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The Influence of Social Norms and Environmental Regulations on Rural Households' Pesticide Packaging Waste Disposal Behavior

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Abstract: The agricultural ecological environment provides an important resource guarantee for social development. The extensive management mode of agriculture in China has not fundamentally changed; the contradiction between production and governance is still prominent, and the management of agricultural surface pollution has a long way to go. Based on the data from 572 rural households in Jiangxi province, this paper uses the Ordered Logit, 2SLS, and the moderation effect model to analyze the mechanism between social norms (SNs) and rural households' (RHs) disposal of pesticide packaging waste (PPW) and to test the moderation effect of environmental regulation (ER) in the influence path of SN to RHs' disposal of PPW. The results show that (1) descriptive norms and directive norms promote RHs not littering PPW; the probability of RHs not littering PPW increases by 4.0% for each unit decrease in descriptive norms, and the probability of RHs not littering PPW increases by 12.1% when there are directive norms, but the directive norms are more significant than the descriptive norms. Consistent conclusions were obtained after the robustness test and endogeneity treatment. (2) Reputational incentives strengthen the promotional effect of directive norms on RHs' behavior of not littering PPW; punitive regulations hinder the promotional effect of descriptive norms on RHs' behavior of not littering PPW. Based on the findings of the study, the following policy recommendations are put forward: Actively cultivate SNs and give full play to their role in promoting RHs' choice of the disposal behavior of PPW; improve the role of ER in regulating RHs' choice of the disposal behavior of PPW; guide the ER and SNs to work in coordination.

Keywords: pesticide packaging waste; social norms; environmental regulation; moderating effects

Citation: Zhang, Y.; Zhang, M.; Weng, Z.; Gao, X.; Liao, W. The Influence of Social Norms and Environmental Regulations on Rural Households' Pesticide Packaging Waste Disposal Behavior. *Sustainability* **2023**, *15*, 15938. https://doi.org/10.3390/su152215938

Academic Editors: Hyoungsuk Lee and Yongrok Choi

Received: 30 September 2023
Revised: 9 November 2023
Accepted: 10 November 2023
Published: 14 November 2023

1. Introduction

Amidst the escalating global demand for food, pesticides are frequently acknowledged as a vital component for enhancing agricultural production. Consequently, the global annual pesticide application rates have continuously increased [1]. As pesticide usage continues to expand over time, the accumulation of pesticide packaging waste (PPW) has emerged as an additional source of agricultural ecological pollution that warrants significant attention. Haphazardly discarded PPW exerts adverse effects on both the soil and water resources, thereby posing a threat to the agricultural ecological environment and restricting agricultural green development [2]. Simultaneously, PPW typically contains 2–5% residual pesticide liquid, which directly infiltrates aquatic systems or the soil environment upon disposal, posing additional risks to the environment and human health [3].

Efficiently mitigating pesticide packaging pollution has emerged as a shared global concern, prompting comprehensive explorations in developed and developing countries. The World Health Organization (WHO), the Food and Agriculture Organization of the

United Nations (FAO), and various international organizations assert that recycling PPW is imperative for safeguarding human health and environmental quality. It belongs to the pesticide product life cycle and is an important part of the pesticide industry, pesticide production and sale of enterprises, the government, and rural households (RHs) should bear the corresponding recycling responsibility and issued guidelines on the recycling of pesticide packaging waste [4]. Brazil's model of 'legislation + advocacy by pesticide industry associations + implementation by government non-profit organizations' serves as a representative case in developing countries. This model has significantly contributed to the recycling and disposal of PPW [5]. The European Union has initiated a pilot project to manage agricultural plastic packaging waste. They have employed institutional mechanisms to delineate the responsibilities of key stakeholders, coupled with mandatory legislation and a robust pesticide regulatory framework. This approach aims to prevent evasive practices in PPW management [6]. It is evident that various countries employ distinct approaches and programs for PPW recovery. However, effective collaboration among diverse stakeholders is pivotal to ensuring successful implementation. Consequently, motivating farmers, who play a crucial role in PPW recycling, and enhancing their enthusiasm for participation have become urgent solutions to address this real-world challenge.

The academic community has a rich body of research on recycling PPW. On a micro level, variations in PPW disposal practices among RHs are influenced by individual characteristics, including age [7], education [8], agricultural training [9], and economic expectations [10]. Therefore, it is crucial to tailor approaches based on the specific conditions of agricultural production and operation [11]. Endowment characteristics, such as the number of laborers, farming experience, and cultivated land area within RHs, also significantly impact PPW disposal behavior [12]. Simultaneously, the convenience and time invested in PPW disposal also influence the RHs' disposal behavior [13]. From an external perspective, some scholars have highlighted the substantial quantity of current PPW, emphasizing the alarming prevalence of haphazard disposal practices, which pose significant threats to rural environmental safety. This issue is exacerbated by the lack of precise enforcement of existing regulations and insufficient attention from environmental protection authorities, significantly contributing to the pollution problem [14,15]. Because recycling PPW by RHs generates positive externalities [16], offering subsidies to RHs has emerged as a relatively effective approach to encourage responsible disposal practices [5,17,18]. It is important to note that sociological scholars have examined RHs' PPW disposal behavior through the lens of SNs. They assert that SNs differ from obligatory legal mandates, representing a shared code of conduct that evolves over time through social interactions and practice. These norms play a significant role in informal systems [19]. When recycling PPW becomes a widely accepted norm among RHs, other community members will naturally follow suit [20,21]. Consequently, it is evident that RHs' behavior in managing PPW is influenced by various factors, either motivating or constraining their actions. Given the existing deficiencies in PPW disposal practices and the limited engagement of RHs in such behavior, there remains a need for a comprehensive exploration of these pertinent issues.

As a major producer and consumer of pesticides, China boasts extensive rural areas and a substantial rural population. The agricultural ecological environment supports rural development and is a crucial resource foundation for society. Statistically, China's annual agricultural production generates over 10 billion units of PPW, of which approximately 3 billion units are irresponsibly disposed of, resulting in a cumulative weight exceeding 100,000 tons [14,22]. Consequently, the Chinese government has introduced various policies and regulations to tackle the problem of PPW on an unprecedented scale. In 2018, the Soil Pollution Prevention and Control Law of the People's Republic of China, adopted during the Fifth Meeting of the Standing Committee of the Thirteenth National People's Congress, mandated that PPW must be entrusted to specialized institutions or organizations for safe disposal, thereby providing legal protection for PPW management. In 2020, the Ministry of Agriculture and Rural Affairs of China introduced the "Measures for the Administration of Recycling and Disposal of Pesticide Packaging Waste", which delineates the roles and responsibilities of pro-

ducers, operators, users, and government departments. These measures ensure the continuity, supervision, and effective management of recycling and treatment activities. Additionally, in 2021, the "Law of the People's Republic of China on the Promotion of Rural Revitalization" and the "14th Five-Year" Comprehensive Work Program for Energy Conservation and Emission Reduction underscored the obligation of governments at all levels and relevant departments to expedite the recycling and treatment of agricultural input packaging waste, including used agricultural films and pesticide containers. Nonetheless, the decentralized, concealed, and delayed characteristics of agricultural pollution necessitate a recognition that the existing policy of solely employing point source control is imperfect. Effective environmental protection demands not only governmental intervention but also widespread public engagement. RHs not only serve as the primary interface with the agricultural ecological environment but also stand as the direct beneficiaries of enhancements to this environment. Consequently, the solution to agricultural surface pollution at its root and the attainment of sustainable agricultural development can be achieved only through the regulation and guidance of RHs' production practices.

China's basic agricultural situation of "big country, small farmers" has led to a large quantity and wide distribution of PPW, making it more difficult for the government to recover and regulate the waste. At the same time, RHs, as rational economic beings, usually make production decisions based on the pursuit of profit and aversion to loss. Therefore, the designation of ERs should not only consider the normative nature but also combine with the needs of RHs; otherwise, it will lead to ineffective policy constraints [23]. It can be seen that the formal system can only play a better role in re-straining and guiding if it is compatible with the rural social environment and the behavioral preferences of RHs [24]. Rural China is a typical humane society, and the informal system represented by SNs can not only directly urge RHs to rationally dispose of PPW but also internalize personal norms and indirectly influence RHs' behavioral choices, which, to a certain extent, has a complementary effect with the formal system. Therefore, this paper studies the mechanism of SNs and ERs on the disposal behavior of PPW, which has great practical significance in exploring the long-term mechanism of PPW disposal.

2. Theoretical Analysis and Research Hypothesis

2.1. The Influence of Social Norms on Rural Households' Disposal of Pesticide Packaging Waste

Social norms (SNs) refer to the shared behavioral guidelines within a specific social group that evolve through social interactions [25]. They establish a sense of obligation among individuals to engage in particular actions due to their directive and constraining influences [26]. These norms encapsulate the common behaviors exhibited by the majority within a social group and involve informal oversight and guidance from fellow group members, encompassing both descriptive and directive norms [23]. According to SNs theory, individuals tend to conform to the established SNs within their respective groups, and those who deviate from these norms, whether written or unwritten, may risk exclusion or even expulsion from the group [27]. The influence of SNs on RHs' disposal of PPW primarily operates through the guidance of values, the internalization of social interactions, and the imposition of behavioral constraints.

In terms of descriptive norms, in the social group in which RHs live, the behavior of those around them creates an invisible social pressure on themselves, creating an implicit constraint. RHs strive to maintain a positive reputation within their community, and, at times, individuals emulate the behaviors of others, aligning themselves with prevalent practices [28]. The disposal of PPW carries quasi-public, negative externalities. When the behaviors, perceptions, and expectations of fellow social network members in an RH's environment lean toward favoring proper disposal practices, the RH adopts these as benchmarks, reshaping their value orientation to align with this shared standard.

Directive norms, functioning as a form of soft constraint mechanism, are upheld through informal sanctions that serve to supervise and guide behavior contravening public interests and standards. In the context of PPW disposal, when a consensus emerges within a social group that disposal practices should be adhered to, RHs anticipate moral con-

demnation, public opinion pressure, and group sanctions for contravening this communal agreement. This expectation is a deterrent against non-compliance with the established norms [29], encouraging RHs to engage in PPW disposal. Based on this, this paper posits the following research hypothesis:

H1: *Descriptive norms positively influence RHs' PPW disposal behavior; the less there is littering of pesticide packaging in villages, the higher the likelihood is that RHs will dispose of PPW.*

H2: *Directive norms positively influence RHs' PPW disposal behavior; there is a higher likelihood that RHs will dispose of PPW when the surrounding population is blamed for the phenomenon of littering.*

2.2. The Moderating Effect of Environmental Regulation on the Relationship between Social Norms and RHs' PPW Disposal Behavior

Despite the enormous socio-ecological benefits of PPW recycling, the private benefits to RHs are minimal and difficult to quantify. Informal constraints of SNs lack the mandatory nature of laws and regulations and cannot compensate for the opportunity costs of recycling behavior, making it difficult to achieve the desired results independently. It needs to be complemented with the formal regulations formulated by the government, through supervision and punishment to restrain RHs from violating the regulation or through economic and material subsidies to bring benefits to RHs, to mobilize their enthusiasm, and to solve the problem of positive externalities in the recycling of PPW. ER refers to government-issued administrative directives, such as subsidies and penalties, aimed at directly intervening in environmental resources. These measures act as incentives or constraints on RHs' production behaviors to enhance the environmental quality [30].

In practice, regulating and penalizing PPW disposal is challenging. Therefore, governments and village collectives often resort to incentive-based strategies to motivate RHs. This paper references the work of Fannie Li and Junbiao Zhang, which categorizes incentive regulations into economic and reputational incentives, and examines their impact on PPW disposal behavior [31]. Based on the preceding analysis, it becomes evident that SNs deter the littering of PPW by altering RHs' perceptions. Economic incentives, achieved through subsidies, reduce the financial burden associated with recycling PPW. They also reshape RHs' perceptions by mitigating the belief that disposing of such waste incurs a loss of leisure time or opportunity cost, thereby enhancing the effectiveness of SNs [32]. Simultaneously, RHs entrenched in long-term agricultural practices find it challenging to alter their habits swiftly. Depending solely on informal constraints is generally anticipated to yield limited efficacy; thus, economic incentives serve to complement the absence of SNs [21]. It is essential to note that SNs and economic incentives are interlinked; RHs operate within the confines of SNs while also being influenced by subsidies and incentives. This interaction yields a moderation effect, significantly enhancing RHs' adherence to PPW disposal practices. Based on this, this paper posits the following research hypothesis:

H3: *Economic incentives play a positive moderating role in descriptive norms influencing PPW disposal behavior.*

H4: *Economic incentives play a positive moderating role in directive norms influencing PPW disposal behavior.*

Reputation encompasses the assessment of an individual by a social group and the attributes and traits attributed to that individual, representing a form of ideological capital. According to the theory of reputation utility, a positive reputation can augment the level of respect that an individual receives, facilitating the development of favorable interpersonal relations—a pursuit intrinsic to individuals [33]. In rural Chinese society, interpersonal dynamics heavily rely on exchanging favors, the concept of 'face', and cultivating relational networks. As such, RHs' behavior considerations extend beyond mere economic rationality; they also encompass social rationality, driven by the pursuit of social respect and self-worth satisfaction [34]. RHs' PPW disposal behaviors are deeply embedded within intricate social

networks. While RHs adhere to SNs and earn recognition within their immediate social circles, reputation incentive policies allow individuals to garner official recognition and reputation assessment at the governmental level. This satisfies RHs' elevated aspirations for honor, influence, and prestige within their communities and enriches their spiritual well-being. Simultaneously, a high reputation evaluation confers official acknowledgment and reputation appraisal, while deviating from socially accepted behavioral norms can result in substantial penalties and losses [35]. Consequently, individuals are more inclined to adhere to SNs and engage in PPW disposal behavior. Based on this, this paper postulates the following research hypothesis:

H5: *Reputational incentives play a positive moderating role in descriptive norms influencing pesticide the packaging waste disposal behavior.*

H6: *Reputational incentives play a positive moderating role in the process of directive norms influencing pesticide packaging waste disposal behavior.*

The regulatory impact of SNs and punitive regulations has dual aspects [24]. On the one hand, when RHs deviate from the practice of not littering PPW, directive norms gain credibility through government regulations [36]. According to rational choice theory, when the economic and social costs of littering PPW increase, the likelihood of RHs adopting proper disposal behaviors increases [32]. On the other hand, when RHs have limited ecological awareness, implementing recycling practices to avoid penalties becomes labor- and time-intensive, leading to resistance. Moreover, strict punitive regulations may foster a culture of evasion among RHs, undermining social reciprocity and trust within groups, thereby partially diminishing the positive impact of descriptive norms [36]. Based on these considerations, this paper proposes the following research hypothesis:

H7: *Penalty regulation plays a negative moderating role in descriptive norms influencing pesticide packaging waste disposal behavior.*

H8: *Penalty regulation plays a positive moderating role in the process of directive norms influencing pesticide packaging waste disposal behavior.*

3. Research Design

3.1. Source of Data Collection

The microdata for this study were sourced from a survey conducted in July 2021 to assess the implementation of the "Twenty Character Guidelines" associated with the Rural Revitalization Strategy within Jiangxi Province, China. The reasons for choosing Jiangxi Province in China as the sample area are: first, Jiangxi Province is the main rice-producing province in China's Yangtze River Basin, with the third highest rice production in the country, but also faces serious rural ecological and environmental pollution problems, and is one of the provinces with the highest intensity of agricultural carbon emissions in China [37]; second, Jiangxi is the only province in China that is both a national ecological civilization pilot area and a national pilot of the mechanism for realizing the value of ecological products, which is rich in ERs; third, Jiangxi was a pilot province of the rural cooperative movement in the Republic of China, which lasted for a long time, and the "culture of relationship" remains strong in Jiangxi's rural areas, and the role of SNs is highly significant. The research is divided into two stages. In the first stage, a pre-survey was conducted in Nanchang County, where 10 RHs were randomly selected for interviews, and the questionnaire design was further improved according to the interviews. In the second stage, a combination of stratified and random sampling was used. Firstly, 100 counties and municipalities in Jiangxi Province were divided into four levels according to the per capita GDP. Based on geographical location, one sample county was taken from each of the four levels located in the east, west, south, and north of Jiangxi Province: Fuliang County, Yudu County, Luxi County, and Xiushui County. Then, the main food-producing

counties were expanded to the sample size, and based on the economic level, at the four levels, Jinggangshan City, Jishui County, Gao'an City, and Wanzai County were sampled, respectively. The distribution of sample counties drawn by ArcGIS is shown in Figure 1. Secondly, purposive sampling was used in each county to measure the four dimensions of industrial prosperity, ecological livability, effective governance, and rural civilization, and two sample villages with strong characteristics were selected in each dimension, thus making the sampled villages highly heterogeneous and further ensuring the representativeness of the samples. Finally, 10 RHs were randomly selected in each village group for questionnaire surveys and structured interviews, mainly to obtain basic information about the villages and the household production and life information of the interviewed RHs. A total of 650 questionnaires were distributed, and 650 were returned. After excluding inconsistent questionnaires and questionnaires with missing key variables, 572 valid samples were obtained, with a questionnaire validity rate of 88%.

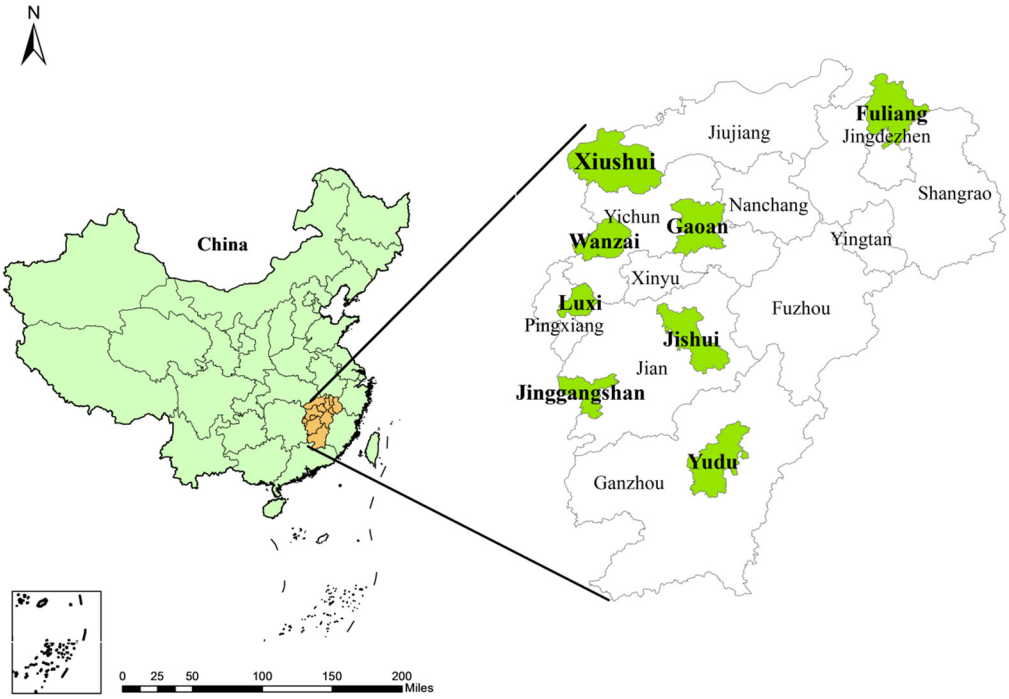

Figure 1. Map of eight pilot cities selected in this study. The map data in Figure 1 are from DataV. GeoAtlas. https://datav.aliyun.com/portal/school/atlas/area_selector. "URL (accessed on 9 November 2023)".

3.2. Choice Experiment Method

3.2.1. Benchmark Regression

In this section, an Ordered Logit model is employed to examine the relationship between SNs and PPW disposal behavior. It is important to highlight that the dependent variable, PPW disposal behavior, is an ordered discrete choice variable. Consequently, it is analyzed utilizing an ordered choice model, refer to existing research [38], structured in the following functional form:

$$\text{Behavior}_i^* = \alpha_0 + \alpha_1 \text{norm}_i + \alpha_i \text{Control}_i + \mu_i, i = 1,2,3 \quad (1)$$

$$\text{Behavior}_i = \begin{cases} 1, & \text{Behavior}_i \le r_1 \\ 2, & r_1 < \text{Behavior}_i \le r_1 \\ 3, & \text{Behavior}_i > r_2 \end{cases} \quad (2)$$

Within this context, $Behavior_i$ represents the latent construct associated with PPW disposal behavior. r_1, r_2, and r_3 are the intercepts, which satisfy $r_1 < r_2 < r_3$, $norm_i$ encompass the descriptive and directive norms, respectively. $Control_i$ encompasses the pivotal control variables influencing PPW disposal behavior, including household head characteristics, family characteristics, agricultural management characteristics, and village-related variables. Lastly, μ_i accounts for the random error term.

In the Ordered Logit model, the probabilities of $Behavior_i = 1, 2, 3$ are as follows:

$$\begin{aligned} P(Behavior_i = 1|norm_i) &= P(\alpha_1 norm_i + \mu_i \le r_1|norm_i) = \Phi(r_1 - \alpha_1 norm_i) \\ P(Behavior_i = 2|norm_i) &= P(r_1 < \alpha_1 norm_i + \mu_i \le r_2|norm_i) = \Phi(r_2 - \alpha_1 norm_i) - \Phi(r_1 - \alpha_1 norm_i) \\ P(Behavior_i = 3|norm_i) &= P(\alpha_1 norm_i + \mu_i > r_2|norm_i) = 1 - \Phi(r_1 - \alpha_1 norm_i) \end{aligned} \quad (3)$$

The calculation of the marginal effect of the PPW disposal behavior is as follows:

$$\frac{\vartheta P(Behavior_i = 1)}{\vartheta norm_i} = -\phi(r_1 - \alpha_1 norm_i)\alpha_1$$

$$\frac{\vartheta P(Behavior_i = 2)}{\vartheta norm_i} = -\phi(r_2 - \alpha_1 norm_i)\alpha_1$$

$$\frac{\vartheta P(Behavior_i = 3)}{\vartheta norm_i} = \phi(r_2 - \alpha_1 norm_i)\alpha_1 \quad (4)$$

In Equation (3), $\Phi(\bullet)$ represents the standard normal distribution function, while $\phi(\bullet)$ represents the probability density function.

3.2.2. Examining Moderation Effects

To understand how SNs influence the PPW disposal behavior, we introduce an interaction term involving ER into the model. With regard to existing research [39], the functional form is expressed as follows:

$$Behavior_i^* = \alpha_0 + \alpha_1 norm_i + \alpha_2 regulation_i + \alpha_3 norm_i \times regulation_i + \alpha_i Control_i + \mu_i, i = 1,2,3 \quad (5)$$

In this context, $norm_i \times regulation_i$ represents the interaction between SNs and environmental regulation. Based on the interaction term modeling implications, the bias derivation of $norm_i$ in Equation (5) is performed:

$$\frac{\partial Behavior_i^*}{\partial norm_i} = \alpha_1 + \alpha_3 regulation_i \quad (6)$$

Analyzing the outcomes of Equation (6), we observe that environmental regulation moderates the impact of SNs on the farmer i's PPW disposal behavior. When α_1 and α_3 share the same sign, it signifies that environmental regulation positively moderates the influence of SNs on RHs' PPW disposal behavior. Conversely, when α_1 and α_3 have opposite signs, this indicates that environmental regulation negatively moderates the influence of SNs on the RHs' PPW disposal behavior.

3.3. Variable Selection

Dependent variable: pesticide packaging waste (PPW) disposal behavior. PPW disposal behavior was assessed by questioning the interviewed RHs. Responses were categorized as follows: "often littering" (assigned a value of 1), "occasionally littering" (assigned a value of 2), and "never littering" (assigned a value of 3). A lower numerical value indicates a more severe PPW disposal behavior.

Core explanatory variable: social norms (SNs). Descriptive norms were assessed using the following query: "To what extent is the phenomenon of pesticide packaging littering the fields in your village?" Descriptive norms were quantified and subsequently classified into five levels based on respondents' actual answers, specifically, "very serious",

"relatively serious", "average", "relatively light", and "very light", which corresponded to the numerical scale of 1–5. Directive norms were gauged through the question: "Will others hold individuals accountable for leaving pesticide packaging in the field?" Respondents who answered "yes" were assigned a value of 1, whereas those who responded with "no" were assigned a value of 0.

Moderating variable: environmental regulation. Economic incentives were measured using the question: "Do villagers receive economic rewards for active participation in environmental remediation?" Reputational incentives were assessed with the question: "Are villagers awarded honorary titles for their active participation?" Additionally, financial penalties were measured by inquiring: "Is there a financial penalty for villagers who do not participate effectively?" A "yes" response to the questions above was assigned a numerical value of 1, while a "no" response received a value of 0.

Control variables. To minimize the estimation bias, we introduced control variables encompassing the characteristics of household heads (age, education level, health level, and whether the village cadres), family characteristics (business scale, part-time involvement, happiness), agricultural management characteristics (land transfer, socialized service, total number of plots, and plot distance) and factors related to the village (cultivated land area of the village group, cultivated land quality, and village topography) that may have an impact on the PPW disposal behavior. Detailed information about the variables incorporated into the model and their descriptive statistics is available in Table 1.

Table 1. Variable definition and descriptive analysis.

Variable Type		Variable Meaning and Assignment	Average Value	Standard Deviation
Dependent variable: pesticide packaging waste disposal behavior		Pesticide packaging waste littering scale: 1 = frequently littered, 2 = occasionally littered, 3 = never littered.	2.691	0.565
Core explanatory variable: Social norms	Descriptive norms	Extent of pesticide packaging litter in village fields: 1 = very serious, 2 = serious, 3 = average, 4 = minor, 5 = very minor.	4.267	0.915
	Directive norms	Social blame for abandoned pesticide packages: 0 = No, 1 = Yes.	0.622	0.485
Incentive regulation	Moderating variable: economic incentives	Environmental regulation: Are villagers given financial incentives for good participation? 0 = No, 1 = Yes	0.302	0.460
	Reputational incentives	Financial incentives for villager participation: 0 = No, 1 = Yes.	0.441	0.497
Penalize regulation	Financial penalties	Financial penalties for villagers with subpar participation: 0 = No, 1 = Yes.	0.252	0.434
Instrumental variable: Neighborly relations		1 = very poor, 2 = poor, 3 = fair, 4 = good, 5 = very good.	3.997	0.739

Table 1. *Cont.*

Variable Type		Variable Meaning and Assignment	Average Value	Standard Deviation
Control variables				
Characteristics of household heads	Age	Based on empirical survey data (Years).	53.736	14.423
	Education level	Educational attainment categories: 1 = elementary school and below, 2 = junior high school, 3 = high school/middle school/technical school, 4 = university college, 5 = bachelor's degree and above.	1.774	0.930
	Health level	1 = very unhealthy, 2 = unhealthy, 3 = fair, 4 = healthy, 5 = very healthy	3.659	0.982
	Whether the village cadres	0 = No, 1 = Yes.	0.157	0.364
Family characteristics	Business scale	Based on empirical survey data (hectares).	0.342	1.038
	Part-time involvement	Non-farm labor force/labor force (%)	0.154	0.279
	Happiness	Happiness rating scale: 1 = very unhappy, 2 = unhappy, 3 = average, 4 = happy, 5 = very happy.	4.222	0.858
Agricultural management characteristics	Land transfer	Whether your family transfers other people's land? 0 = No, 1 = Yes.	0.129	0.336
	Socialized service	Whether socialized services are used for drug injection? 0 = no, 1 = yes.	0.082	0.275
	Total number of plots	According to the actual survey data.	3.337	3.705
	Plot distance	The longest distance between plots. (km)	0.647	0.973
Factors related to the village	The cultivated land area of the village group	Based on empirical survey data (hectares).	84.914	73.861
	Cultivated land quality	Arable land fertility assessment: 1 = very poor, 2 = poor, 3 = fair, 4 = good, 5 = very good.	3.816	0.845
	Mountainous terrain (plains reference)	0 = no, 1 = yes.	0.367	0.482
	Hilly terrain (plains reference)	0 = no, 1 = yes.	0.544	0.499

4. Results and Discussion

4.1. Direct Influence of Social Norms on Pesticide Packaging Waste Disposal Behavior

The estimation results of the Ordered Logit model are shown in Table 2. In Model 1, the *p*-values all passed the 1% significance test, indicating that the model selection is appropriate. It can also be seen from Model 1 that the regression coefficients of descriptive norms and directive norms on PPW littering are positively significant at 5% and 1% levels, respectively. This indicates that, as descriptive norms increase, RHs are more likely to refrain from littering PPW and that the likelihood that RHs will refrain from littering PPW is higher in the presence of directive norms. This result is consistent with the findings of many current studies [40,41], while hypotheses H1 and H2 were verified.

Table 2. Benchmark regression results of social norms on the treatment of pesticide packaging waste.

	Model 1
Descriptive norms	0.285 ** (0.121)
Directive norms	0.859 *** (0.221)
Age	−0.024 ** (0.009)
Education level	−0.311 ** (0.128)
Health level	0.219 * (0.115)
Whether the village cadres	1.643 *** (0.420)
Business scale	0.059 (0.114)
Part-time involvement	0.102 (0.396)
Happiness	−0.407 *** (0.136)
Land transfer	−0.970 *** (0.314)
Socialized service	1.568 *** (0.585)
Total number of plots	−0.085 ** (0.039)
Plot distance	−0.311 ** (0.131)
The cultivated land area of the village group	−0.004 *** (0.001)
Cultivated land quality	0.389 *** (0.154)
Mountainous terrain (plains reference)	−0.015 (0.439)
Hilly terrain (plains reference)	−0.570 (0.393)
Prob > chi2	0.000
R^2	0.211
Observations	572

Note: Significance levels are represented as *, **, and ***, indicating statistical significance at the 10%, 5%, and 1% levels, respectively. Standard errors are provided in parentheses for reference.

It is important to note that, in the context of the nonlinear model, the regression coefficients do not inherently represent the marginal effects of the parameters. To provide a more accurate assessment of the variables' impact on RHs' PPW disposal behavior, we analyzed the estimated coefficients for each parameter in Model 1. The resulting marginal effects are presented in Table 3. Both descriptive and directive norms substantially and positively impact RHs' PPW disposal behavior. Specifically, for each unit decrease in the incidence of village pesticide packaging littering in the field, the likelihood of RHs refraining from littering PPW increases by 4.0%. Conversely, the probabilities of frequent and occasional littering decreased by 1.1% and 2.9%, respectively. When the surrounding people blamed the phenomenon of pesticide packaging disposal in the field, the probability of RHs refraining from littering PPW increased by 12.1%. Simultaneously, the probabilities of occasional littering and frequent littering decreased by 2.9% and 8.7%, respectively. One possible explanation for this phenomenon is the RHs' limited educational background, which often results in a lack of cognitive and behavioral understanding of ecological protection. Additionally, they commonly assume that the majority's behavior is appropriate. Consequently, when RHs observe those in their vicinity refraining from littering PPW, they are inclined to mimic this conduct to cultivate a positive self-image through conformity with SNs. This tendency can be attributed to herd mentality. Rural China is characterized by relatively closed social dynamics, marked by a pattern of interpersonal relations often described as "head up, no see, head down, see". Within this context, RHs emphasize the goodwill and recognition of their immediate social circles. They actively work to enhance their reputation by earning favorable evaluations from others. This behavior stems from their desire to avoid the social isolation resulting from non-compliance with group standards, which compels them to conform and "fit in". In summary, the necessity to evade social isolation due to deviations from group norms compels farmers to align with the majority's opinion. Consequently, directive norms are pivotal in encouraging farmers not to litter pesticide packaging waste.

Table 3. The marginal effect of social norms on the treatment of pesticide packaging waste.

Variable	Model 2 Often Littering	Model 3 Occasional Littering	Model 4 Never Littered
Descriptive norms	−0.011 ** (0.005)	−0.029 ** (0.012)	0.040 ** (0.017)
Directive norms	−0.029 *** (0.012)	−0.087 *** (0.022)	0.121 *** (0.030)
Age	0.001 ** (0.0003)	0.002 *** (0.001)	−0.003 *** (0.001)
Education level	0.012 ** (0.005)	0.032 ** (0.013)	−0.044 ** (0.018)
Health	−0.009 * (0.005)	−0.022 * (0.012)	0.031 * (0.016)
Whether the village cadres	−0.065 *** (0.019)	−0.169 *** (0.041)	0.232 *** (0.057)
Business scale	−0.002 (0.004)	−0.006 (0.012)	0.009 (0.016)
Part-time involvement	−0.004 (0.016)	−0.010 (0.040)	0.014 (0.056)
Happiness	0.016 *** (0.006)	0.042 *** (0.014)	−0.058 *** (0.019)
Land transfer	0.038 *** (0.013)	0.099 *** (0.032)	−0.137 *** (0.043)
Socialized service	−0.062 *** (0.025)	−0.159 *** (0.060)	0.221 *** (0.081)
Total number of plots	0.003 ** (0.002)	0.009 ** (0.004)	−0.012 ** (0.005)
Plot distance	0.012 ** (0.005)	0.032 ** (0.013)	−0.044 ** (0.018)
The cultivated land area of the village group	0.0002 *** (0.0001)	0.0004 *** (0.0001)	−0.0006 *** (0.0002)
Cultivated land quality	−0.015 ** (0.006)	−0.040 *** (0.015)	0.055 ** (0.021)
Mountainous terrain (plains reference)	0.001 (0.017)	0.002 (0.045)	−0.002 (0.062)
Hilly terrain (plains reference)	0.023 (0.016)	0.058 (0.040)	−0.080 (0.055)
Observations	572	572	572

Note: *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively; the numbers reported before the * sign are the marginal effects of the explanatory variables in the Ordered Logit model, and standard errors are in parentheses.

Further analysis reveals that the impact of surrounding group supervision (directive norms) on RHs' tendency to refrain from littering PPW is more significant compared to the influence of the surrounding group's behavior (descriptive norms). This observation suggests that, for RHs, the perception of the surrounding group carries greater informative weight than the group's actual conduct. This is different from the conclusion of Niemiec R M's research [42], and the possible reasons are: on the one hand, rural China is characterized by a strong sense of community. RHs with long-established roots in a specific area typically have limited social networks that predominantly consist of interactions with relatives and friends. For these RHs, maintaining social capital by garnering recognition and respect from their community takes precedence over other considerations. On the other hand, RHs tend to adhere to more conservative thought patterns deeply influenced by traditional Confucianism, which places significant emphasis on group orientation and interpersonal relationships. This profound influence extends to daily behavior, where most of the population's value judgments serve as a critical code of conduct.

4.2. Robustness Tests

In order to further verify the robustness of the regression results, this study employs a technique involving the substitution of the dependent variable and constraining sample characteristics for conducting a robustness test. The outcomes of this test are presented in Table 4.

Replace the dependent variable. Based on the distribution of dependent variable scores, we categorized 1-point and 2-point samples as the "littering" group, assigning them a value of 0. Conversely, 3-point samples were categorized as the "not littering" group, assigned a value of 1, creating the new dependent variable "Whether to litter pesticide packaging waste". This new dependent variable was employed in a binary logit model regression, and the regression outcomes are presented in Model 5. Overall, the estimation results of the binary logit model exhibit substantial consistency with those of the ordered logit model, confirming the robustness of the research findings.

Restriction of sample characteristics. An advanced age among RHs may limit their active involvement in agricultural production. Consequently, individuals aged over 65 are excluded from the sample. Subsequently, while controlling for the household head, family, agricultural management, and village characteristics, the Ordered Logit regression is re-executed, and the outcomes are presented in Model 6 within Table 4. The regression results in Model 6 closely align with those obtained from the full sample, underscoring the robustness of the study's findings.

Table 4. Results of the robustness test on the disposal of pesticide packaging waste by social norms.

Variable	Whether to Litter Pesticide Packaging Waste Model 5	Pesticide Packaging Waste Disposal Behavior Model 6
Descriptive norms	0.224 * (0.130)	0.274 * (0.148)
Directive norms	0.734 ** (0.231)	0.830 ** (0.268)
Age	−0.013 (0.009)	0.003 (0.013)
Education level	−0.293 ** (0.136)	−0.229 (0.147)
Health	0.270 ** (0.125)	0.254 * (0.139)
Whether the village cadres	1.672 *** (0.432)	2.202 *** (0.578)
Business scale	0.117 (0.144)	0.014 (0.119)
Part-time involvement	0.125 (0.425)	−0.260 (0.436)
Happiness	−0.368 *** (0.140)	−0.574 *** (0.192)
Land transfer	−1.088 *** (0.346)	−1.027 *** (0.374)
Socialized service	1.701 *** (0.621)	1.686 ** (0.675)
Total number of plots	−0.166 *** (0.051)	−0.103 ** (0.044)
Plot distance	−0.281 ** (0.149)	−0.188 (0.163)
The cultivated land area of the village group	−0.006 *** (0.002)	−0.005 *** (0.002)
Cultivated land quality	0.400 ** (0.162)	0.381 ** (0.194)
Mountainous terrain (plains reference)	−0.084 (0.470)	0.212 (0.528)
Hilly terrain (plains reference)	−0.538 (0.424)	−0.712 (0.462)
Prob > chi2	0.000	0.000
R^2	0.256	0.250
Observations	572	572

Note: Significance levels are represented as *, **, and ***, indicating statistical significance at the 10%, 5%, and 1% levels, respectively. Standard errors are provided in parentheses for reference.

4.3. Endogenous Treatment

Within the context of a rural community characterized by close-knit relationships, the disposal of PPW and monitoring behaviors are not random occurrences. Individual actions are apt to shape the behavioral choices of other community members, potentially introducing endogeneity issues into the baseline regression. To address this concern, we have employed "neighborhood" as an instrumental variable for SNs. There are several compelling justifications for the suitability of instrumental variables. Firstly, macro-level neighborhoods are highly exogenous to RHs' disposal of PPW. Secondly, neighborhoods exhibit a robust correlation with both descriptive and directive norms. Furthermore, the stronger the emotional connection among RHs, their willingness to engage in collectively and authentically advantageous actions increases. The preceding study employed an Ordered Logit model to assess the impact of SNs on PPW disposal behavior. However, due to technical feasibility constraints, it was not feasible to directly estimate this effect using the instrumental variables method for the ordered regression model. Consequently, this paper employs the two stage least squares (2SLS) method to tackle potential endogeneity in the model.

Table 5 presents the estimation results obtained through 2SLS. Prior to conducting the 2SLS estimation of the model, the Hausman test was performed. This test yields two measures of endogeneity assessment: the *p*-value of Durbin (score) and the Wu–

Hausman test, which stand at 0.038 and 0.041, respectively. These results signify that both descriptive and directive norms are deemed endogenous explanatory variables at the 5 percent significance level, thus validating the necessity for 2SLS estimation. In assessing weak instrumental variables, the descriptive norm's Shea's Partial R^2 is less than 0.03, while the one-stage F-value stands at 10.664, surpassing the critical value of 10. Similarly, for the directive norm, Shea's Partial R^2 is under 0.04; however, the one-stage F-value is 21.175, also exceeding the critical value of 10. Therefore, we reject the initial hypothesis of the existence of weak instrumental variables. In the first-stage regression results of the 2SLS estimation, it is evident that neighborhood relationships reduce PPW littering among community members and enhance the likelihood of oversight by others. In the subsequent second-stage regression, the coefficients for descriptive and directive norms are significantly positive, consistent with the baseline regression results, affirming their significance even after addressing the endogeneity issue.

Table 5. Estimation results of endogenous processing (2SLS method).

Variant	Model 7 Descriptive Norms		Model 8 Directive Norms	
	First Phase	Second Phase	First Phase	Second Phase
Descriptive norms		0.352 ** (0.179)		
Directive norms				0.658 ** (0.285)
Instrumental variable:				
Neighborly relations	0.198 *** (0.061)		0.119 *** (0.026)	
Control variables	Containment		Containment	
Shea's partial R^2	0.029		0.032	
Phase I F-value	10.664		21.175	
Durbin (score) test *p*-value	0.038		0.038	
Wu–Hausman test *p*-value	0.041		0.041	
Observations	572		572	

Note: Significance levels are represented as ** and ***, indicating statistical significance at the 5% and 1% levels, respectively. Standard errors are provided in parentheses for reference.

4.4. Moderation Effects Test

To test the moderating role of environmental regulation in the role path of SNs and PPW disposal behavior, this study conducts a mechanistic examination by introducing interaction terms involving two regulatory factors: incentive regulation and penalty regulation, in conjunction with SNs, into the initial model. The test outcomes are presented in Table 6.

Firstly, we examine the moderation effect of economic incentives on the relationship between descriptive norms and PPW disposal behavior. As demonstrated in Model 9 of Table 6, descriptive norms exhibit a significant positive impact on PPW disposal behavior. However, the coefficients related to incentive regulation and the interaction term are non-significant. This indicates the non-moderating effect of economic incentives in the pathway between descriptive norms and PPW disposal behavior and rejects Hypothesis H3. One plausible explanation is that, when RHs opt for PPW recycling, it results in an increased labor input and higher production costs. Given the current state of imperfect incentive regulation, the rewards offered primarily consist of low-value household items, which fail to offset the heightened capital investments made by RHs. So, there is no moderating effect of incentive regulation.

Secondly, we examine the moderation effect of economic incentives on the relationship between directive norms and the PPW disposal behavior. As demonstrated in Model 10 of Table 6, upon introducing the moderating term for directive norms and economic incentives, directive norms exhibit a significant positive influence on the PPW disposal behavior. However, the coefficient of economic incentives and the interaction term is non-significant, suggesting the absence of a moderation effect of economic incentives in the pathway between directive norms and PPW disposal behavior, thereby leading to

the rejection of Hypothesis H4. One plausible explanation for this phenomenon is that economic incentives, primarily targeting individual RHs by offering financial rewards to those who refrain from littering PPW or engage in recycling, typically do not extend rewards to the social group responsible for monitoring activities. This lack of incentive fails to motivate the social group to engage in monitoring, thus negating any moderation effect.

Table 6. Estimation results of endogenous processing (2SLS method).

	Incentive Regulation				**Penalize Regulation**	
	Economic Incentives		**Reputational Incentives**		**Financial Penalties**	
	Model 9	**Model 10**	**Model 11**	**Model 12**	**Model 13**	**Model 14**
Descriptive norms	0.031 * (0.018)		0.028(0.018)		0.058 *** (0.019)	
Directive norms		0.122 *** (0.034)		0.070 ** (0.034)		0.102 *** (0.034)
Economic incentives	−0.025 (0.177)	0.088 (0.055)				
Reputational incentives			0.087 (0.156)	0.102 ** (0.050)		
Financial penalties					0.332 ** (0.161)	−0.009 (0.059)
Descriptive norms * Economic incentives	0.026 (0.041)					
Directive norms * economic incentives		−0.009 (0.075)				
Descriptive norms * Reputational incentives			0.020 (0.037)			
Directive norms * reputational incentives				0.115 * (0.069)		
Descriptive norms * financial penalties					−0.073 * (0.038)	
Directive norms * financial penalties						0.078 (0.077)
Control variables	Containment	Containment	Containment	Containment	Containment	Containment
Prob > chi2	0.000	0.000	0.000	0.000	0.000	0.000
PseudoR2	0.218	0.217	0.242	0.245	0.217	0.213
Observations	572	572	572	572	572	572

Note: *, **, *** indicate significance at the levels of 10%, 5%, and 1%, respectively. The figures reported before the * are the marginal effects of each explanatory variable in the Ordered Logit model when the pesticide packaging waste treatment "behavior = 3" and the standard error in parentheses.

Thirdly, we explore the moderation effect of reputation incentives on the relationship between descriptive norms and the PPW disposal behavior. As evident from Model 11 in Table 6, upon introducing the moderating terms, descriptive norms, reputation incentives, and interaction terms, none of these variables exhibit statistical significance. This suggests the absence of a moderation effect of reputation incentives in the context of descriptive norms and PPW disposal behavior, leading to the rejection of the Hypothesis H5. One plausible explanation for this phenomenon is that honorary titles are typically conferred upon individuals exhibiting exceptional behavior, primarily those engaged in large-scale farming activities. When the broader social group demonstrates a tendency not to litter PPW, it becomes challenging for small-scale RHs to emulate this behavior and consequently receive rewards. Moreover, in rural societies where small-scale RHs predominate, reputation incentives struggle to influence the behavior of the majority of RHs, leading to the absence of a moderation effect.

Fourthly, we explore the moderation impact of reputational incentives on the relationship between directive norms and PPW disposal behavior. As demonstrated in Model 12 of Table 6, directive norms exhibit a significant positive influence on the PPW disposal behavior, and reputational incentives also demonstrate a significant positive effect on this behavior. Additionally, the coefficients associated with the moderating terms of directive norms and reputational incentives are positive and statistically significant. This suggests that reputational incentives enhance the promotional effect of directive norms on RHs, encouraging them not to litter PPW, thereby confirming Hypothesis H6. It has been argued that, when village regulations include incentive policies, i.e., praising RHs for their waste resource utilization behaviors, so that RHs understand the implicit benefits of an improved reputation and status, their willingness to utilize waste resources will subsequently increase [43], and thus regulatory provisions only need to be synergistic with incentive

policies in order to play a better effect of [30], which coincides with the findings of this paper. Rural China embodies a quintessential acquaintances-based society. Following RHs' adherence to directive norms and the ensuing benefits derived from informal communication, the honorary titles conferred by grassroots governance entities serve a dual purpose. They fulfill RHs' lofty aspirations for prestige and respect and mitigate the psychological burdens associated with increased capital investments, thus augmenting their spiritual well-being.

Fifthly, we investigate the moderation effect of punitive regulations on the relationship between descriptive norms and PPW disposal behavior. As demonstrated in Model 13 of Table 6, descriptive norms exhibit a significant positive influence on PPW disposal behavior. Additionally, a punitive regulation also displays a significant positive effect on this behavior, suggesting that the implementation of corresponding punitive regulations can deter RHs from engaging in PPW littering. Notably, the interaction term between descriptive norms and punitive regulation is significantly negative, indicating that punitive regulation hampers the ability of descriptive norms to promote RHs' non-littering behavior concerning PPW. This evaluation serves to test Research Hypothesis H7. Some studies showed that inappropriate ERs can cause resistance among RHs, instead making them reluctant to choose to use pro-environmental behaviors [44,45], which is consistent with the findings of this paper. During the policy development process, the initial purpose of penalty regulations was to encourage RHs to refrain from littering PPW. However, the implementation of these policies, along with the design of their original intent, may have led to excessive behavioral control, resulting in RHs' resistance to the policies. This resistance, in turn, contributed to RHs' psychological opposition to SNs.

Sixthly, we explore the moderation effect of punitive regulation in the pathway of directive norms and PPW disposal behavior. As evident from Model 14 in Table 6, with the inclusion of the moderating term involving directive norms and punitive regulation, both the directive norms and punitive regulation coefficients remain positive and significant. However, the interaction term no longer demonstrates significance, suggesting the absence of a moderation effect of punitive regulation on the relationship between directive norms and PPW disposal behavior. This leads to the rejection of Hypothesis H8. One plausible explanation for this phenomenon is that directive norms primarily rely on social groups to assign blame, provide oversight, and impose constraints on RHs' behavior. In contrast, the authority to enforce punitive regulations lies within administrative bodies, and social groups lack the power to penalize arbitrary PPW disposal. Moreover, the decentralized nature of agricultural operations poses challenges for administrative bodies to effectively monitor the arbitrary disposal of PPW. These factors contribute to the ineffectiveness of punitive regulations and their inability to complement directive norms in achieving significant results in PPW management among RHs, ultimately resulting in a lack of moderation effect.

5. Main Conclusions and Policy Implication

5.1. Main Conclusions

Using 572 research samples of RHs in Jiangxi Province, this paper employs the Ordered Logit, 2SLS, and moderating effect methods to analyze the mechanism between SNs and RHs' PPW disposal behaviors, consider the differences in the impact on RHs with different characteristics, and then test the moderating effect of ER on the path of influence between SNs and RHs' PPW disposal behaviors. The study results show that (1) the baseline regression results show that descriptive norms and directive norms can promote RHs not to litter PPW, and the probability of RHs not littering PPW increases by 4.0% for every unit decrease in descriptive norms. The probability of RHs not littering PPW increases by 12.1% when there are directive norms, but compared to descriptive norms, the directive norms' effect is more pronounced. Consistent conclusions were obtained after the robustness test and endogeneity treatment. (2) The results of the moderating effect show that there is no moderating effect of economic incentives; there is no moderating effect of reputational

incentives in the influence path of descriptive norms and RHs not littering PPW; however, the reputational incentives strengthen the promotional effect of directive norms on RHs not littering PPW; punitive regulations impede the promotional effect of descriptive norms on RHs not littering PPW. There is no moderating effect in the influence path between directive norms and RHs not littering PPW.

5.2. Policy Implication

Within the framework of environmental regulation-driven governance, it is imperative to enhance the impact of environmental regulation on RHs' choices regarding PPW disposal behavior and acknowledge the significance of SNs. Coordinate the relationship between social norms and environmental regulation in rural environmental governance and ultimately build a benign comprehensive interaction mechanism based on the economic incentives of environmental regulation, supplemented by the correction of social norms. The recommendations are:

Actively cultivate social norms and give full play to their facilitating role in the choice of pesticide packaging waste disposal behavior of RHs. Rural China is a "relational" society based on blood, kinship, and geography, and SNs, as representatives of the informal system, are not only an important complement to formal systems such as ERs, but also the cornerstone of their effective implementation, which results in SNs having a superior nature compared to formal systems such as ERs. Therefore, we should appropriately screen, integrate, and improve the content of SNs and strengthen the shaping and publicity of SNs in line with ecological values; we should give full play to the interconnectedness and mutual reinforcement between descriptive and directive norms, and together, we can promote the continuous functioning of SNs, and cultivate a good social soil and atmosphere for the corrective role of ERs. Social soil and atmosphere plays roles in corrective environmental regulation.

Enhance the effectiveness of environmental regulations in governing RHs' decisions regarding PPW disposal. This can be achieved by refining the methods and mechanisms of public awareness campaigns and technical training to minimize the imposition on RHs' time and mobilization expenses. Furthermore, it is imperative to recalibrate subsidy approaches and the subsidy framework for incentive-based regulations. Simultaneously, it bolsters the environmental oversight of subsidized farmers and fortifies the development of constraint-based regulations.

Facilitating the harmonization of environmental regulations and SNs is essential. To achieve this, we should devise and enhance environmental regulations that align with the specific stage of rural development and local SNs. Additionally, it is prudent to allocate subsidies primarily to rural regions characterized by robust social cultures and strong SNs. This approach allows for the utilization of SNs in refining environmental regulations and establishing a model of sustainable green development.

Author Contributions: Conceptualization, Y.Z. and X.G.; methodology, M.Z. and Z.W.; software, Y.Z. and M.Z.; validation, Y.Z., M.Z. and W.L.; formal analysis, Y.Z.; investigation, W.L.; resources, W.L.; data curation, M.Z.; writing—original draft preparation, Y.Z.; writing—review and editing, M.Z.; visualization, X.G.; supervision, W.L.; project administration, W.L.; funding acquisition, X.G.; Y.Z. and M.Z. contributed equally to this work and should be regarded as co-first authors. All authors have read and agreed to the published version of the manuscript.

Funding: This research was funded by the National Natural Science Foundation of China, grant number 71763012, and Jiangxi Provincial Department of Education Science and Technology Research Project, grant number GJJ180192.

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Data Availability Statement: The data presented in this study are available upon request from the corresponding author.

Acknowledgments: We wish to thank Xu Zhang, Jiangqi Sun, and Danting Wang for their advice on the English writing.

Conflicts of Interest: The authors declare no conflict of interest.

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