RESEARCH ARTICLE

Awareness and Perceptions of Farmers about Water Pollution in Rajasthan

Gargi Bhatt[1] and S Aravindh Kumar[2]

ABSTRACT

This study assessed 120 farmers' awareness and perceptions of water pollution in Udaipur district of Rajasthan, India using Latent Class Analysis (LCA). Findings revealed that most of the farmers had low legal literacy (67.50%), with limited awareness on laws such as the Environment Protection Act, 1986, and the Water (Prevention and Control of Pollution) Act, 1974. While 85.83 per cent perceived visible effects of water pollution, such as foul smells, only 13.33 per cent were aware of specific legal frameworks. Television and social media emerged as primary information sources. The study highlights the need for targeted legal literacy programmes to empower farmers in addressing water pollution issues.

Keywords: Legal Awareness; Legal Perception; Water Pollution; Laws and Acts; Latent Class Analysis; Rajasthan

INTRODUCTION

Water pollution refers to the process by which water's physical, chemical, or biological properties are altered, rendering it unsuitable for its intended purpose, whether natural or artificial (CPCB, 1974). Contaminants from domestic sewage, industrial effluents, agricultural runoff, and shipping activities are among the leading causes of water pollution (MoEFCC, 1986). In India, nutrient runoff from excessive fertilizer use has been a significant contributor to water quality degradation, leading to eutrophication and hypoxic conditions in several water bodies (Gupta et al., 2020). Furthermore, the economic cost of water pollution in India has been estimated to be significant, as polluted water impacts public health, reduces agricultural productivity, and increases the treatment costs of drinking water (Dasgupta, 2022).

Indian farmers need to be informed about the existing public systems for water quality monitoring and information dissemination. Central Ground Water Board (CGWB) had regularly published reports on groundwater quality, covering parameters such as nitrate, fluoride, and arsenic contamination, which

[1]Delhi Metropolitan Education College, Noida (Affiliated to GGSIPU, New Delhi), Uttar Pradesh - 201309

[2]Department of Agricultural Extension and Rural Sociology, Tamil Nadu Agricultural University, Coimbatore, Tamil Nadu – 641003.

were crucial for irrigation and health decision-making (CGWB, 2023). Similarly, the Irrigation Departments in various states, including Rajasthan, were mandated to conduct periodic assessments of irrigation water quality and share this data through official portals and reports (Ministry of Jal Shakti, 2022). However, access and usability of such information remained limited due to low awareness and interpretation challenges among the rural farming community. Recent studies had emphasized that integrating water quality testing into regular agricultural advisory services, akin to soil health testing could significantly empower farmers to adopt sustainable water use practices (FAO, 2022; Sharma and Patel, 2024). Furthermore, enabling extension agents to deliver localized water quality advisories based on CGWB and state-level monitoring data could bridge critical information gaps and enhance community-level resilience to water pollution risks (Prasad and Singh, 2023).

In India, where agriculture is the backbone of the economy, farmers constitute a majority of the population. Their reliance on water for irrigation, livestock, and household use makes them highly vulnerable to water pollution. India has a strong legal framework to address water pollution, encompassing several laws and policies that aim to regulate and manage water resources sustainably. The cornerstone of India's water pollution legislation is the Water (Prevention and Control of Pollution) Act, 1974, which was the first comprehensive law enacted to control water pollution in the country (Central Pollution Control Board [CPCB], 1974). This Act established the Central and State Pollution Control Boards (CPCB and SPCBs) to oversee the prevention and control of water pollution. It empowers these boards to set effluent standards, monitor compliance, and take punitive action against violators. The Act prohibits the discharge of untreated industrial or domestic effluents into water bodies and emphasizes the importance of maintaining the "wholesomeness" of water. Despite its significance, enforcement of this Act remains a challenge due to limited resources and lack of awareness among stakeholders, including farmers. Complementing the Water Act is the Environment (Protection) Act, 1986, which provides an overarching framework for environmental regulation in India (Ministry of Environment, Forest and Climate Change [MoEFCC], 1986a). This Act was enacted following the Bhopal gas tragedy and aims to address all aspects of environmental protection, including water quality. Under this Act, the government has the authority to take necessary measures to prevent and control water pollution, including setting standards for the discharge of pollutants, prohibiting hazardous waste dumping, and promoting environmental awareness. The Act also supports the implementation of several water-specific rules, such as the Environment (Protection) Rules, 1986, which outline permissible limits for pollutants in water (MoEFCC, 1986b).

Another significant legal instrument is the Air and Water Prevention and Control of Pollution Cess Act, 1977, which introduced a cess on water consumption by industries to encourage responsible water usage (CPCB, 1977). The funds collected through this cess are used to finance activities under the Water Act. However, enforcement of this Act is uneven, particularly in rural areas, where monitoring mechanisms are weaker. In addition to these laws, the National Water Policy, 2012, outlines a broad vision for sustainable water management in India. While not a law, this policy provides strategic guidance for addressing water pollution. It emphasizes the need for integrating water quality management into broader water resource planning, promoting recycling and reuse of wastewater, and controlling agricultural runoff through improved

practices (Ministry of Water Resources, River Development & Ganga Rejuvenation (MoWR, 2012). The policy also highlights the importance of stakeholder participation, particularly the farming community, in implementing water conservation measures. While these laws provide a strong foundation for controlling water pollution, their success depends largely on public awareness and compliance.

Farmers, as primary stakeholders in rural water usage, often lack adequate knowledge about these legal provisions. Recent studies suggest that a significant proportion of rural populations, remain unaware of legal instruments. Moreover, research indicates that legal literacy among farmers is critical for effective implementation of water pollution control measures (Sharma and Mehta, 2021). This raises a critical question: Are farmers aware of these laws related to water pollution and their implications? What is their perception regarding water pollution?

Understanding farmers' legal awareness and perceptions is essential, as it directly influences their behavior and practices regarding water use and pollution. This research seeks to bridge this gap by assessing the legal awareness levels of farmers and exploring their perceptions of water pollution laws. The findings aim to provide valuable insights for policymakers and environmental activists, enabling the development of targeted strategies to enhance legal literacy and promote sustainable water management practices among the farming community. By addressing these issues, the study aspires to contribute to the broader goal of environmental sustainability and the preservation of water resources for future generations.

METHODOLOGY

The present study was conducted in Udaipur district of Rajasthan state in India, which was selected purposively in line with the objectives of the study, with the primary objective of assessing the awareness and perceptions of farmers regarding water pollution and related legal frameworks. A total of 120 respondents was selected using the snowball sampling technique, which was deemed appropriate given the difficulty in identifying a well-defined sampling frame of farmers with varying degrees of awareness and legal literacy on the subject. Data were collected using a structured questionnaire comprising both closed-ended and open-ended questions, designed to capture demographic details, legal awareness, exposure to extension services, participation in awareness campaigns, and perceptions toward water pollution and environmental laws. The questionnaire was pre-tested for content validity and revised accordingly before administration. Latent Class Analysis (LCA) was employed to identify unobserved (latent) subgroups within the sample, based on farmers' responses across multiple dimensions such as legal literacy, income, education, and perceptions. The LCA was performed using Jamovi (Version 2.4) statistical software, which provided model fit indices and classification probabilities to validate the robustness of the derived classes. In LCA, the probability of a response pattern $Y = (Y_1, Y_2, \ldots, Y_p)$ for a person belonging to latent class $C=c$ is given by the formula:

$$P\big(Y_1 = y_1, Y_2 = y_2, \ldots, Y_p = y_p\big) = \sum_{c=1}^{k} \pi_c \sum_{j=1}^{p} P\big(Y_j = y_j, \mid C = c\big)$$

Where:

- π_c *is the probability of membership in latent class (class prevalence)*

- $P(Y_j=y_j|\ C = c)$ *is the conditional probability of response on variable Y_j given membership in class c*

- *k is the number of latent classes*

- *p is the number of observed categorical indicators*

In addition to LCA, descriptive statistics such as frequencies, percentages, and cross-tabulations were computed to summarize key demographic and socioeconomic characteristics of the respondents.

FINDINGS AND DISCUSSION

The profile of the farmers selected for the study reveals valuable insights into their age, education, farm size, income, legal literacy, participation in awareness campaigns, and sources of legal information about laws and acts related to water pollution.

Table 1: Profile of the Farmers   **(n=120)**

Sl. No.		Category	Number	Per cent (%)
1.		**Age**		
	a.	Young (less than 35 years)	38	31.67
	b.	Middle (35-60 years)	47	39.17
	c.	Old (more than 60 years)	35	29.16
2.		**Education**		
	a.	Illiterate	18	15.00
	b.	Primary	29	24.17
	c.	Middle	34	28.33
	d.	Secondary	30	25.00
	e.	Graduate and above	09	07.50
3.		**Farm Size**		
	a.	Marginal (less than 1 ha)	11	09.17
	b.	Small (1-2 ha)	17	14.17
	c.	Medium (2-4 ha)	51	42.50
	d.	Semi-Medium (4-10 ha)	26	21.66
	e.	Large (more than 10 ha)	15	12.50
4.		**Monthly Income**		
	a.	Below Rs. 10000	12	10.00
	b.	Between 10001 – Rs. 17000	76	63.33
	c.	More than Rs. 17001	32	26.67

Sl. No.		Category	Number	Per cent (%)
5.		**Legal Literacy**		
	a.	Low	81	67.50
	b.	Moderate	27	22.50
	c.	High	12	10.00
6.		**Participation in Awareness Campaign (PAC)**		
	a.	No participation	69	57.50
	b.	Less than 3 Programmes	43	35.83
	c.	More than 3 Programmes	08	06.67
7.		**Source of Legal Information about laws and acts related to Water Pollution (SLIWP)**		
	a.	Newspaper	19	15.83
	b.	Television	37	30.84
	c.	Social Media	26	21.67
	d.	Peers	13	10.83
	e.	Neighbours	06	05.00
	f.	Friends	09	07.50
	g.	Extension Agents	10	08.33

A majority of the farmers (39.17%) belong to the middle-aged category (35–60 years), practiced agriculture, as this age group is actively involved in farming activities. Young farmers' proportion (31.67%) indicates some level of generous participation, they may be more inclined to explore modern farming techniques and access legal information through digital platforms, while older farmers (29.16%) might rely on traditional agricultural practices. About 28.33 per cent of farmers had middle school education, while 25.00 per cent completed secondary schooling. However, 15.00 per cent were illiterate and 7.50 per cent had graduate-level education or higher. Limited education levels can directly impact farmers' ability to access, understand, and comply with laws and acts related to water pollution. The predominance of middle and secondary education suggests some

awareness on environmental issues, but the low percentage of graduates indicates barriers to higher education in rural areas. Illiteracy and low educational attainment reduced their exposure to legal information, making farmers more reliant on intermediaries such as extension agents, peers and campaigns for understanding environmental laws.

Less than half (42.50%) of the respondents possessed medium-sized farms (2–4 ha) followed by semi-medium farms (21.66%), large farms (12.50%) and marginal (9.17%). Farmers with medium-sized farms were more likely to participate in agricultural markets and thus may encounter issues related to water usage and pollution. However, marginal farmers, constituting a smaller group, might struggle with resources to access legal or environmental

information. Large farm owners, though fewer, may have better access to resources and information due to their economic status. A majority of farmers (63.33%) earned between Rs. 10,001–Rs. 17,000 per month. The dominance of middle-income farmers indicates a relatively modest financial capacity, which might limit investments in knowledge-building activities or accessing specialized information. The study reveals that 67.50 per cent of farmers had low level of legal literacy, and 10.00 per cent farmers exhibited high level of legal literacy. The limited understanding of legal frameworks was due to low literacy levels and reliance on traditional farming practices. Insufficient extension services, limited government outreach, and lack of tailored awareness programmes for farmers may explain this gap. The complexity of legal language in environmental laws might also act as a barrier to comprehension, particularly for less-educated farmers.

A majority of farmers (57.50%) have not participated in any awareness campaign. Farmers might be unaware of the availability or schedule of such programmes due to poor communication or ineffective dissemination of information. Campaigns might be infrequent, inadequately targeted, or inaccessible for farmers in remote areas. The opportunity cost of attending such programmes could deter farmers,

especially those in the low-income bracket who prioritize immediate livelihood needs over long-term legal knowledge. The most common sources of legal information were television (30.84%), followed by social media (21.67%) and newspapers (15.83%). Television's prominence suggests that mass media campaigns could be an effective tool for disseminating information about water pollution laws. Social media's growing role indicates a shift toward digital platforms, especially among younger and literate farmers. The minimal contribution of extension agents (8.33%) highlights a significant gap in the extension system, which is traditionally expected to play a crucial role in educating farmers about environmental laws. This gap could stem from the lack of training or prioritization of legal literacy by extension services. The findings highlight a critical need for improving legal literacy among farmers to enhance their understanding of water pollution laws. Addressing gaps in education, extension and awareness campaign participation could lead to significant progress in empowering farmers as stewards of sustainable water management.

Table 2 presents the awareness of farmers regarding various aspects of water pollution, including the causes, effects, and the relevant legal frameworks. The data reveal significant gaps in legal awareness.

Table 2: Awareness of Farmers regarding Water Pollution

(n=120)

Statement No.	Statements	Aware		Not Aware	
		No.	%	No.	%
S1	The polluted water contains poisonous chemicals	68	56.67	52	43.33
S2.	The polluted water contains harmful microbes and other organism	43	35.83	77	64.17
S3	Laws like the Environment Protection Act, 1986 provide regulations addressing water pollution.	16	13.33	104	86.67

Statement No.	Statements	Aware		Not Aware	
		No.	%	No.	%
S4	The polluted water produces foul smell	103	85.83	17	14.17
S5	The Water (Prevention and Control of Pollution) Act, 1974 helps in understanding legal actions to prevent and control water pollution	22	18.33	98	81.67
S6	Leaching of polluted surface water makes the groundwater salty and unsuitable for irrigation purposes	92	76.67	28	23.33
S7	Leaching of polluted surface water makes the groundwater salty and unsuitable for drinking purposes	98	81.67	22	18.33
S8	The National Green Tribunal Act, 2010 provides a mechanism to address grievances related to water pollution.	8	6.67	112	93.33
S9	The polluted water causes many diseases like infertility, lack of resistance, non-deductible diseases and mortality among cattle	42	35.00	78	65.00
S10	Familiarity with penalties under the Water Cess Act, 1977 encourages farmers to adopt sustainable water practices.	19	15.83	101	84.17
S11	The polluted water when used for irrigation affect the seed germination and retards the plant growth and thereby reduces the crop yield	27	22.50	93	77.50
S12	Provisions under the Factories Act, 1948 helps identify industrial responsibilities in preventing water pollution.	10	8.33	110	91.67
S13	The polluted water endangers the survival of the acquatic organisms	34	28.33	86	71.67
Mean		**44.77**	**37.31**	**75.23**	**62.69**

Statements regarding the physical effects of polluted water (e.g., foul smell, impact on irrigation and drinking water) have relatively high awareness. For instance, 85.83 per cent of farmers were aware that polluted water produces a foul smell (S4), and 76.67 per cent recognize the harmful impact of leaching polluted water on groundwater for irrigation (S6). The recognition of water pollution's effect on drinking water is also notably high, with 81.67 per cent of farmers

aware that leaching of polluted surface water makes groundwater salty and unsuitable for drinking (S7). This suggests that farmers are more familiar with the immediate, observable consequences of water pollution, likely because these impacts directly affect their daily lives.

Farmers seem to have moderate awareness of the impact of polluted water on human health, with 35.00 per cent aware of the diseases caused by polluted water, such as infertility and mortality among cattle (S9). Awareness of how polluted water affects seed germination and plant growth is also moderate, with 22.50 per cent aware of this issue (S11). This suggests that while the broader effects of pollution were recognized, specific legal measures were less understood. Awareness of specific laws and legal frameworks is markedly low. Only 13.33 per cent of farmers were aware of the Environment Protection Act, 1986 (S3) and 6.67 per cent were aware of the National Green Tribunal Act, 2010 (S8). Even basic legal frameworks like the Water (Prevention and Control of Pollution) Act, 1974 were only known to 18.33 per cent of farmers (S5). Similarly, awareness of penalties under the Water Cess Act, 1977 was at 15.83 per cent (S10).

Legal literacy programmes specifically addressing water pollution laws were likely inadequate. The laws governing environmental protection were not well communicated. Limited access to formal legal training or extension services was a likely cause for this gap. Legal documents often use complex terminology, which might be inaccessible to farmers with lower education levels. Many farmers might struggle to comprehend legal texts related to water pollution, even when such materials were available. The extension services, which should ideally play a critical role in disseminating legal and environmental information, appear to be underutilized or insufficiently focused on legal issues. Extension agents were unlikely to prioritize legal awareness related to water pollution, focusing instead on immediate farming concerns. As a result, farmers had limited exposure to legal information. As reflected in Table 1, a large proportion of farmers (57.50%) had not participated in any awareness programme. This lack of participation might be due to poor communication of the availability of such programmes, the absence of local outreach efforts, or farmers' prioritization of immediate economic and farming concerns over legal matters. As television and social media were relatively more effective sources of information, they tend to focus more on general environmental issues. Nearly one-third (30.84%) of the farmers received information from television, but the content was more likely to be about the effects of pollution rather than the legal consequences or preventive measures. Improving legal literacy among farmers is an urgent need. The low awareness on legal frameworks related to water pollution calls for more targeted educational initiatives, better communication through extension services, and simplified legal resources that are accessible to farmers, especially those with lower educational levels. Raising awareness about these laws would empower farmers to engage in sustainable practices and contribute to broader efforts to reduce water pollution and protect both the environment and public health.

Table 3: Perception of Farmers about Legal Information Related to Water Pollution

(n=120)

Statement No.	Statements	Agree		Neutral		Disagree	
		No.	%	No.	%	No.	%
S1	Seepage of industrial effluents contaminates the drinking water source.	68	56.67	23	19.17	29	24.17
S2.	Farmers perceive that the absence of targeted campaigns about the Water (Prevention and Control of Pollution) Act, 1974, leaves them unaware of their rights and responsibilities.	16	13.33	85	70.83	19	15.83
S3	Effluents are discharged into drainage channels and remains stagnated until gets evaporated or infiltrated into soil.	52	43.33	39	32.50	29	24.17
S4	There is a general perception among farmers that the National Green Tribunal (NGT) focuses more on urban cases, sidelining rural water pollution issues.	34	28.33	61	50.83	25	20.83
S5	More dependence of groundwater for agriculture also accounts to quality reduction in drinking water.	34	28.33	46	38.33	40	33.33
S6	Effluents are discharged into open drains through pipeline and gets stagnated for long time.	89	74.17	10	8.33	21	17.50
S7	Farmers think that industrial compliance with the Factories Act, 1948, is weak, leading to unchecked discharge of harmful effluents into water bodies.	19	15.83	78	65.00	23	19.17
S8	Farmers perceive that higher penalties under the Water Cess Act, 1977, could deter industries from polluting water sources, but they lack awareness of its enforcement mechanisms.	37	30.83	66	55.00	17	14.17

Statement No.	Statements	Agree		Neutral		Disagree	
		No.	%	No.	%	No.	%
S9	The stagnated effluents produce foul smell and create health hazards in the locality.	94	78.33	18	15.00	8	6.67
S10	Farmers believe that laws like the Environment Protection Act, 1986, should be simplified for better understanding and application at the grassroots level.	17	14.17	95	79.17	8	6.67
S11	The lands irrigated with industrial waste waters becomes saline and unproductive in due course.	102	85.00	15	12.50	3	2.50
S12	The stored water gets changed in its colour and appearance often	94	78.33	18	15.00	8	6.67
S13	The discharged effluents produce scorching effect to the plants and trees lies along its pathway.	83	69.17	24	20.00	13	10.83
Mean		56.85	47.37	44.46	37.05	18.69	15.58

Table 3 presents farmers' perceptions about legal information related to water pollution. It categorizes responses into three groups: "Agree," "Neutral and "Disagree." The mean percentages show that 47.37 per cent agree, while 37.05 per cent of farmers remain neutral and 15.58 per cent explicitly disagree.

Statements regarding direct, observable impacts of water pollution, such as seepage of industrial effluents contaminating drinking water (S1) (56.67%), effluents stagnating and creating health hazards (S9) (78.33%), and land salinity caused by wastewater irrigation (S11) (85.00%), perceived higher agreement. Farmers seemed to be more perceptive of the tangible effects they experience in daily life, such as unproductive lands, foul smells, or visible water discoloration (S12: 78.33%). These direct experiences drive higher agreement. Farmers were more aware of physical and health impacts, as these directly affect their livelihoods and well-being. However, their awareness often lacks connection to the underlying legal frameworks and responsibilities.

Statements related to legal frameworks received low agreement. Perception of targeted campaigns under the Water (Prevention and Control of Pollution) Act, 1974 (S2) had 13.33 per cent agreement, and perception of weak compliance with the Factories Act, 1948 (S7) had only 15.83 per cent agreement. Similarly, only 14.17 per cent agreed that simplification of the Environment Protection Act, 1986 (S10) was needed, and 30.83 per cent agreed that higher

penalties under the Water Cess Act, 1977 (S8) could deter pollution. On the other hand, Neutral responses were highest for legal statements like targeted campaigns for water pollution laws (S2: 70.83%), focus of NGT on rural issues (S4: 50.83%) and compliance with the Factories Act (S7: 65.00%). This indicated that farmers were ignorant and lack engagement regarding legal information. Farmers might have limited exposure to campaigns, workshops, or extension services focusing on water pollution laws. Furthermore, rural settings often lack robust institutional mechanisms to inform farmers about their legal rights and responsibilities.

Farmers showed more disagreement with statements such as S5 (Dependence on groundwater impacts drinking water quality: 33.33%) and S4 (NGT focuses more on urban cases: 20.83%). This disagreement could stem from a lack of correlation between perceived and actual causes or outcomes. Farmers might not directly associate groundwater dependence with drinking water quality deterioration, even though scientific evidence suggests otherwise.

The Latent Class Analysis (LCA) provides a detailed segmentation of farmers based on their awareness and perception of water pollution laws, offering a roadmap for targeted interventions in grassroots-level governance. The analysis identified three distinct latent classes: Class 1 (30%), Class 2 (46.7%), and Class 3 (23.3%), derived from variables such as Age, Education, Farm Size, Monthly Income, Legal Literacy, Participation in Awareness Campaigns (PAC), Source of Legal Information about Water Pollution Laws (SLIWP), Awareness, and Perception. The model's G^2 statistic (2364) and significant p-value (p < 0.001) confirm an absolute fit to the data (Table 4).

Table 4: Latent Class Analyses Absolute model fit

Class	Log-Likelihood	AIC	CAIC	BIC	Df	G^2	p
2	-1685	3716	4372	4199	-54	2554	<0.001
3	-1590	3701	4686	4426	-141	2364	<0.001

Manifest items:

Age Education Farm Size Monthly Income Legal Literacy PAC SLIWP Awareness Perception

Number of latent classes: 3

Marginal prevalence for latent class:

Class 1: 0.300 (30%); Class 2: 0.467 (46.7%) and Class 3: 0.233 (23.3%)

Number of observations: 120

Number of parameters: 260

- **Class 1:** Farmers in this group exhibit moderate awareness and perception of water pollution laws. These individuals generally have average levels of education, legal literacy, and participation in awareness campaigns, as reflected in Tables 1, 2, and 3.

- **Class 2:** The largest group, characterized by low awareness and perception, includes farmers with lower education levels, smaller farms, limited income, and reliance on informal sources of legal information. Many in this group have minimal exposure

to awareness campaigns or legal literacy efforts, as indicated by the high "Not Aware" responses for specific statements (S2 and S7 in Table 3). These farmers also perceived a disconnect from formal legal mechanisms.

• **Class 3:** Farmers in this group demonstrated high levels of awareness and perception of water pollution laws, supported by better education, access to legal resources, and active participation in campaigns. They exhibit a strong understanding of environmental impacts, aligning with high "Agree" percentages for statements such as S1, S9, S11, and S13 in Table 3.

The findings underscore the need for tailored strategies to enhance legal awareness among farmers. For Class 2, intensive interventions such as simplified dissemination of laws, targeted awareness campaigns, and active involvement of local institutions are critical to bridging the knowledge gap. Class 1 requires moderate support to build on their existing understanding, while Class 3 can act as peer educators, sharing their knowledge and experiences to empower other groups. Developing peer-learning models and strengthening rural legal mechanisms are key to achieving widespread legal awareness and fostering effective grassroots-level governance.

CONCLUSION

Farmers have limited exposure to legal frameworks due to inadequate dissemination, technical complexity and weak rural outreach of legal institutions. Low legal literacy levels further hinder their understanding of water pollution laws, while extension services often prioritize production-focused information over environmental and legal education. Many farmers perceive legal actions, such as those under the NGT and Factories Act, as urban-centric, neglecting rural issues. To address these gaps, agricultural extension programmes should integrate modules on water pollution laws, supported by simplified, localized formats of legal provisions. It was recommended that water quality testing, similar to soil testing, be institutionalized at the farm level, especially in pollution-prone areas. Strengthening the role of extension services in disseminating legal and water quality information was also advised. The findings implied that improving farmers' access to legal knowledge and public datasets could enhance sustainable water use and compliance with environmental laws in rural settings. Engaging local leaders and farmer organizations and strengthening rural legal enforcement mechanisms are essential to empower farmers and ensure effective implementation of water pollution regulations.

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