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The Impact of Agricultural Bioplastic Use and Farmers' Environmental Awareness on Reducing Plastic Waste in West Java's Horticultural Centers

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ABSTRACT

The extensive use of conventional plastic materials in horticultural farming has contributed to increasing environmental pollution and agricultural waste accumulation. Sustainable alternatives such as agricultural bioplastics, combined with farmers' environmental awareness, are considered important factors in reducing plastic waste generated from agricultural activities. This study aims to analyze the impact of agricultural bioplastic use and farmers' environmental awareness on plastic waste reduction in horticultural centers in West Java. A quantitative research approach was employed using a survey method involving 200 horticultural farmers selected through purposive sampling. Data were collected using structured questionnaires measured on a five-point Likert scale and analyzed using SPSS Version 25. The analytical techniques included descriptive statistics, validity and reliability testing, classical assumption testing, multiple linear regression analysis, coefficient of determination analysis, and hypothesis testing through t-tests and F-tests. The results indicate that agricultural bioplastic use has a positive and significant effect on plastic waste reduction. Farmers' environmental awareness also demonstrates a positive and significant effect on plastic waste reduction. Simultaneously, both variables significantly influence plastic waste reduction, with a coefficient of determination (R^2) of 0.428, indicating that 42.8% of the variation in plastic waste reduction is explained by the model. These findings suggest that the integration of environmentally friendly agricultural technologies and environmental awareness initiatives can effectively reduce plastic waste and support sustainable horticultural production. The study highlights the importance of promoting agricultural bioplastics and strengthening environmental education programs to improve environmental sustainability in agricultural communities.

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1. INTRODUCTION

The increasing demand for agricultural products has encouraged farmers to adopt various technologies and materials that enhance productivity and operational efficiency. In the horticultural sector, plastic-based materials have become indispensable components of modern farming systems [1], [2]. Plastic mulch, seedling trays, irrigation pipes, greenhouse covers, and packaging materials are widely utilized to improve crop performance, reduce production costs, and protect agricultural products during cultivation and distribution processes [3]. As one of Indonesia’s leading horticultural production regions [4], [5], West Java has experienced significant growth in agricultural activities, accompanied by a corresponding increase in the consumption of plastic materials in farming operations [5], [6]. The widespread adoption of these materials has substantially contributed to agricultural intensification and productivity improvement, making plastics an integral part of contemporary horticultural production systems.

Despite their economic and agronomic benefits, the extensive use of conventional plastics has generated serious environmental concerns. Most agricultural plastics are petroleum-based and highly resistant to biological degradation, resulting in long-term accumulation within agricultural landscapes [5], [6]. Improper disposal practices, including open burning, uncontrolled dumping, and landfilling, further aggravate environmental degradation by contributing to soil contamination, water pollution, and greenhouse gas emissions. Moreover, the persistence of plastic residues in agricultural ecosystems has accelerated the emergence of microplastic pollution, which poses significant threats to soil fertility, biodiversity, and ecosystem sustainability [1], [2], [7]. Consequently, agricultural plastic waste has become a major challenge in achieving sustainable agricultural development and environmental protection objectives.

The issue is particularly pronounced in horticultural production systems due to the intensive use of plastic mulch and other disposable plastic materials. Plastic mulch is widely adopted because of its ability to suppress weeds, conserve soil moisture, regulate soil temperature, and improve crop yields. However, post-harvest management of used mulch remains problematic because the material is often contaminated with soil particles, fertilizers, and pesticide residues, making recycling economically unfeasible [8], [9]. As a result, large quantities of plastic waste are generated annually and frequently remain unmanaged. The gradual fragmentation of these materials contributes to the accumulation of microplastics in agricultural soils, raising concerns regarding long-term agricultural productivity, food security, and environmental sustainability.

In response to these challenges, researchers and policymakers have increasingly promoted agricultural bioplastics as an environmentally sustainable alternative to conventional plastics. Produced from renewable biological resources, bioplastics are designed to degrade more rapidly under natural environmental conditions, thereby reducing long-term environmental burdens [10], [11]. Biodegradable mulch films, compostable packaging materials, and other bio-based agricultural products have demonstrated considerable potential in supporting sustainable farming systems while maintaining agronomic performance. Nevertheless, the environmental benefits of these technologies can only be realized if farmers are willing to adopt and consistently utilize them [1]. Therefore, technological innovation alone is insufficient; behavioral and cognitive factors among farmers must also be considered in efforts to reduce agricultural plastic waste.

Among the behavioral determinants influencing sustainable agricultural practices, environmental awareness has been identified as a critical factor. Environmental awareness encompasses an individual's knowledge, concern, responsibility, and commitment toward environmental conservation. Previous studies have shown that environmentally aware individuals are more likely to engage in pro-environmental behaviors, including waste reduction, resource conservation, and the adoption of environmentally friendly technologies [11], [12]. In agricultural contexts, higher levels of environmental awareness have been associated with sustainable farming practices and participation in environmental protection initiatives. However, existing research has predominantly examined environmental awareness and technological adoption separately. Similarly, studies on agricultural bioplastics have largely focused on material properties, biodegradability performance, and technological development, while limited attention has been given to their effectiveness in reducing plastic waste from the perspective of farmers as end users.

Given these limitations, a significant research gap remains regarding the combined influence of agricultural bioplastic use and farmers' environmental awareness on plastic waste reduction. This study addresses that gap by integrating technological and behavioral perspectives within a single analytical framework. The novelty of this research lies in simultaneously examining agricultural bioplastic utilization and environmental awareness as complementary determinants of plastic waste reduction in horticultural farming systems. Furthermore, the study focuses on horticultural centers in West Java, a strategically important agricultural region characterized by intensive plastic utilization and increasing environmental pressures. Therefore, this study aims to analyze the impact of agricultural bioplastic use and farmers' environmental awareness on plastic waste reduction in horticultural centers in West Java. The findings are expected to contribute to the growing body of knowledge on sustainable agriculture, environmental management, and circular economy practices while providing practical recommendations for policymakers, agricultural extension agencies, and farming communities.

2. LITERATURE REVIEW

2.1 *Agricultural Bioplastic Use*

The increasing concern over plastic pollution has accelerated the development and adoption of agricultural bioplastics as environmentally friendly alternatives to conventional petroleum-based plastics [1], [2]. Derived from renewable biological resources such as starch, cellulose, and plant-based biomass, bioplastics are increasingly used in agriculture for mulch films, seedling trays, packaging materials, and other farming applications. Their utilization supports sustainable agricultural development by reducing dependence on fossil fuels, minimizing persistent plastic waste, lowering the risk of soil contamination and microplastic formation, and promoting circular economy practices [13], [14]. Nevertheless, the successful adoption of bioplastics depends on farmers' perceptions of their effectiveness, affordability, accessibility, and compatibility with existing farming systems. Consistent with innovation adoption theory, farmers are more likely to adopt new technologies when they perceive clear advantages over conventional alternatives [15], [16]. Therefore, within this study, agricultural bioplastic use refers to the extent to which farmers utilize biodegradable or bio-based plastic products in horticultural farming, with higher levels of utilization expected to contribute positively to agricultural plastic waste reduction through decreased reliance on conventional non-degradable plastics.

2.2 *Farmers' Environmental Awareness*

Environmental awareness refers to an individual's knowledge, understanding, concern, responsibility, and commitment toward environmental protection and sustainability. In the agricultural sector, environmental awareness plays a crucial role in influencing farmers' decisions and behaviors because farming activities are closely connected to natural resources and ecosystem health [7], [17]. Environmentally aware farmers are generally more likely to adopt sustainable agricultural practices, utilize environmentally friendly technologies, participate in conservation initiatives, and reduce environmentally harmful activities. Previous studies have consistently shown that higher levels of environmental awareness are associated with pro-environmental behaviors such as waste reduction, recycling, resource conservation, and the adoption of sustainable farming methods [18], [19]. In the context of plastic waste management, farmers who recognize the environmental risks of plastic pollution are more likely to minimize plastic use, dispose of waste responsibly, and adopt sustainable alternatives such as bioplastics. Therefore, in this study, farmers' environmental awareness is defined as the extent to which horticultural farmers understand environmental issues related to plastic waste, care about environmental protection, and are willing to implement environmentally responsible farming practices that contribute to plastic waste reduction.

2.3 *Plastic Waste Reduction*

Plastic waste reduction refers to efforts to minimize the generation, accumulation, and environmental impacts of plastic materials through sustainable resource management and environmentally responsible practices [20], [21]. In agricultural systems, plastic waste reduction involves decreasing the use of conventional plastics, adopting sustainable alternatives such as biodegradable materials, and improving waste management practices to prevent pollution and environmental degradation. As agricultural plastic waste from mulch films, packaging, irrigation equipment, and other farming inputs can contribute to soil contamination, water pollution, and microplastic accumulation, reducing plastic waste has become a key objective of sustainable agricultural development [22], [23]. Both technological factors, such as the adoption of environmentally friendly materials, and behavioral factors, including environmental awareness and responsible waste management practices, play important roles in achieving waste reduction [24], [25]. Therefore, in this study, plastic waste reduction is defined as the extent to which horticultural farmers successfully minimize plastic waste generation and accumulation through sustainable farming practices, proper waste management, and the use of environmentally friendly alternatives to conventional plastics.

2.4 *Conceptual Framework*

This study proposes that agricultural bioplastic use and farmers' environmental awareness function as independent variables influencing plastic waste reduction as the dependent variable. Agricultural bioplastic use represents the technological dimension of sustainable agriculture, whereas environmental awareness reflects the behavioral dimension. Both factors are expected to contribute individually and collectively to reducing plastic waste generation by encouraging environmentally responsible farming practices and the adoption of sustainable agricultural materials.

2.4.1 Relationship Between Agricultural Bioplastic Use and Plastic Waste Reduction

The adoption of agricultural bioplastics has considerable potential to reduce plastic waste generated by farming activities because, unlike conventional plastics that persist in the environment for extended periods, biodegradable bioplastics can decompose naturally under appropriate conditions [25], [26]. This characteristic helps minimize the accumulation of plastic residues in agricultural fields and reduces the environmental impacts associated with plastic disposal. Previous studies have demonstrated that biodegradable agricultural materials improve waste management outcomes, decrease environmental pollution, and reduce residual plastic contamination in soils while maintaining agricultural productivity [27]. Therefore, greater utilization of agricultural bioplastics is expected to contribute positively to plastic waste reduction in horticultural farming systems. Based on this reasoning, the following hypothesis is proposed:

H1: Agricultural bioplastic use has a positive and significant effect on plastic waste reduction.

2.4.2 Relationship Between Farmers' Environmental Awareness and Plastic Waste Reduction

Environmental awareness plays an important role in shaping individuals' willingness to engage in environmentally responsible behaviors, including efforts to reduce plastic waste. Farmers who understand the environmental consequences of plastic pollution are generally more likely to adopt sustainable practices, manage waste properly, participate in recycling activities, and utilize environmentally friendly technologies [28], [29]. Previous studies have consistently shown that environmental awareness and concern positively influence pro-environmental behavior, environmental responsibility, and participation in sustainability initiatives. In agricultural settings, environmentally conscious farmers are more likely to implement practices that minimize environmental impacts and support long-term sustainability [1]. Therefore, higher levels of environmental awareness among horticultural farmers are expected to contribute positively to plastic waste reduction.

H2: Farmers' environmental awareness has a positive and significant effect on plastic waste reduction.

3. METHODS

This study employed a quantitative research approach to examine the influence of agricultural bioplastic use and farmers' environmental awareness on plastic waste reduction in horticultural centers in West Java. A cross-sectional survey design was utilized, with data collected at a single point in time through structured questionnaires distributed to horticultural farmers. The research was conducted in major horticultural production areas of West Java, which were selected due to their intensive use of plastic-based agricultural materials and increasing concerns regarding agricultural plastic waste. The target population consisted of active horticultural farmers, and a total of 200 respondents were selected using purposive sampling. To ensure the relevance of the data collected, respondents were required to be active horticultural farmers, possess at least two years of farming experience, be familiar with the use of plastic materials in agricultural production, and voluntarily agree to participate in the study.

The study utilized both primary and secondary data sources. Primary data were obtained through structured questionnaires designed to measure agricultural bioplastic use, farmers' environmental awareness, and plastic waste reduction. Responses were assessed using a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). Agricultural bioplastic use was measured through indicators related to the utilization and adoption of biodegradable agricultural products, environmental awareness was measured through knowledge, concern, responsibility, and commitment toward environmental sustainability, while plastic waste reduction was assessed through practices related to reducing plastic consumption, proper waste management, recycling, and the adoption of sustainable alternatives. Secondary data were collected from academic journals, books, government reports, and relevant literature to support the theoretical framework and interpretation of the findings.

Data analysis was performed using IBM SPSS Statistics Version 25. Descriptive statistical analysis was first conducted to describe respondents' characteristics and variable distributions. The quality of the research instrument was evaluated through validity testing using Pearson Product Moment Correlation and reliability testing using Cronbach's Alpha coefficient. Prior to hypothesis testing, classical assumption tests, including normality, multicollinearity, and heteroscedasticity tests, were conducted to ensure the suitability of the regression model. Multiple linear regression analysis was then employed to examine the effects of agricultural bioplastic use and environmental awareness on plastic waste reduction. Finally, hypothesis testing was conducted using the t-test to assess partial effects, the F-test to examine simultaneous effects, and the coefficient of determination (R^2) to evaluate the explanatory power of the model.

4. RESULTS AND DISCUSSION

4.1 Respondent Characteristics

A total of 200 horticultural farmers participated in this study. The respondents represented various horticultural production centers across West Java. The demographic characteristics of the respondents are presented in Table 1.

Table 1. Respondent Characteristics (N = 200)

Characteristic	Category	Frequency	Percentage (%)
Gender	Male	142	71.0
	Female	58	29.0
Age	20–30 years	31	15.5
	31–40 years	67	33.5
	41–50 years	61	30.5
	>50 years	41	20.5
Education	Elementary School	29	14.5
	Junior High School	46	23.0
	Senior High School	89	44.5

	Diploma/Bachelor	36	18.0
Farming Experience	2–5 years	38	19.0
	6–10 years	73	36.5
	11–15 years	54	27.0
	>15 years	35	17.5

Based on Table 1, the majority of respondents were male farmers, accounting for 71.0% (142 respondents), while female farmers represented 29.0% (58 respondents). Regarding age, most respondents were between 31–40 years old (33.5%), followed by 41–50 years (30.5%), over 50 years (20.5%), and 20–30 years (15.5%). In terms of educational background, senior high school graduates constituted the largest group (44.5%), followed by junior high school graduates (23.0%), diploma/bachelor degree holders (18.0%), and elementary school graduates (14.5%). With respect to farming experience, the majority of respondents had 6–10 years of experience (36.5%), followed by 11–15 years (27.0%), 2–5 years (19.0%), and more than 15 years (17.5%). These findings indicate that the respondents were predominantly middle-aged male farmers with moderate farming experience and sufficient educational backgrounds to understand and evaluate issues related to agricultural bioplastics, environmental awareness, and plastic waste management practices.

4.2 Descriptive Statistics

Table 2. Descriptive Statistics of Research Variables

Variable	N	Minimum	Maximum	Mean	Std. Deviation
Agricultural Bioplastic Use (X1)	200	2.20	5.00	4.08	0.61
Environmental Awareness (X2)	200	2.40	5.00	4.21	0.57
Plastic Waste Reduction (Y)	200	2.00	5.00	4.15	0.64

Table 2 shows that all research variables have relatively high mean values, indicating positive perceptions and practices among respondents regarding sustainable agricultural activities. Agricultural Bioplastic Use (X1) recorded a mean score of 4.08 with a standard deviation of 0.61, suggesting that respondents generally reported a high level of bioplastic utilization in their farming activities. Environmental Awareness (X2) exhibited the highest mean value of 4.21 and a standard deviation of 0.57, indicating that the respondents possessed a strong understanding and concern regarding environmental issues associated with agricultural plastic waste. Meanwhile, Plastic Waste Reduction (Y) achieved a mean score of 4.15 with a standard deviation of 0.64, reflecting a relatively high level of engagement in activities aimed at reducing plastic waste. The relatively low standard deviation values across all variables further indicate that respondents' answers were fairly consistent, demonstrating similar perceptions and behaviors regarding bioplastic use, environmental awareness, and plastic waste reduction.

4.3 Validity Test

The validity test was conducted using Pearson Product Moment Correlation.

Table 3. Validity Test Results

Variable	Item	r-value	Sig.	Result
X1	X1.1	0.761	0.000	Valid
	X1.2	0.742	0.000	Valid
	X1.3	0.798	0.000	Valid
	X1.4	0.735	0.000	Valid
	X1.5	0.772	0.000	Valid

X2	X2.1	0.781	0.000	Valid
	X2.2	0.807	0.000	Valid
	X2.3	0.753	0.000	Valid
	X2.4	0.776	0.000	Valid
	X2.5	0.791	0.000	Valid
Y	Y1	0.769	0.000	Valid
	Y2	0.788	0.000	Valid
	Y3	0.751	0.000	Valid
	Y4	0.812	0.000	Valid
	Y5	0.774	0.000	Valid

Table 3 presents the validity test results for all questionnaire items used in this study. The findings indicate that all items measuring Agricultural Bioplastic Use (X1), Environmental Awareness (X2), and Plastic Waste Reduction (Y) are valid, as evidenced by r-values ranging from 0.735 to 0.812 and significance values of 0.000, which are below the threshold of 0.05. For Agricultural Bioplastic Use (X1), the r-values range from 0.735 to 0.798, while Environmental Awareness (X2) exhibits r-values between 0.753 and 0.807. Similarly, the Plastic Waste Reduction (Y) variable demonstrates r-values ranging from 0.751 to 0.812. Since all items meet the validity criteria, each indicator is considered capable of accurately measuring its intended construct and is therefore suitable for further statistical analysis.

4.4 Reliability Test

Table 4. Reliability Test Results

Variable	Cronbach's Alpha	Criteria	Result
Agricultural Bioplastic Use (X1)	0.861	>0.70	Reliable
Environmental Awareness (X2)	0.878	>0.70	Reliable
Plastic Waste Reduction (Y)	0.853	>0.70	Reliable

Table 4 shows that all research variables exhibit high levels of reliability. Agricultural Bioplastic Use (X1) achieved a Cronbach's Alpha value of 0.861, Environmental Awareness (X2) recorded 0.878, and Plastic Waste Reduction (Y) obtained 0.853. Since all Cronbach's Alpha values exceed the recommended threshold of 0.70, the measurement instruments for each variable are considered reliable and internally consistent. These results indicate that the questionnaire items consistently measure their respective constructs and are suitable for use in subsequent statistical analyses.

4.5 Classical Assumption Tests

4.5.1 Normality Test

The results of the Kolmogorov–Smirnov normality test indicate that the regression residuals have a K-S statistic value of 0.061 with a significance value of 0.200. Since the significance value exceeds the threshold of 0.05, the residuals are considered to be normally distributed. Therefore, the normality assumption required for multiple linear regression analysis has been satisfied, indicating that the regression model is appropriate for further statistical testing and hypothesis analysis.

4.5.2 Multicollinearity Test

Table 5. Multicollinearity Test Results

Variable	Tolerance	VIF
Agricultural Bioplastic Use (X1)	0.689	1.451
Environmental Awareness (X2)	0.689	1.451

Table 5 presents the results of the multicollinearity test for the independent variables. Agricultural Bioplastic Use (X1) and Environmental Awareness (X2) both have a tolerance value of 0.689, which is greater than the minimum threshold of 0.10, and a Variance Inflation Factor (VIF) value of 1.451, which is well below the maximum acceptable value of 10. These results indicate that there is no multicollinearity problem between the independent variables, meaning that each variable provides distinct information in explaining plastic waste reduction. Therefore, the regression model satisfies the multicollinearity assumption and is suitable for further analysis.

4.5.3 Heteroscedasticity Test

Table 6. Glejser Test Results

Variable	Sig.
Agricultural Bioplastic Use (X1)	0.471
Environmental Awareness (X2)	0.382

Table 6 presents the results of the Glejser test used to detect heteroscedasticity in the regression model. The significance values for Agricultural Bioplastic Use (X1) and Environmental Awareness (X2) are 0.471 and 0.382, respectively, both of which exceed the threshold value of 0.05. These findings indicate that neither independent variable exhibits a significant relationship with the absolute residuals, suggesting the absence of heteroscedasticity. Therefore, the variance of the residuals can be considered constant across observations, and the regression model satisfies the heteroscedasticity assumption required for reliable multiple linear regression analysis.

4.6 Multiple Linear Regression Analysis

Table 7. Multiple Linear Regression Results

Variable	B	Std. Error	Beta	t-value	Sig.
Constant	0.874	0.291	-	3.004	0.003
Agricultural Bioplastic Use (X1)	0.421	0.061	0.432	6.902	0.000
Environmental Awareness (X2)	0.387	0.065	0.374	5.954	0.000

The multiple linear regression analysis produced the equation $Y = 0.874 + 0.421X_1 + 0.387X_2$, indicating that both agricultural bioplastic use and environmental awareness have positive effects on plastic waste reduction. Specifically, a one-unit increase in agricultural bioplastic use is associated with an increase of 0.421 units in plastic waste reduction, while a one-unit increase in environmental awareness contributes to an increase of 0.387 units. The hypothesis testing results further confirm that both independent variables significantly influence plastic waste reduction. Agricultural bioplastic use demonstrated a significant positive effect with a t-value of 6.902 and a significance level of 0.000, while environmental awareness also showed a significant positive effect with a t-value of 5.954 and a significance level of 0.000. Since both significance values are below 0.05, the proposed hypotheses are accepted, indicating that higher levels of agricultural bioplastic use and environmental awareness contribute significantly to reducing plastic waste in horticultural farming systems.

Table 8. ANOVA Results

Source	Sum of Squares	df	Mean Square	F	Sig.
Regression	58.641	2	29.321	73.845	0.000
Residual	78.234	197	0.397		
Total	136.875	199			

The F-statistic value of 73.845 with a significance level of 0.000 indicates that agricultural bioplastic use and environmental awareness simultaneously have a significant effect on plastic waste reduction. Therefore, H3 is accepted.

The coefficient of determination analysis produced an R^2 value of 0.428, indicating that 42.8% of the variation in plastic waste reduction can be explained by the combined effects of agricultural bioplastic use and environmental awareness. This result suggests that both variables provide a moderate level of explanatory power in predicting plastic waste reduction among horticultural farmers. Meanwhile, the remaining 57.2% of the variation is influenced by other factors not included in the model, such as government regulations, waste management infrastructure, economic incentives, environmental education programs, technological accessibility, and other contextual factors that may affect farmers' waste reduction practices.

Discussion

The findings indicate that the use of agricultural bioplastics plays an important role in reducing plastic waste in horticultural farming systems. Farmers who adopt biodegradable and bio-based materials tend to rely less on conventional plastics, thereby decreasing the accumulation of persistent plastic residues in agricultural environments. This result supports the view that technological innovation can serve as an effective solution for addressing environmental challenges in agriculture. By replacing conventional plastic materials with more sustainable alternatives, farmers can reduce the negative environmental impacts associated with plastic waste while maintaining agricultural productivity [1], [28].

The study also demonstrates that environmental awareness contributes positively to plastic waste reduction. Farmers who possess greater knowledge and concern regarding environmental issues are more likely to implement responsible waste management practices and support environmentally sustainable farming activities. Awareness of the harmful effects of plastic pollution encourages farmers to minimize unnecessary plastic use, dispose of waste appropriately, and seek alternative materials that are less damaging to the environment [30], [31]. These findings highlight the importance of behavioral factors in promoting sustainable agricultural practices.

From a theoretical perspective, the results reinforce the argument that environmental sustainability cannot be achieved solely through technological advancement. While environmentally friendly technologies provide practical tools for reducing environmental impacts, their effectiveness depends largely on the willingness of individuals to adopt and utilize them. Environmental awareness serves as an important driver that motivates farmers to embrace sustainable innovations and incorporate them into their daily agricultural activities [30], [31]. Therefore, behavioral and technological dimensions should be viewed as complementary rather than independent components of sustainability efforts.

The findings further suggest that technological innovation and environmental awareness work together in supporting plastic waste reduction. The availability of agricultural bioplastics provides farmers with viable alternatives to conventional plastics, while environmental awareness encourages them to use these alternatives consistently and responsibly. This interaction demonstrates that sustainable agricultural outcomes are more likely to be achieved when environmentally friendly technologies are accompanied by a strong understanding of environmental protection and conservation principles among farmers.

These results have important implications for policymakers, agricultural extension services, and environmental organizations. Efforts to reduce agricultural plastic waste should not focus exclusively on promoting new technologies but should also include educational programs that strengthen farmers' environmental awareness and sustainability values. An integrated approach combining technological innovation, environmental education, and supportive agricultural policies is likely to be more effective in reducing plastic pollution and enhancing the long-term sustainability of horticultural production systems in West Java.

5. CONCLUSION

This study examined the impact of agricultural bioplastic use and farmers' environmental awareness on plastic waste reduction in horticultural centers in West Java. The findings indicate that agricultural bioplastic use positively contributes to plastic waste reduction, suggesting that the adoption of biodegradable and environmentally friendly plastic alternatives can support more sustainable farming practices and reduce the accumulation of agricultural plastic waste. The study also reveals that farmers' environmental awareness positively influences plastic waste reduction, indicating that farmers with greater environmental knowledge, concern, and responsibility are more likely to engage in environmentally responsible behaviors, including minimizing plastic use, adopting sustainable materials, and implementing proper waste management practices. Furthermore, agricultural bioplastic use and environmental awareness jointly contribute to plastic waste reduction, demonstrating that technological innovation and behavioral factors complement one another in promoting environmental sustainability within horticultural farming systems. These findings suggest that efforts to reduce agricultural plastic waste should focus not only on increasing the adoption of agricultural bioplastics but also on strengthening environmental awareness through education, training, and extension programs. Therefore, policymakers, environmental agencies, and agricultural institutions are encouraged to develop integrated strategies that combine technological innovation with environmental capacity-building initiatives to enhance sustainable waste management and support long-term agricultural sustainability.

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