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EDITED BY

Liye Wang,
Shandong University of Finance and
Economics, China

REVIEWED BY

Xueling Guan,
Xuzhou Medical University, China
Wei Liu,
Qufu Normal University, China
Cui Wang,
Shandong Agriculture and Engineering
University, China

*CORRESPONDENCE

Shuting Xu
✉ xushuting223@163.com

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Publicity media use, ecological policy cognition and farmers' green production behaviors: evidence from Hainan, China

Dan Qiao, Yuanxiang Zhu, Qiongyao Ren, Tao Xu and
Shuting Xu*

International Business School, Hainan University, Haikou, China

Farmers' green production behaviors are of great significance in promoting the green development of agriculture and enhancing the level of rural ecological civilization construction. Based on the research data from four cities and counties in Hainan Province, this study explored the role mechanisms between publicity media use, ecological policy cognition and farmers' green production behaviors using Ordered Logit model and Mediated effect model, addresses the underexplored differential impacts of traditional publicity media use and new publicity media use on farmers' green production behaviors. The results show that (1) publicity media use and ecological policy cognition have a significant positive effect on farmers' green production behaviors, (2) ecological policy cognition plays a mediating role in publicity media use on farmers' green production behaviors, (3) there is a difference in the effect of different types of publicity media use on farmers' green production behaviors, with new publicity media use having a stronger direct effect, while the traditional publicity media influence is more mediated by ecological policy cognition. Based on these findings, the government should improve the level of rural information infrastructure, emphasize the role of media in improving farmers' ecological policy cognition, and strengthen the training of new publicity media use.

KEYWORDS

publicity media use, ecological policy cognition, green production behaviors, mediating effect, farmers

1 Introduction

As agricultural productivity continues to advance at an unprecedented rate, China's rural ecosystems are increasingly confronted with escalating environmental pressures that threaten their long-term sustainability. In response, the Chinese government has strategically elevated the development of rural eco-civilization to a national policy priority, systematically implementing a series of green transition initiatives designed to foster sustainable agricultural practices throughout the country. These strategic interventions have significantly enhanced the quality of rural ecological environments while effectively promoting the sustainable development of agricultural systems (Liu Y. et al., 2020; Chen et al., 2019). Nevertheless, persistent challenges remain, including farmers' excessive application of chemical fertilizers and pesticides, unauthorized straw burning, and improper disposal of pesticide packaging during agricultural production. Moreover, rural ecological environment management constitutes a complex, long-term undertaking that requires sustained efforts, making it challenging to achieve substantial improvements within a short timeframe (Ostrom, 2009; Wang et al., 2016). To ensure the long-term efficacy of rural environmental governance,

government agencies have implemented a comprehensive set of policy measures and regulatory frameworks. A notable example is the *Report of the 19th National Congress of the Communist Party of China*, which explicitly advocated for the establishment and steadfast adherence to the ecological concept that “lucid waters and lush mountains are invaluable assets” while emphasizing the integration of resource conservation with environmental protection. *China’s No.1 central document for 2019* underscored the imperative to simultaneously enhance the utilization efficiency of chemical fertilizers and pesticides while progressively reducing their application quantities, coupled with advancing the recycling and reutilization of pesticide waste materials. *China’s No.1 central document for 2023* further advocates for the establishment of an integrated management system for crop residues and agricultural plastic films, along with the development of demonstration zones for sustainable agricultural practices. Furthermore, the government has promulgated and implemented a series of relevant laws and regulations, including but not limited to the *Environmental Protection Law* and the *Regulations on Agricultural Production and Management*, to strengthen the legal framework for environmental governance.

As the primary stakeholders in agricultural production processes, farmers’ adoption of green production practices plays a pivotal role in determining the practical outcomes of agricultural green development initiatives. However, empirical studies have consistently demonstrated that farmers exhibit limited motivation and suboptimal adoption rates regarding green production behaviors in real-world agricultural operations (Li et al., 2020; Ren et al., 2022). Consequently, identifying and analyzing the constraining factors that impede farmers’ adoption of green production practices holds significant theoretical and practical implications for advancing agricultural green development in China. Contemporary research on farmers’ environmentally sustainable agricultural practices primarily focuses on three key areas: the application of biopesticides (Burli, 2017), the implementation of straw incorporation techniques (Yu et al., 2023), and the utilization of organic fertilizers (Li et al., 2023). Scholars have systematically categorized the determinants influencing green production practices into four primary dimensions: individual farmer characteristics, farm management attributes, external environmental factors, and cognitive capacity levels (Sarkar et al., 2022).

In recent years, the substantial improvement of rural infrastructure has led to a remarkable advancement in rural informatization levels. This development has prompted scholarly attention to investigate the impact of information dissemination media on farmers’ adoption of green production behaviors (Du et al., 2025; Yu et al., 2024). Characterized by rapid information transmission, extensive coverage, and significant influence, these publicity media have emerged as crucial channels for disseminating knowledge about rural ecological civilization and sustainable agricultural development initiatives. Publicity media not only do they facilitate the transmission of environmental knowledge to farmers, but they also significantly shape farmers’ comprehension, perception, and decision-making processes regarding green production practices, consequently influencing their adoption of green production behaviors (Junsheng et al., 2019).

Media use generally refers to exposure or attention to the media, which includes traditional media such as television or newspapers, and the Internet (Huang, 2016). With the progressive advancement of next-generation information infrastructure, mass information dissemination media have evolved into two distinct categories:

traditional publicity media and new publicity media (Kioussis, 2001). The traditional publicity media use primarily refers to the utilization of conventional media forms such as television, radio, newspapers, books, and public bulletin boards. In contrast, the new publicity media pertains to the application of information and communication devices centered on the internet, including mobile phones and computers. Within academic discourse, scholars maintain divergent perspectives regarding the differential impacts of these two media types on farmers’ adoption of green production behaviors. A body of scholarly research suggests that both traditional and new publicity media exert positive influences on farmers’ adoption of green production behaviors; however, empirical evidence indicates that traditional media channels demonstrate a more substantial promotional effect compared to their new media counterparts (Lekei et al., 2014). Another school of thought maintains that new publicity media demonstrate a more pronounced effect in promoting environmentally conscious behaviors among farmers when compared to traditional media channels (Aker, 2011). Existing research indicates that both traditional and new publicity media have emerged as crucial channels for farmers to access green production information and enhance environmental awareness (Yin et al., 2024; Yang et al., 2021; Choudhury and Akter, 2024). Nevertheless, the academic community has yet to reach a consensus regarding the comparative effectiveness of traditional versus new media in promoting farmers’ adoption of green production behaviors.

Simultaneously, as the principal agents in agricultural production systems, farmers constitute the core stakeholders in implementing green production behaviors. Their level of cognitive engagement with and comprehension of ecological policies plays a pivotal role in facilitating the transition toward sustainable agricultural development (Ren et al., 2022; Lei et al., 2023). Empirical research has consistently demonstrated that ecological cognition exerts a statistically significant positive influence on farmers’ adoption of clean production behaviors (Liu P. et al., 2020), firewood collection behaviors (Zhang et al., 2025), fruit cultivation behaviors in specialty orchards (Chen et al., 2021), and adoption of ecological agricultural practices (Guo et al., 2022). Furthermore, several studies adopting a policy perception perspective have revealed that farmers’ policy cognition significantly and positively influences both their resource conservation practices (Liu P. et al., 2020) and adoption of ecological conservation technologies (Li et al., 2024). The review reveals that the majority of existing studies have predominantly adopted either an ecological cognition or policy cognition perspective in isolation, rather than integrating both dimensions to conduct more systematic and in-depth investigations.

Based on this, using the field survey data of farmers in Hainan Province, the research empirically analyzes the impact and role of publicity media use on farmers’ green production behavior. The main contributions of this paper are reflected in the following three aspects: First, considering the complexity of the agricultural production process, five representative green production behaviors are selected. From the perspective of publicity media use, the green production behavior of farmers is discussed to promote the implementation of green production behaviors. Second, using the propensity score matching method to control the impact of endogenous problems, analyze the impact of publicity media use on farmers’ green production behaviors. Third, the mediation effect model is used to deeply explore the impact mechanism of publicity media use on farmers’ green production behaviors, trying to provide better policy suggestions for promoting farmers’ green

production in the context of the comprehensive green transformation of agricultural development.

2 Theoretical analyses

2.1 Publicity media use and farmers' green production behaviors

Since the 1980s, the proliferation of mass communication media has prompted scholarly attention to the influence of media engagement on public behavior. The extant literature has extensively investigated diverse domains, including but not limited to urban residents' political participation (Stockmann and Gallagher, 2011; Pinkleton et al., 1998), infectious disease prevention strategies (Oh et al., 2021; Li and Liu, 2020), sustainable rural tourism development (Joo et al., 2020), and social welfare systems (Bekalu et al., 2019). In recent years, the escalating severity of environmental issues has prompted growing academic interest in examining the influence of the use of publicity media on individual environmental behaviors. Empirical evidence has demonstrated that both the frequency and intensity of the use of publicity exert a positive influence on individuals' environmentally conscious behaviors (Shirley, 2015). As research in this domain has progressed, scholars have increasingly focused their attention on examining the differential impacts of specific media types on individuals' environmental behaviors. For instance, Huang (2016) employed a comprehensive modeling approach to elucidate the pivotal role of publicity media use in fostering pro-environmental behaviors, with particular emphasis on the influence of new media platforms. Concurrently, the advent of Internet technology has expanded individuals' access to information beyond traditional media channels, establishing new media as an alternative avenue for information dissemination and engagement. Empirical studies have demonstrated that the utilization of new publicity media, such as mobile devices and computers, significantly facilitates farmers' adoption of green production technologies (Han and Xu, 2020; Dilleen et al., 2023; Khan et al., 2025).

Building upon the aforementioned scholarly investigations, the extant literature has reached a substantial consensus regarding the positive impact of publicity media use on individuals' environmental behavior. Regarding the interpretation of underlying mechanisms, the utilization of publicity media predominantly influences farmers' adoption of green production behaviors through the following pathways. Firstly, from the perspective of social pressure mechanisms, when media platforms disseminate information emphasizing that environmentally detrimental practices contradict societal values, while actively adopting green production behaviors aligns with prevailing social norms, they generate considerable social pressure on farmers. Consequently, to gain social acceptance and avoid potential isolation or exclusion, farmers are motivated to actively implement green production behaviors. Secondly, examining the advocacy participation mechanism, media attention to environmental issues and their promotion of environmental protection initiatives frequently enhance farmers' engagement in ecological conservation efforts, thereby facilitating the adoption of green production behaviors. As a result, the following hypotheses are proposed.

H1: The publicity media use may exert a statistically significant and positive influence on farmers' adoption of green production behaviors.

2.2 Ecological policy cognition and farmers' green production behaviors

Farmers' comprehension and perception of ecological policies serve as crucial determinants in ensuring the effective realization of agricultural policy objectives. The literature has substantiated these findings across multiple dimensions, including farmers' participation in plantation insurance schemes (Barrett et al., 2016), their willingness to engage in food crop cultivation (Embaye et al., 2018), and their satisfaction levels with wetland ecological compensation policies (Pang et al., 2022). Several scholars have directed their research focus toward policy perception in relation to green production behaviors. As primary stakeholders in the policy implementation process, farmers' adoption of green production behaviors is significantly influenced by their level of ecological policy cognition. For example, Li et al. (2024) demonstrated that policy cognition exerts a significant positive influence on farmers' adoption of green production behaviors. Their findings indicate that farmers with enhanced policy comprehension are more likely to implement green production technologies, such as organic fertilizers and water-saving irrigation systems. Furthermore, those exhibiting stronger policy support demonstrate greater participation in environmental conservation activities, including pesticide reduction and arable land protection. Based on this, this paper aims to examine the mechanisms influencing farmers' green production behaviors through the lens of ecological policy cognition. Enhanced levels of ecological policy cognition strengthen farmers' capacity to comprehend specific policy requirements, thereby increasing their willingness to adopt sustainable agricultural practices and subsequently promoting the implementation of green production behaviors. Simultaneously, heightened ecological policy cognition enables farmers to more profoundly comprehend the severity of environmental degradation and the urgency of adopting sustainable practices. This enhanced understanding fosters greater risk perception and responsibility among farmers, motivating them to adapt to ecological changes and actively implement green production methods. Consequently, the following hypotheses are proposed.

H2: Ecological policy cognition may exert a statistically significant and positive influence on farmers' adoption of green production behaviors.

2.3 The mediating role of ecological policy cognition

Constrained by limited educational attainment and restricted social networks, farmers predominantly rely on media platforms as their primary source of agricultural information. Empirical evidence has established that individuals' exposure to and engagement with media channels significantly shape their perceptions, and influence their behavioral patterns (Bandura, 2009). More specifically, individuals' engagement with the publicity media shapes their cognitive perceptions of various phenomena (Wauters and Mathijs, 2014), facilitates the development of corresponding value systems, and ultimately influences

behavioral patterns through the formation of behavioral intentions. With specific regard to farmers' green production, their exposure to and utilization of publicity media influence their comprehension of ecological policies, foster the development of corresponding ecological values, and subsequently generate intentions for sustainable agricultural practices, ultimately leading to the adoption of green production behaviors. Simultaneously, different types of publicity media often fulfill distinct roles in information dissemination, potentially resulting in differential impacts of traditional and new media on farmers' adoption of green production behaviors. Government-led traditional media channels typically adopt a policy-oriented approach when communicating green production information, employing subtle educational strategies to enhance farmers' ecological cognition, particularly regarding policy comprehension, through gradual knowledge transfer. While the new publicity uses media empowers farmers with greater autonomy, enabling them to proactively seek green production information through mobile devices or computers based on their specific needs, thereby enhancing their ecological cognition and ultimately influencing their adoption of sustainable practices. The aforementioned analysis reveals that despite differing communication approaches between traditional and new media channels, and whether farmers passively receive or actively seek green production information, both media types effectively elevate farmers' ecological policy cognition and facilitate the implementation of green production behaviors. Consequently, the following hypotheses are proposed.

H3: Ecological policy cognition serves as a mediating factor in the relationship between the publicity media use and farmers' adoption of green production behaviors.

H4: Whether traditional publicity media or new publicity media, both can effectively enhance farmers' ecological policy cognition, thereby promoting the implementation of ecological behaviors.

Drawing upon the theoretical foundations of farmer behavior theory, planned behavior theory, and externality theory, this study investigates the influence of publicity media use and ecological policy cognition on farmers' green production behaviors. Within the

proposed conceptual framework illustrated in [Figure 1](#), publicity media use serves as the antecedent variable, ecological policy cognition functions as the mediating variable, and farmers' green production behaviors constitute the dependent variable.

3 Data sources and model construction

3.1 Data sources

The data are from a rural household survey on "Agricultural Production and Rural Ecological Conservation in Hainan Province" conducted by the research group in July–August 2021. As a national ecological civilization pilot zone, Hainan Province actively adheres to the principle of "ecology-first, green development," strengthens the governance of its agricultural ecological environment, and implements initiatives such as reducing chemical fertilizers and pesticides while enhancing efficiency, resource utilization of livestock and poultry manure, comprehensive utilization of crop straw, and improvement of soil organic matter. It also advances the recycling and disposal of waste agricultural films and pesticide packaging waste. Thus, selecting Hainan Province as a research subject demonstrates strong representativeness. Additionally, by comprehensively considering factors such as geographical location, ecological conditions, agricultural foundations, and other factors, four cities and counties—Haikou City, Dongfang City, Lingshui Li Autonomous County, and Qiongzong Li and Miao Autonomous County, were ultimately chosen as sample regions within Hainan Province. The research adopts the combination of random sampling and stratified sampling, selecting 2 ~ 3 districts or townships in each city and county, 4 ~ 5 villages randomly selected from each district or township, and 20 ~ 30 households randomly selected from each sample village for the research. In order to ensure the authenticity and validity of the questionnaire, uniform training was provided to the researchers before the research, and the contents of the questionnaire were explained to ensure that the researchers could fully understand the questionnaire. The main contents of this research include: farmers' green production situation, basic personal and family characteristics, ecological

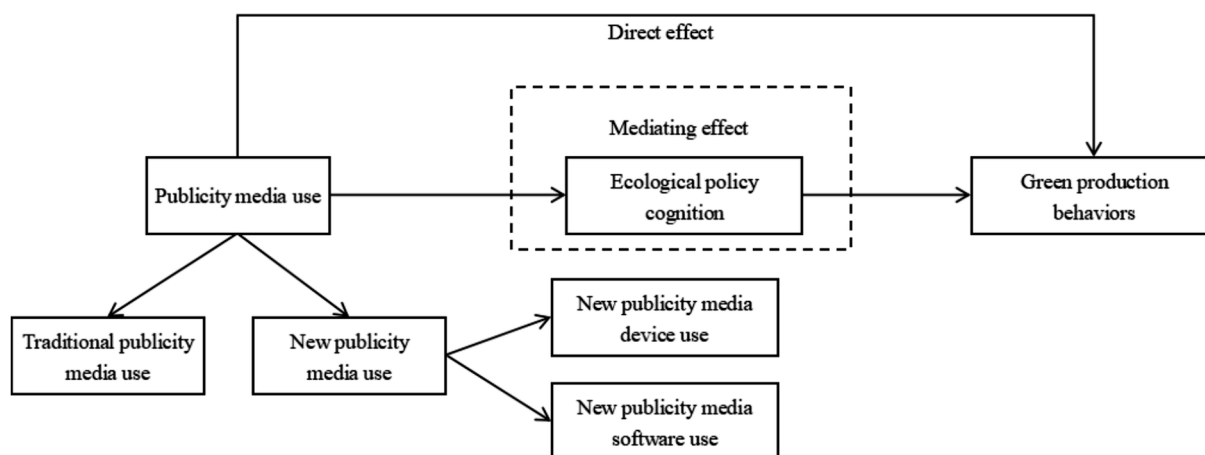


FIGURE 1
Theoretical framework diagram.

policy cognition, risk preference and other characteristics. The number of questionnaires distributed in this research is 666. After deleting the missing questionnaires, 629 valid questionnaires were obtained, and the validity rate of the questionnaires reached 94.44%. The research object of this paper is the green production behaviors of farmers, so five kinds of green production behaviors were selected for the study, such as organic fertilizer application, soil formula fertilization, straw return to the field, pesticide packaging recycling and mulch film recycling, etc., and those farmers who did not use mulch film and did not have straw were excluded from the sample data, and finally a total of 516 samples could be used for this paper's study of farmers' green behavior.

3.2 Variables

3.2.1 Dependent variable

The explanatory variables in this paper are farmers' green production behaviors. Due to the differences in farmers' agricultural production situation, there will be some differences in the types of green production technology accepted, but farmers' adoption of some major types of green production technology is not much different. Therefore, it is more scientific and comprehensive to understand the implementation of green production behaviors of farmers by measuring the overall green production behaviors of farmers holistically. In this paper, to quantify the actual implementation of green production behaviors in the whole production process of farmers, we drew on the studies of [Li et al. \(2024\)](#), [Ren et al. \(2022\)](#), and [Qiao et al. \(2022\)](#) and combined with the actual situation of green production and development in Hainan Province, and finally chose the five green production behaviors, namely, organic fertilizer application, pesticide packaging recycling, straw return to the field, soil-formulated fertilizer application, and mulch film recycling, to examine the implementation of green production behaviors in farmers' households. Based on the number of green production behaviors implemented by farmers in the production process, the values of none of the green production behaviors, any of the green production behaviors, two of the green production behaviors, three of the green production behaviors, four of the green production behaviors, and all of the green production behaviors were assigned values ranging from 0 to 5, respectively.

3.2.2 Core independent variable

The core independent variable of this paper is publicity media use. For farmers, the publicity media is an important way to obtain information about green production, and the use of publicity media plays an important role in farmers' decision-making on green production behaviors. This paper draws on the research of [Flanagin and Metzger \(2001\)](#) and [Huang \(2016\)](#) and selects the question "What kinds of publicity media do you mainly use to obtain useful agricultural information?" The options included newspapers and books, bulletin boards, radio, TV, cell phones, and computers for a total of six items. Assign a value of 0 to 6 to the following scenarios respectively: no media used, use of any one type of publicity media, use of two types of publicity media, use of three types of publicity media, use of four types of publicity media, use of five types of publicity media, and use of all publicity media; the use of newspapers and books, bulletin boards, radio and TV was defined as the use of traditional media, coded as 1 if anyone used, 0 otherwise; the use of cell phones and computers was defined as the use of new media,

coded as 1 if used, 0 otherwise; Use of new publicity media, if used is assigned a value of 1, otherwise 0.

3.2.3 Mediating variable

The mediating variable in this paper is ecological policy cognition. Farmers' ecological policy cognition is a key variable influencing farmers' green production behaviors, and the higher farmers' ecological policy cognition is, the more it helps to combine and organically unify social, economic and ecological benefits in actual production. In this paper, we refer to the studies of [Ren et al. \(2022\)](#) and [Li et al. \(2024\)](#), and argue that the measurement of ecological policy cognition should involve different dimensions, including whether farmers know, understand, and evaluate relevant ecological protection policies. Therefore, this paper is as comprehensive as possible when selecting the questions "Do you know and understand the meaning of 'green water and green mountains is golden silver mountains'?" and "Do you know and understand the meaning of 'ecological livability'?" and "Do you know and understand the meaning of 'ecological livability'?" were selected to measure farmers' knowledge of the national basic ecological policies; "Do you understand the local government's ecological protection policies?" was selected to measure farmers' knowledge of the local ecological policies. "Do you feel that the government's publicity on ecological environmental protection is in place?" was chosen to measure farmers' overall evaluation of ecological policies. Combined with the existing studies, the entropy value method was used to calculate the weights of the four indicators in the above content. The entropy value method is an objective approach used to determine the weight of each evaluation index. During the process of index evaluation, this method can objectively determine the weight size based on the amount of information reflected by the change of each index value. The greater the amount of information, the smaller the entropy value and the greater the weight; conversely, the opposite is true. The specific steps are as follows: (1)Data standardization; (2)Calculation of indicator entropy; (3)Determination of the weights of the indicators.

3.2.4 Control variables

Combined with existing research, the individual characteristics of farmers and family business characteristics have a very important impact on the green production behaviors of farmers. In view of this, this paper selects gender, political appearance, education level, family size, agricultural labor force ratio, to characterize the individual characteristics of farmers and family business characteristics; at the same time, existing studies have shown that herd mentality ([Liu et al., 2024](#); [Li et al., 2022](#)), interpersonal communication ([Unay Gailhard et al., 2015](#); [Han and Xu, 2020](#)), risk preference ([Huang et al., 2025](#); [Zhang et al., 2023](#)), have a significant impact on the green production behaviors of farmers. In order to ensure the accuracy of the results, the above variables are included in the control variables, as shown in [Table 1](#).

3.3 Model construction

3.3.1 Ordered logit model

In this paper, the green production behaviors of farmers is used as the explanatory variable, which is a categorical variable from 0 to 5, and in order, it indicates that none of the green production behaviors are implemented, any of the green production behaviors are implemented, two of the green production behaviors, three of the green production

TABLE 1 Variable definitions and descriptive statistics.

Variable types	Variables	Variable description and assignment	Mean	Std. Dev.	Min	Max
Dependent variable	Green production behaviors	The number of green production behaviors adopted (0–5)	1.407	0.994	0	5
Core independent variables	Publicity media use	The number of media channels used by farmers to access useful agricultural information (count)	1.448	1.081	0	6
	New publicity media use	Whether farmers use new publicity media to access useful agricultural information? 1 = Yes, 0 = No	0.587	0.493	0	1
	Traditional publicity media use	Whether farmers use traditional publicity media to access useful agricultural information? 1 = Yes, 0 = No	0.585	0.493	0	1
Mediating variable	Ecological policy cognition	Calculated based on the entropy method	0.318	0.269	0	1
Control variables	Gender	1 = Male; 0 = Female	0.928	0.258	0	1
	Age	Actual age (years)	51.822	11.218	23	87
	Education Level	Actual years of schooling (years)	8.372	3.127	0	18
	Political Affiliation	Is there a communist party member in your household? 1 = Yes; 0 = No	0.314	0.465	0	1
	Family size	Actual number of family members (persons)	4.620	1.985	1	14
	Agricultural labor ratio	Number of agricultural laborers/Total number of family laborers	0.885	0.210	0.14	1
	Land fragmentation	Total cultivated area/Number of plots	3.187	5.492	0.2	50
	Distance to land	Average distance from home to cultivated land (kilometers)	1.585	1.516	0	15
	Agricultural expenditure	Actual household agricultural expenditure (10,000 yuan)	1.681	3.649	0.01	41.5
	Herd mentality	Do you follow others' decisions in agricultural production? 1 = Yes; 0 = No	0.335	0.473	0	1
	Social interactions	Do you frequently discuss agricultural matters with villagers? 1 = Yes; 0 = No	0.767	0.423	0	1
	Risk preference	Do you consider yourself a risk-taker? 1 = Strongly disagree; 2 = Disagree; 3 = Neutral; 4 = Agree; 5 = Strongly agree	2.159	1.397	1	5
	Agricultural extension services	Have you received agricultural extension services? 1 = Yes; 0 = No	0.610	0.488	0	1

behaviors, four of the green production behaviors, and all of the green production. The explanatory variables in this paper are ordered multicategorical variables, so regression is performed using the Ordered Logit model, and this model can be set as:

$$y_i^* = X_i' \beta + \mu_i \quad (1)$$

In Equation 1, y_i^* represents the unobserved latent variable, X_i' is the vector of explanatory variables, β denotes the coefficients to be estimated, and μ_i is the random disturbance term. Assuming r_0, r_1, r_2, r_3, r_4 as the threshold parameters, the specific equation is as follows:

$$y_i = \begin{cases} 0(\text{adpot none}) & \text{if } y_i^* \leq r_0 \\ 1(\text{adpot one}) & \text{if } r_0 \leq y_i^* \leq r_1 \\ 2(\text{adpot two}) & \text{if } r_1 \leq y_i^* \leq r_2 \\ 3(\text{adpot three}) & \text{if } r_2 \leq y_i^* \leq r_3 \\ 4(\text{adpot four}) & \text{if } r_3 \leq y_i^* \leq r_4 \\ 5(\text{adpot five}) & \text{if } y_i^* \leq r_4 \end{cases} \quad (2)$$

From Equation 2, it can be obtained that the probability that a farmer does not implement, implement any one, implement two, implement three, implement four and implement all green production behaviors, respectively, as in Equation 3:

$$\begin{aligned} P(y_i = 0|X) &= \Phi(r_0 - X_i' \beta) \\ P(y_i = 1|X) &= \Phi(r_1 - X_i' \beta) - \Phi(r_0 - X_i' \beta) \\ P(y_i = 2|X) &= \Phi(r_2 - X_i' \beta) - \Phi(r_1 - X_i' \beta) \\ P(y_i = 3|X) &= \Phi(r_3 - X_i' \beta) - \Phi(r_2 - X_i' \beta) \\ P(y_i = 4|X) &= \Phi(r_4 - X_i' \beta) - \Phi(r_3 - X_i' \beta) \\ P(y_i = 5|X) &= 1 - \Phi(r_4 - X_i' \beta) \end{aligned} \quad (3)$$

3.3.2 Mediation effect test model

In order to verify how publicity media use indirectly affects farmers' green production behaviors through ecological policy cognition, this paper constructs the following regression equation

with reference to the mediation effect test proposed by Wen and Ye (2014) and this paper, as in Equation 4:

$$\begin{aligned} Y_i &= \alpha_0 M_i + \alpha_1 X_i + \varepsilon_i \\ C_i &= \alpha_2 + \alpha_3 M_i + \alpha_4 X_i + \varepsilon_i \\ Y_i &= \alpha_5 M_i + \alpha_6 C_i + \alpha_7 X_i + \varepsilon_i \end{aligned} \quad (4)$$

3.3.3 Propensity score matching (PSM)

In practice, the decision of whether or not farmers adopt green production behaviors is not a random assignment, but a rational choice based on factors such as farmers' characteristics (Qing et al., 2023). If the regression is performed directly, the estimated results may be biased due to the "self-selection" problem. To this end, this paper adopts the propensity score matching (PSM) method to correct the selection bias (Rosenbaum and Rubin, 1983). The specific steps include: dividing the samples into treatment groups and control groups according to whether green production behavior is adopted or not. First, the propensity score value is calculated. According to the observable variables, the Logit model is used to predict the probability of farmers adopting green production behaviors. Second, the treatment and control groups were matched based on propensity score values. Finally, based on the matched samples, compare the average difference in green production behaviors between the treatment group and the control group, and obtain the Average Treatment Effect on the Treated (ATT) of the treatment group. To ensure accurate results, this paper adopts three matching methods, including K-nearest neighbor matching, radius matching, and kernel matching, to verify the findings. The expression is as follows:

$$ATT = E(Y_{1i} - Y_{0i} | X_i = 1) = E(Y_{1i} | X_i = 1) - E(Y_{0i} | X_i = 1) \quad (5)$$

In Equation 5, Y_{1i} is the green production behaviors of farmer in the context of traditional publicity media or new publicity media use, Y_{0i} is the green production behaviors of farmer that do not use traditional publicity media or new publicity media.

4 Results

4.1 Baseline regression

Firstly, this paper uses Ordered Logit model for estimation in order to analyze the impact of publicity media use and ecological policy cognition on farmers' green production behaviors. Before model estimation, variance inflation factor (VIF) assesses multicollinearity to ensure the accuracy of the final results. Usually, a VIF value below 10 indicates the absence of multicollinearity, and in this study the range of VIF values for all variables was less than 3, indicating that the variables were independent from each other and no covariance problem was found, which indicated that further regression analysis could be done. Table 2 reports the results of the effects of publicity media use, different types of publicity media use, and ecological policy cognition on farmers' green production behaviors, respectively. From the regression results of Model 2, it can be seen that publicity media use is significant at 1% statistical level and

the coefficient is 0.314, which indicates that publicity media use has a significant positive effect on farmers' green production behaviors, and Hypothesis H1 is verified, which suggests that the more publicity media channels that farmers have to obtain useful information, the higher the degree of implementation of their green production behaviors; ecological policy cognition is significant at 1% statistical level and the coefficients are 1.162 and 1.302, respectively, which indicates that ecological policy cognition has a positive impact on farmers' green production behaviors, following which hypothesis H2 is verified, indicating that the higher the level of farmers' ecological policy cognition, the more conducive to the implementation of green production.

From the regression results of Model 4, it can be concluded that the use of new publicity media and the use of traditional propaganda media are significant at the statistical level of 1 and 5%, respectively, and the coefficients are 0.517 and 0.333, i.e., the use of new publicity media and the use of traditional publicity media have a significant positive impact on the green production behaviors of farmers, i.e., compared with farmers who do not use traditional publicity media and new publicity media, farmers who use traditional publicity media and new publicity media are more likely to use traditional publicity media and new publicity media than those who do not use them. New publicity media will have a higher level of implementation of green production behaviors compared to farmers who do not use traditional publicity media and new publicity media. It was further found that the significance of the use of new publicity media was higher than the significance of the use of traditional publicity media, which confirms that the use of new publicity media is more likely to influence the green production behaviors of farmers than the use of traditional publicity media. This indicates new media's superior efficiency in disseminating targeted information, interactive features that reduce knowledge gaps, and lower adoption costs, whereas traditional media, constrained by one-way communication and narrower reach, yield comparatively weaker behavioral incentives.

Among the control variables, the size of the family has a positive effect on the green production behaviors of farmers and is significant at the 1% level, indicating that the larger the size of the family, the higher the degree of green production will be carried out. Possible reasons green production behaviors are mostly labor-intensive, requiring more human input, the larger the family size of the farmers, the more abundant the manpower, more inclined to implement green production. Land distance has a negative effect on green production behaviors of farmers and is significant at 1% level, indicating that the further the land of farmers is from home, the lower the probability of their implementing green production behaviors. The possible reason for this is that the farther the land is from home, the farmer will consider the cost of labor, materials, and capital, and the increase in cost may reduce the farmer's motivation to carry out green production. Agricultural expenditure of farmers has a positive effect on green production behaviors and is significant at 1% level, which means that the more farmers spend on the agricultural production process, the higher the degree of implementation of their green production behaviors will be. The possible reason for this is that the amount of agricultural expenditure reflects to a certain extent the increase of farmers' input in agricultural production, which indicates that farmers' main income depends on agriculture, and they will pay more attention to the eco-efficiency of agricultural production, which will increase the degree of implementation of their green production

TABLE 2 Estimation of ordered logit regression model results.

Variables	Model 1		Model 2		Model 3		Model 4	
	Regression coefficient	Standard error	Regression coefficient	Standard error	Regression coefficient	Standard error	Regression coefficient	Standard error
Green production behaviors	0.264***	0.079	0.314***	0.084	–	–	–	–
Publicity media use	–	–	–	–	0.492***	0.169	0.517***	0.182
New publicity media use	–	–	–	–	0.335**	0.167	0.333*	0.173
Traditional publicity media use	1.420***	0.327	1.162***	0.366	1.532***	0.319	1.302***	0.361
Gender	–	–	–0.340	0.327	–	–	–0.063	0.327
Age	–	–	0.015*	0.008	–	–	0.018***	0.008
Education level	–	–	0.041	0.029	–	–	0.043	0.030
Political affiliation	–	–	–0.247	0.194	–	–	–0.188	0.193
Family size	–	–	0.114***	0.043	–	–	0.114***	0.043
Agricultural labor ratio	–	–	0.504	0.423	–	–	0.589	0.424
Land fragmentation	–	–	–0.001	0.018	–	–	–0.004	0.018
Distance to land	–	–	–0.184***	0.056	–	–	–0.161***	0.056
Agricultural expenditure	–	–	0.100***	0.028	–	–	0.095***	0.028
Herd mentality	–	–	0.358**	0.174	–	–	0.364**	0.175
Social interactions	–	–	0.357*	0.204	–	–	0.335*	0.204
Risk preference	–	–	0.038	0.062	–	–	0.030	0.062
Agricultural extension services	–	–	0.182	0.184	–	–	0.205	0.184
Log likelihood	–684.957		–660.215		–684.575		–661.506	
R ²	0.0304		0.0654		0.0309		0.0636	
Prob > chi2	0.0000		0.0000		0.0000		0.0000	
Sample	516		516		516		516	

*, **, And *** are significant at the 10, 5, and 1% levels, respectively.

behaviors. The positive effect of herd mentality on farmers' green production behaviors is significant at the 5% level, indicating that farmers with herd mentality will implement green production behaviors to a higher extent compared to other farmers. The possible reason for this is that the benefits and risks of implementing green production behaviors have already been reflected in the surrounding farmers, and the farmers make judgments based on the decisions of the surrounding farmers, and make decisions that are more inclined to implement green production.

4.2 Mediating effect

In order to further explore, the mediating role of ecological policy cognition that exists between the publicity media use and farmers' green production behaviors. In this paper, the test is carried out through the method of stepwise regression, and the resulting coefficients are standardized to ensure the accuracy of the results. The specific estimation results are shown in Table 3.

From the results of Model 5, the total effect of the publicity media use variable on farmers' green production behaviors is significantly positive at the 1% statistical level. The regression results from Model 6 show that the publicity media use variable significantly increases farmers' ecological policy cognition (coefficient of 0.457 and passed the 1% significance test). The coefficient of ecological policy cognition in Model 7 is 0.312 and significant at 1% statistical level, which further indicates that the increase of farmers' ecological policy cognition can significantly promote farmers' green production behaviors, i.e., Hypothesis H3 is verified. Further calculation shows that the magnitude of the mediating effect is 0.143, which accounts for about 35.74% of the total effect of publicity media use on farmers' green production behaviors. Therefore, ecological policy cognition plays a partial mediating role in publicity media use affecting farmers' green production behaviors.

The total effect of the new publicity media use variable on farmers' green production behaviors is significant at the 1% statistical level, and the coefficient is positive (Model 5). From the regression results of Model 6, it can be seen that the new publicity media use

variable significantly increased farmers' ecological policy cognition (coefficient of 0.197 and passed the test at the 5% level of significance). The coefficient of ecological policy cognition in model 7 is 0.350 and significant at 1% statistical level, which shows that the increase of farmers' ecological policy cognition can significantly promote farmers' green production behaviors. The size of this effect is calculated to be 0.069, which accounts for about 23.61% of the total effect of new publicity media use on farmers' green production behaviors. Therefore, ecological policy cognition plays a partial mediating role between new publicity media use and farmers' green production behaviors.

The total effect of traditional publicity media use variables on farmers' green production behaviors was significantly positive at the 5% statistical level (Model 5). The regression results of Model 6 showed that the traditional publicity media use variable significantly increased farmers' ecological policy cognition (coefficient of 0.158 and passed the test at the 5% level of significance). The coefficient of ecological policy cognition in Model 7 is 0.350 and significant at 1% statistical level, which further verifies that the increase of farmers' ecological policy cognition can significantly promote farmers' green production behaviors. The size of this effect is calculated to be 0.055, which accounts for about 31.24% of the total effect of traditional publicity media use on farmers' green production behaviors. Therefore, ecological policy cognition plays a partial mediating role in the traditional publicity media use affecting farmers' green production behaviors.

Through further analysis, it can be seen that the mediating role of ecological policy cognition in the pathway of traditional publicity media use affecting farmers' green production behaviors is greater than the mediating role in the pathway of new publicity media use affecting farmers' green production behaviors ($R_{\text{traditional}} = 31.24\% > R_{\text{new}} = 23.61\%$). The possible reason is that the traditional publicity media follow the government-driven model in the process of dissemination, and most of the reported content will be centered on government policies, which means that the traditional publicity media such as radio, newspaper, and television are more conducive for farmers to obtain information related to ecological policies, and thus improve their ecological policy cognition. This indicates traditional media's higher credibility and systematic information delivery, which aligns better with farmers' information reception habits, thereby enhancing the conversion of policy cognition into behavioral motivation; in contrast, new media, though interactive, often faces challenges like fragmented content and uneven credibility, weakening its role in mediating policy cognition.

4.3 Endogeneity test

In the above analysis, it has been concluded that the use of traditional publicity media and the use of new publicity media have a significant positive impact on farmers' green production behaviors. However, farmers' use of traditional publicity media or new publicity media is often not completely random, which suggests that there may be a causal relationship between the use of traditional propaganda media, new publicity media and farmers' green production behaviors. In order to test whether this problem exists in the results obtained, this paper conducts another test on the role effect of traditional publicity

media use and new publicity media use in promoting green production behaviors of farmers through the Propensity Score Matching method (PSM) to avoid bias in the sample. The specific results are shown in Table 4.

In order to ensure the full utilization of the sample and the reliability of the results, three methods of k-nearest neighbor matching ($k = 4$), radius matching ($r = 0.05$) and kernel matching were selected in this paper. From the results, it can be seen that among the new publicity media use variables, the average treatment effects of k-nearest neighbor matching, radius matching and kernel matching are 0.304, 0.327 and 0.331, all of which are significant at the 1% statistical level. Among the traditional publicity media use variables, the mean treatment effects of k-nearest neighbor matching, radius matching, and kernel matching were 0.206, 0.225, and 0.228, all significant at the 5% statistical level. Further analysis revealed that the mean ATT value of the new publicity media use variable was 0.321, indicating that the mean value of green production behaviors of farmers was 1.228, if they did not use the new publicity media, but due to the use of the new publicity media, the mean value of green production behaviors was 1.549, which was an increase of 0.321. Similarly, the mean ATT value of the traditional publicity media use variable was 0.220. When farmers did not use traditional publicity media, the mean value of their green production behaviors was 1.278, and after farmers used traditional publicity media, the mean value of their green production behaviors was 1.497, which increased by 0.220. Thus, it can be seen that the use of the new publicity media and the use of the traditional publicity media have a significant role in promoting the green production behaviors of farmers, and the effect of the publicity media use variable was higher than that of the traditional publicity media use.

4.4 Further exploration

From the empirical analysis in Table 2, it can be concluded that the use of new publicity media has a stronger promotion effect on farmers' green production behaviors than the use of traditional publicity media. Further analysis of the research data reveals that there is a difference in the proportion of the use of new publicity media devices and new publicity media software when farmers use new publicity media to obtain useful agricultural information, which indicates that farmers still lack the ability to use new publicity media software. The results are shown in Table 5.

From the results, it can be seen that the use of new publicity media equipment and new publicity media software has a significant positive impact on the green production behaviors of farmers, and both are significant at the 1% statistical level. However, the coefficient of the use of new publicity media software is higher than that of the use of new publicity media equipment, which indicates that the use of new publicity media software has a stronger effect on the promotion of green production behaviors of farmers, which may be since part of the farmers' education is relatively low and they lack the ability to recognize words and comprehend information, so the application of cell phone functions is only confined to the level of communication, and the application of cell phone software also stays at a more basic level, and they are unable to obtain useful agricultural information from it.

4.5 Heterogeneity analysis

In Table 3, the effect of ecological policy cognition on farmers' green production behaviors is verified, but there may be variability among different groups. In this paper, we will select three variables of ethnicity, whether there are party members at home and whether there are village cadres at home for heterogeneity analysis to further explore the influence of ecological policy cognition on green production behaviors of farm households. The specific results are shown in Table 6.

4.5.1 Ethnic heterogeneity

The samples are divided into two groups, Han and ethnic minorities, according to the ethnicity of the farmers and estimated. From the estimation results of Model 10, it can be seen that the effect of ecological policy cognition on farmers' green production behaviors is significant at the statistical level of 5 and 1% for Han and ethnic minority groups, respectively, indicating that the effect of ecological policy cognition on farmers' green production behaviors is more significant in ethnic minority farmers compared to Han farmers. This may be since ethnic minorities live in ecologically protected areas, and the government focuses more on implementing policies related to green production, and ethnic minority farmers receive more education, extension services and subsidies related to green production. Meanwhile, ethnic minority farmers, often with more traditional production practices closely tied to local ecosystems, may perceive stronger alignment between policy goals and their livelihood sustainability needs, amplifying cognitive-behavioral conversion. In this context, compared with Han Chinese farmers, ethnic minority farmers are more concerned about green production, have a higher

awareness of ecological policies, and are more inclined to implement green production.

4.5.2 Party membership heterogeneity

The sample was categorized into no party members at home and party members at home based on the presence or absence of party members in the farmer's household and was estimated. From the estimation results of Model 11, it can be seen that the effect of ecological policy cognition on farmers' green production behaviors is significant at the 1 and 5% statistical level in the subgroups of having party members at home and not having party members at home, respectively, which indicates that compared with farmers without party members at home, the effect of ecological policy cognition on farmers' green production behaviors is more significant in farmers with party members at home. This may be because farmer party members characterized by higher political engagement and organizational discipline, tend to proactively align with policy directives, enhancing the practical impact of policy cognition. Hence and farmers who have party members at home or who are party members themselves will give full play to their exemplary role as "leaders" in the implementation of green agricultural production technology, take the lead in responding to the state's relevant ecological protection policies, actively learn ecological protection knowledge, improve their own ecological awareness and cognition and take the initiative to implement green production.

4.5.3 Village cadre membership heterogeneity

The sample was categorized into no village cadres at home and village cadres at home based on the presence or absence of village cadres in the farmer's household and estimated. From the results of

TABLE 3 Mediating effects of ecological policy cognition in the publicity media use on farmers' green production behaviors.

Variables	Model 5		Model 6		Model 7	
	Green production behaviors		Ecological policy cognition		Green production behaviors	
	Original coefficient	Standardized coefficient	Original coefficient	Standardized coefficient	Original coefficient	Standardized coefficient
Publicity media use	0.369*** (0.082)	0.399*** (0.088)	0.423*** (0.080)	0.457*** (0.087)	0.314*** (0.084)	0.339*** (0.090)
Ecological policy cognition	–		–		1.162*** (0.366)	0.312*** (0.098)
R ²	0.0582		0.0387		0.0654	
Prob > chi2	0.0000		0.0000		0.0000	
New publicity media use	0.592*** (0.180)	0.292*** (0.089)	0.400** (0.168)	0.197** (0.083)	0.517*** (0.182)	0.255*** (0.090)
Traditional publicity media use	0.359** (0.172)	0.177** (0.085)	0.320** (0.161)	0.158** (0.079)	0.333* (0.173)	0.164* (0.085)
Ecological policy cognition	–		–		1.302*** (0.361)	0.350*** (0.097)
R ²	0.0543		0.0350		0.0636	
Prob > chi2	0.0000		0.0000		0.0000	
Control variables	Yes		Yes		Yes	
Sample	516		516		516	

*, **, And *** are significant at the 10, 5, and 1% levels, respectively, with standardized coefficients in parentheses.

model 12, it can be seen that the effect of ecological policy cognition on farmers' green production behaviors is significant at 1 and 10% statistical level in the grouping of having village cadres at home and not having village cadres at home, respectively, which indicates that compared with farmers without village cadres at home, the effect of ecological policy cognition on farmers' green production behaviors is more significant in the grouping of having village cadres at home. This may be because households with village cadres, by virtue of their stronger organizational reliance and more extensive social connections, benefit from closer access to policy interpretation and demonstration. This proximity reduces information asymmetry, enabling them to obtain and learn about green production-related information earlier, enhance their ecological cognition, thereby strengthening the behavioral expression of their policy understanding and positioning them as "early implementers" of green production.

4.6 Robustness test

In order to verify the validity and reliability of the conclusions, this paper needs further robustness tests, and the specific results are shown in Table 7. In this paper, two testing methods are adopted: (1) referring to the study of Liu P. et al. (2020), using the method of model replacement, replacing the Ordered Logit model with the Ordered Probit model and re-estimating the samples, and the results are shown in Models 13 ~ 15; (2) utilizing the method of changing the sample capacity, on the basis of the original samples, randomly selecting 85% of the samples to form a new sample set and reestimate the sample for analysis, and the results obtained are shown in Models 13 ~ 15. Based on the results, it can be concluded that the results estimated by the two methods are basically the same as those in the previous paper, and the significance and direction of the tests of publicity media use, ecological policy cognition, and mediating effects are consistent with those in the previous paper. Overall, the results of the analysis in this paper are robust.

5 Discussion

Media, as a critical channel for farmers to access information, due to its diverse forms, not only effectively reduces farmers' information acquisition costs but also profoundly shapes their production decisions. This paper innovatively incorporates publicity media use, ecological policy cognition, and green production behaviors into the research

framework. The findings indicate that publicity media use significantly promotes the implementation of green production behaviors among farmers, which aligns with the results reported by Gao et al. (2017) and Huang (2016). More specifically, both traditional and new publicity media use were also found to significantly promote farmers' green production behaviors, which contrasts with the findings of Zhao et al. (2019). Their study, focusing on consumers, reported that traditional media had no significant impact on consumers' green consumption behavior, whereas new media exerted a positive effect on consumers' green consumption behavior. Notably, the current research further reveals that the impact of new publicity media use on farmers' green production behaviors is more pronounced than that of traditional media, a result consistent with Zhang et al. (2021) and Liao et al. (2025) demonstrates that new publicity media enables more efficient dissemination of agricultural information due to their interactive nature and real-time capabilities (Li et al., 2020; Qiao et al., 2022). Both the use of new publicity media hardware (e.g., digital devices) and software (e.g., application platforms) have been found to exert significant positive impacts on farmers' green production behaviors. These findings, to some extent, expand the scope of relevant research and address a limitation in prior literature, which has often examined farmers' green production behaviors through a singular lens of publicity media rather than distinguishing between its hardware and software components.

In terms of underlying mechanisms, existing research has established that media usage positively correlates with pro-environmental attitudes and behaviors, with the dissemination of environmental knowledge emerging as a critical intermediate pathway (Awan et al., 2022). However, our study reveals that the level of ecological policy cognition exhibits a positive correlation with farmers' green production behaviors, a finding consistent with the results reported by Yang et al. (2024). Specifically, publicity media use influences the implementation of farmers' green production behaviors primarily through enhancing their ecological policy cognition. Further analysis indicates that ecological policy cognition plays a stronger mediating role in the path from traditional publicity media use to farmers' green production behaviors compared to its role in the path from new publicity media use to such behaviors.

Additionally, we expanded our analysis by investigating the heterogeneity of the impact of ecological policy cognition on farmers' green production behaviors across key household characteristics: ethnicity, the presence of Party members in the household, and the presence of village cadres in the household. The empirical results revealed that ecological policy cognition exerts a more pronounced

TABLE 4 Propensity score matching method treatment effects of farmers' green production behaviors.

Variables	Matching methods	Treated	Controls	ATT	S.E.	T-stat
New publicity media use	K-nearest neighbor matching ($k = 4$)	1.551	1.247	0.304	0.102	2.98
	Radius matching	1.548	1.221	0.327	0.098	3.33
	Kernel matching	1.548	1.217	0.331	0.098	3.37
	Mean	1.549	1.228	0.321	–	–
Traditional publicity media use	K-nearest neighbor matching ($k = 4$)	1.497	1.291	0.206	0.104	1.97
	Radius matching	1.498	1.273	0.225	0.096	2.35
	Kernel matching	1.497	1.269	0.228	0.096	2.36
	Mean	1.497	1.278	0.220	–	–

positive effect on farmers' green production behaviors among ethnic minority farmers, households with Party members, and households with village cadres. This suggests that farmers with differing characteristics possess heterogeneous resource endowments, which in turn leads to variations in the influence of ecological policy cognition on their green production behaviors. As Adnan et al. (2019) noted, "Party members can function as vanguards in promoting green production initiatives."

However, this study is subject to several limitations. Firstly, constrained by temporal and financial resources, the research sample was limited to 516 farmers across four cities and counties in Hainan Province, potentially limiting the generalizability of findings to the broader population of Chinese rural residents' green production behaviors. Future research should expand the sample size to encompass more diverse geographical regions and demographic groups to enhance the external validity and practical applicability of the findings. Secondly, the analysis relied exclusively on cross-sectional data from a single year. While cross-sectional data can effectively capture farmers' green production behaviors at a specific temporal point, it fails to reflect the longitudinal dynamics and evolutionary patterns of these behaviors. Consequently, future studies should incorporate longitudinal tracking surveys to provide a more comprehensive understanding of behavioral adoption trends over time. The study's geographical focus on Hainan Province, characterized by its tropical agriculture, presents unique environmental conditions, climatic features, and cultural contexts that may differ from other regions. Therefore, regional variations should

be carefully considered when extrapolating the study's findings. Furthermore, while this research primarily examines the positive impacts of media engagement (both traditional and new publicity media) on farmers' green production behaviors, the potential adverse effects of excessive new media usage (e.g., mobile phones, computers), such as the proliferation of misinformation, warrant further investigation in subsequent studies.

6 Conclusion

With the progressive advancement of information technology, the use of publicity media has assumed an increasingly pivotal role in facilitating agricultural green development, emerging as a primary channel for farmers to access valuable green production information, enhance their ecological policy cognition, and inform decision-making processes regarding sustainable agricultural practices. Utilizing micro-level research data from 516 farmers across four cities and counties in Hainan Province, this study conducts an empirical analysis of the impacts of media utilization and ecological policy cognition on farmers' adoption of green production behaviors. The following conclusions were drawn:

Publicity media use significantly enhances farmers' green production behaviors. Both traditional and new media exert positive effects, with new media showing a stronger impact. Further, new media hardware and software both promote green behaviors, though software exerts a relatively stronger influence.

TABLE 5 Effect of new publicity media equipment use and software use on farmers' green production behaviors.

Variables	Model 8		Model 9	
	Green production behaviors		Green production behaviors	
	Regression coefficient	Standard error	Regression coefficient	Standard error
New publicity media device use	0.553***	0.180	–	–
New publicity media software use	–	–	0.671***	0.230
Log likelihood	–670.704		–671.203	
R ²	0.0506		0.0499	
Prob > chi2	0.0000		0.0000	
Control variables	Yes		Yes	
Sample	516		516	

*, **, And *** are significant at the 10, 5, and 1% levels, respectively, with standardized coefficients in parentheses.

TABLE 6 Heterogeneity analysis.

Variable	Model 10		Model 11		Model 12	
	Han Chinese	Ethnic minorities	Households with party members	Households without party members	Households with village cadres	Households without village cadres
Ecological policy cognition	1.031** (0.446)	1.964*** (0.635)	1.935*** (0.613)	0.948** (0.475)	1.913*** (0.589)	0.889* (0.460)
R ²	0.0655	0.0877	0.0870	0.0613	0.0942	0.0572
Prob > chi2	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Control variables	Yes	Yes	Yes	Yes	Yes	Yes
Sample	358	158	162	354	153	363

*, **, And *** are significant at the 10, 5, and 1% levels, respectively, with standardized coefficients in parentheses.

TABLE 7 Robustness tests.

Variable	Model 13		Model 14		Model 15	
	Green production behaviors		Ecological policy cognition		Green production behaviors	
	Regression coefficient	Regression coefficient	Regression coefficient	Regression coefficient	Regression coefficient	Regression coefficient
Publicity media use	0.216*** (0.048)	0.420*** (0.087)	0.252***(0.046)	0.462***(0.086)	0.178*** (0.049)	0.367*** (0.089)
Ecological policy cognition	–	–	–	–	0.744*** (0.207)	1.079*** (0.401)
R ²	0.0580	0.0649	0.0385	0.0401	0.0672	0.0709
Prob > chi2	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
New publicity media use	0.342*** (0.103)	0.578*** (0.197)	0.261*** (0.097)	0.370** (0.185)	0.296*** (0.104)	0.520*** (0.199)
Traditional publicity media use	0.213** (0.099)	0.481** (0.188)	0.216*** (0.093)	0.421** (0.175)	0.190* (0.099)	0.444** (0.190)
Ecological policy cognition	–	–	–	–	0.822*** (0.203)	1.295*** (0.395)
R ²	0.0542	0.0580	0.0348	0.0355	0.0658	0.0670
Prob > chi2	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Control variables	Yes	Yes	Yes	Yes	Yes	Yes
Sample	516	439	516	439	516	439

*, **, And *** are significant at the 10, 5, and 1% levels, respectively, with standardized coefficients in parentheses.

Ecological policy cognition positively and significantly affects farmers' green production behaviors, and mediates the relationship between publicity media use and such behaviors. Specifically, it mediates both traditional and new publicity media's impacts on green production behaviors, with a stronger mediating role in the traditional media path than in the new media path.

Heterogeneity analysis further reveals significant variations in the impact of ecological policy cognition on farmers' green production behavior adoption across key demographic groups. Specifically, the effect is more pronounced among ethnic minority farmers than Han Chinese counterparts. Similarly, farmer Party members exhibit a stronger response to ecological policy cognition than non-members. Additionally, households with village cadres experience a stronger influence of ecological policy cognition on green production adoption than those without.

Based on the empirical findings presented above, this study proposes the following policy recommendations:

Firstly, enhance the development of rural informatization infrastructure by continuously advancing the modernization of traditional rural information systems and further refining rural media communication mechanisms. Simultaneously, priority should be given to the development of rural informatization infrastructure, with particular emphasis on remote and impoverished rural areas as focal points for infrastructure enhancement, prioritize addressing issues of poor network connectivity and unstable signals, and prioritize the deployment of 4G/5G base stations, optical fiber broadband, and other basic network infrastructure. This approach necessitates increased investment in financial, human, and material resources to improve both the coverage rate of rural informatization infrastructure and the penetration rate of broadband networks.

Secondly, an integrated communication strategy should be developed by strategically combining traditional and new publicity

media, establishing a framework where traditional media serves as the primary channel, complemented by new media. This approach should be tailored to diverse farmer demographics to effectively disseminate and promote sustainable agricultural technologies. Concurrently, greater emphasis should be placed on leveraging new publicity media to enhance farmers' understanding of ecological policies and expand their access to agricultural information. Furthermore, it is imperative to regulate and improve the governance of online information dissemination systems, while rigorously combating the spread of false agricultural information through legal measures. These efforts aim to prevent misinformation from misleading farmers, thereby ensuring their access to accurate and reliable green production-related information. Thirdly, enhance promotional efforts and training programs regarding new media utilization to reduce accessibility barriers. Specifically, platforms should be established to facilitate farmers' acquisition of new media literacy, such as implementing "village-to-household" initiatives to disseminate knowledge and operational skills related to mobile devices and computers, training mobile apps like WeChat for policy dissemination.

Finally, building upon the heterogeneity analysis of farmer demographics, policymakers should implement differentiated policy measures to enhance ecological policy cognition among diverse farmer groups. It is crucial to comprehensively consider local informatization levels, economic development status, and farmers' individual circumstances when selecting appropriate policy interventions. Simultaneously, particular emphasis should be placed on the pivotal role of party members and village cadres in facilitating farmers' adoption of sustainable agricultural practices. The promotion department should facilitate party members and village cadres in assuming exemplary leadership roles by actively engaging with green

production policies and effectively disseminating this knowledge to surrounding farmers in a timely and accurate manner, thereby enhancing farmers' ecological policy cognition.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Author contributions

QD: Writing – original draft, Supervision, Data curation, Conceptualization, Project administration, Resources, Investigation, Funding acquisition, Validation. YZ: Writing – review & editing, Formal analysis, Visualization, Validation. QR: Validation, Writing – review & editing, Visualization. XT: Funding acquisition, Resources, Writing – review & editing, Data curation, Project administration, Investigation, Supervision, Methodology. SX: Investigation, Software, Methodology, Conceptualization, Visualization, Writing – original draft.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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