The recurrent occurrence of wind and flood causes soil erosion, The improper burying of biomedical waste causes groundwater pollution, Disposal of the chemical pesticide and fertilizer containers near the field or water bodies pollutes them, The dumping of domestic wastes in and around the field pollutes the soil, and The debris left behind from fishing activities pollute the water and destroy aquatic ecosystem

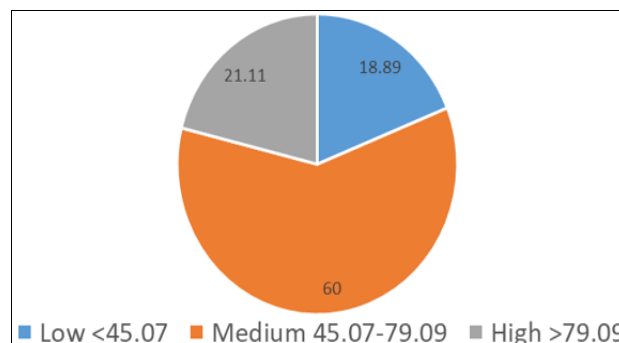


Fig 1: Distribution of farmers based on their awareness about the causes of pollution

Table 2: Distribution of farmers based on their awareness about the effects of pollution

Sl. No.	Categories of awareness	Range of indices	Percentage
1	Low	<45.18	00.00
2	Medium	45.18-76.46	17.78
3	High	>76.46	82.22
Mean- 60.82 SD-15.64			

Item used to measure: Poor crop stand and yield is as a result of pollution, Presence of dead aquatic animals is a consequence of pollution, Respiratory diseases occur in the farmer and his family due to prolonged air pollution, Death of livestock and other farm animals occur due to pollution, Difficulty in carrying out agricultural operations in the field occurs due to pollution, Trash dumped around the field is the breeding ground for pests and diseases, Dead aquatic creatures are seen in water bodies due to leftover debris from fishing activities and Blue baby syndrome in infants is a consequence of water pollution.

Table 2 and figure 2 displays the distribution of farmers based on their awareness of the effects of pollution on agricultural systems. A significant majority of farmers, 82.22%, were highly aware of the effects, with an awareness index greater than 76.46. A smaller percentage, 17.78%, had medium awareness, with indices ranging between 45.18 and 76.46. Notably, none of the farmers fell into the low awareness category, with indices below 45.18. The mean awareness score for the effects of pollution was 60.82, with a standard deviation of 15.64, reflecting a relatively high level of understanding among the farmers regarding the consequences of pollution. The items used to measure awareness of the effects included poor crop yield, dead aquatic animals, respiratory diseases due to air pollution, livestock deaths, difficulties in agricultural operations, pest and disease breeding grounds due to trash, dead aquatic creatures from fishing debris, and the occurrence of Blue Baby Syndrome in infants due to water pollution.

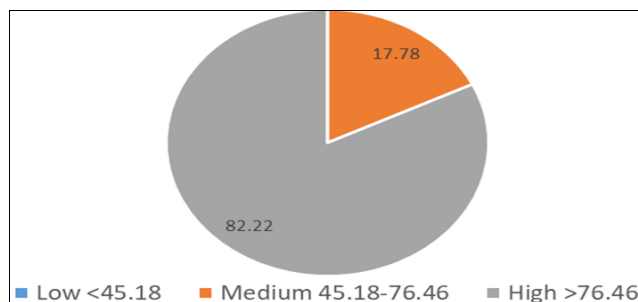


Fig 2: Distribution of farmers based on their awareness about the effects of pollution

Discussion

The findings of this study reveal important insights into the levels of awareness among farmers regarding the causes and effects of pollution in agricultural systems. The awareness levels are critical because they influence how farmers respond to environmental challenges and their ability to implement sustainable farming practices. The results indicate that most farmers possess a moderate level of awareness about the causes of pollution in their agricultural practices. This is a positive sign, as it suggests that the majority of farmers are somewhat informed about the environmental challenges they face. However, the fact that a significant portion of farmers falls into the low-awareness category is concerning. These farmers may lack crucial information about how their practices or external factors contribute to environmental degradation. This gap in knowledge could lead to continued harmful practices that exacerbate pollution and undermine the sustainability of their farming operations.

The study identified several key sources of pollution that farmers need to be aware of, including the discharge of industrial sludge into water bodies, pollution from aquaculture practices, and the impact of domestic waste disposal. These sources are particularly relevant in regions with significant agricultural activities, where improper waste management and industrial activities pose a direct threat to soil and water quality. Awareness of these issues is essential for promoting better practices among farmers, such as reducing reliance on harmful chemicals and improving waste disposal methods.

Another important finding is the high level of awareness among farmers regarding the effects of pollution. The majority of farmers recognize the impact of pollution on their crops, livestock, and overall agricultural productivity. This awareness is crucial for motivating farmers to adopt practices that mitigate pollution and protect their livelihoods. For instance, understanding that pollution can lead to poor crop yields or livestock deaths may encourage farmers to implement more sustainable farming techniques, such as organic farming or integrated pest management. Despite the high level of awareness about the effects of pollution, the study suggests there is still room for improvement. The awareness of pollution effects does not always translate into action. Some farmers may recognize the dangers but feel powerless to change their practices due to economic constraints, lack of access to alternative technologies, or insufficient support from local governance. This highlights the need for targeted interventions that not only raise awareness but also provide practical solutions and

support to farmers. For example, local governments and agricultural agencies could offer training programs on sustainable farming practices, subsidize eco-friendly inputs, or provide incentives for farmers who adopt environmentally responsible practices. The study also underscores the importance of involving a broader range of stakeholders, including local governance, development personnel, and NGOs, in efforts to raise awareness and address pollution in agricultural areas. These stakeholders play a crucial role in shaping policies, providing resources, and supporting farmers in their transition to more sustainable practices. Collaborative efforts that bring together farmers, local authorities, and civil society can create a more enabling environment for addressing the causes and effects of pollution.

Conclusion

This study provides valuable insights into farmers' awareness of environmental pollution caused by agricultural practices. The results indicate that while a majority of farmers are aware of the effects of pollution on crops, livestock, and overall productivity, there is a notable gap in their understanding of pollution causes. This disparity highlights the need for enhanced educational initiatives focused on the sources of pollution, such as industrial sludge, waste disposal, and aquaculture impacts. Despite the high level of awareness about the consequences of pollution, farmers face challenges in translating this knowledge into practice due to economic constraints, limited access to sustainable technologies, and insufficient support. Therefore, targeted interventions are essential, including training programs, financial incentives, and support from local authorities. The study also underscores the importance of involving a broad range of stakeholders, including local governance, NGOs, and development agencies, in addressing pollution issues. Collaborative efforts are crucial for creating an environment conducive to adopting sustainable practices. By improving awareness, providing practical solutions, and fostering stakeholder cooperation, it is possible to mitigate environmental impacts and enhance the sustainability of agricultural systems.

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