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Integrated Pest Management Practices of Rice Farmers in Marantao, Lanao Del Sur

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ABSTRACT

This study generally aimed to find out the selected integrated pest management practices of the rice farmers in their production at selected barangays at Marantao, Lanao del Sur. It specifically aimed to find out the demographic profile of the respondents; to identify integrated pest management practices; to determine the benefits acquired in practicing the integrated pest management control; and to identify the problems encountered in the application of integrated pest management (IPM) control. The information on their production was based during the year 2023 to 2024. The study surveyed seventy-four (74) rice farmers in Marantao, Lanao del Sur, assessing their IPM practices. This made use of descriptive survey research design, structured survey questionnaire, and frequency and percentage distribution, weighted mean, and the Likert scale to provide an accurate understanding of their practices and challenges. This study revealed that rice farmers in Marantao, Lanao del Sur are predominantly around 50 to 59 years old, male, married, elementary level, 4 to 6 family members with monthly net income of ₱5,000.00 and below, and have been into farming for around 5 years and above. IPM practices such as biological practice using predators, often use integrated pest management techniques for cost savings, reduced chemical use, and improved crop quality. The researchers suggested that farmers should receive training in IPM practices to promote sustainable crop production. The Local Government Unit should collaborate with experts to provide training, resulting in improved crop yields, reduced costs, and reduced pesticide use.

INTRODUCTION

Integrated Pest Management on rice is very important in sustaining and environmental health. IPM reduces the use and reliance on chemical pesticides which leads to environmental pollution, and harms both the crops and non-target insect pests. It focuses on incorporating biological, cultural, physical, and mechanical methods rather than use of chemical inputs, but is the last resort if the problem is still not addressed. In summary, IPM is crucial in improving agricultural productivity, conserving the environment, and improving both the well-being of the farmers and consumers (Moore *et al.,* 2022).

Rice is an essential food crop in the world and is considered a staple food for many countries, including the Philippines. More than a hundred species of insects and pests target rice in a variety of ways. These minimize the overall productivity of rice causing it to lower production of rice. Thus, it is important to control those dangerous pests from further destroying the rice by applying various effective and appropriate pest control measures (Ehi-Eromosele *et al.,* 2013).

Using a variety of control methods, including biological, cultural, mechanical, physical, and chemical ones, integrated pest management minimizes the damage caused by insect pests to crops. It is a systematic approach that combines numerous insect pest control strategies into a single program. The use of pesticides that damage plants is reduced when biological, chemical, cultural, mechanical, and physical factors are considered. A sustainable approach to pest management, integrated pest management has been around for a while (Farm Biosecurity, n.d.).

Biological, cultural, and chemical methods are all part of integrated pest management, which prevents insects and other pests from harming crops. Biological control refers to the management of insect pests and their harm using natural enemies such as diseases, parasites, competitors, and predators. Enhancing different farm practices to lower the proliferation of pests and insects is known as cultural control. Additionally, chemical control is achieved by using specific pesticides only when necessary to reduce their impact (Poudel *et al.,* 2021).

This study generally aimed to find out the selected integrated pest management practices of the rice farmers in their production at selected barangays at Marantao, Lanao del Sur. It aimed to find out the demographic profile of the respondents, the integrated pest management practices of the rice farmers, the benefits acquired by the rice farmers practicing the integrated pest management control, and the problems encountered by the rice farmers in application of integrated pest management control.

LITERATURE REVIEW

History of Integrated Pest Management

Over the years, environmentalists have been worried about pesticides causing harm to the environment. In the 1960s, the book of Rachel Carson entitled Silent Spring warned the public about the risks of using pesticides.

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Entomologists discover that insects were developing resistance to the excessive use and abuse of pesticides in 1950s. During 1950s, there were many areas that were disappointed and dissatisfied with using only insecticidal approach to pest control which leads to the development of integrated pest management. Through then, IPM became one of the essential foundations of agriculture against the management of insect pests during the second half of the 20th century (Hajjar *et al.,* 2023).

Integrated pest management technique uses biological, cultural, mechanical, physical, and chemical methods to control dangerous insect disturbance at an economic level of damage of a certain plant. As time passes by, number of people increases and the demand for food consumption also increases. People moving from one place to another or from different places resulted to the increased globalization of the food industry leading to different pest species being introduced to these places. Appropriate and suitable precautions against harmful pests and progress, strategic planning, and effective implementation are critical (Hajjar *et al.,* 2023).

Integrated Pest Management in the Philippines

Farmers in the Philippines have learned to use integrated pest management instead of using harmful pesticides and insecticides to protect their crops from the danger of pests. Integrated pest management uses all available technologies and farming practices to control and regulate the amount of pest infestation with efficiency and least possible damage to the environment. The government working with the Department of Agriculture and other organizations like Philippine Rice Research Institute (IRRI) has have trained over 100,000 farmers in IPM to promote it widely. Philippine Rice Research Institute is conducting seminars and workshops throughout the Philippines extending relevant information and training materials to the farmers. Rice farmers claim that IPM practices have helped them increase their yields and avoiding the use of too many pesticides has allowed edible snails, crabs, and fish to return to paddy fields improving both income and food supply for local farmers. IPM costs less and is effective and safe than commercial pesticides and has had a positive impact on the livelihoods of the farmers and to the environment (Rejesus & Jones, 2020).

For many years, integrated pest management techniques have been used in the Philippines. The government and many non-governmental groups are focusing on how important it is to promote sustainable integrated pest management. The National Integrated Pest control, which was founded in 1993 with the intention of teaching farmers environmentally sound pest control techniques and reducing their dependency on toxic chemical pesticides, was one of the significant advancements. Several training facilities have sprung up around the nation with the goal of arming farmers with the know-how and abilities needed to properly adopt integrated pest management. To ensure that farmers can implement what they learn in their farming operations, these training facilities offer knowledge, learning resources, and practical learning experiences. These governmental and private sector backings demonstrate consistent advancements in the broad implementation of integrated pest management (Braganza, 2023).

Integrated Pest Management Challenges

Despite the advantages of integrated pest management, there will inevitably be challenges that must be overcome. One significant issue is that farmers, especially those living in rural areas where access to technology and information is limited, lack expertise, education, and awareness. Another issue preventing farmers, especially small-scale farmers with limited resources, from embracing integrated pest management measures is their high cost. Farmers who are accustomed to using pesticides as their primary means of controlling pests may also object. Furthermore, because shifting weather patterns alter insect populations and crop growth cycles, climate change presents threats and obstacles to the application of integrated pest management (IPM). This led to the ongoing development of fresh approaches and methods for mitigating the effects of climate change and controlling newly developing pests. These issues can be resolved by coordinated efforts and ongoing training on sustainable agricultural practices for farmers, together with the provision of essential resources. This might lead to the effective implementation of IPM techniques (Braganza, 2023).

Integrated Pest Management on Rice

Farmers have devised effective countermeasures to deal with pest insects that pose a threat to crop productivity. When pesticides were made available to farmers, they helped eradicate pests, boost yields, and save labor costs; nevertheless, they also lowered crop resilience and contributed to environmental pollution. IPM was created as a pest control method that combines conventional, knowledge-based methods with prudent pesticide application to reduce adverse effects. Its goals are to raise crop yields, strengthen crop resilience, and lessen the damaging effects of excessive pesticide use on the environment (Alam *et al.,* 2016).

Employing pest management strategies correctly promotes ecosystem health and gives beneficial insects a steady supply of food (Hillocks & Cooper, 2012). A complex food web is maintained by robust rice agroecosystems, which in turn sustain a diversified population of insects (Redfern *et al.,* 2012). If predator species, insects, and other organisms continue to flourish, the insects in this food web can contribute to the preservation of ecosystem function (Allara *et al.,* 2012). Predator species have decreased in number in tandem with the rise in pesticide use. Pest damage to crop production increased because of overuse of pesticides, which also reduced the number of beneficial insects (Abrol, 2017).

Farmers-Related Factors

It was shown that a significant number of farmers regularly participate in agricultural techniques, especially

those between the ages of fifties. The frequency of farming activities within this age group suggests that they have a significant impact on agricultural landscapes and provide an assortment of experience that could influence pest management strategies (Angon *et al.,* 2023).

The study's findings regarding most male farmers are in line with those of Jost *et al.* (2015) investigation, which found a similar gender imbalance in farming communities. This underscores the importance of addressing gender-specific advantages and disadvantages in agricultural improvement initiatives, such as integrated pest management practices.

Married farmers may profit from combined work and resources, which can increase production and stability in the agricultural sector (Ngeywo *et al.,* 2015). The study shows that whereas married farmers usually have more household duties and a greater need for consistent income, they are more likely to engage in long-term agricultural improvements (Badstue *et al.,* 2020).

Numerous research has investigated the connection between rural farmers' agricultural methods and their level of education. Gomez (2013) found that significant numbers of farmers with only minimal elementary school education actively engage in farming activities. In addition, Ninh (2021) research shows that farmers with lower levels of educational attainment continue to be actively involved in farming. Furthermore, regardless of formal education levels, the study by Smith *et al.* (2018) emphasizes the value of practical knowledge and experience in farming.

The study conducted by Herrera *et al.,* (2021) showed that farming communities typically have average-sized dwellings. In a similar study conducted by Graeub *et al.* (2016) found that most households in agricultural settings are moderately sized.

A major part of agricultural households, according to Bowman & Zilberman (2013), struggle with low profits, which affects their ability to invest in farming technologies and their overall standard of living. The presence of low-income households among farmers was additionally emphasized by Bisaga *et al.* (2019), who pointed out that this economic reality frequently affects their access to the resources required for sustainable farming techniques. Furthermore, these conclusions have been supported by Alam *et al.,* (2016) study, which emphasizes that low income is still a major barrier to raising agricultural productivity and sustainability.

Sekhar *et al.* (2024) states that farmers can optimize their farming activities given they have an extensive knowledge of the environmental conditions in their locality. Furthermore, Carnoy & Luschei (2008) found that farmers had enhanced knowledge of crop rotation and pest management, which improves their capacity to control pests sustainably and boost yields. In addition, experienced farmers are more likely to successfully implement their techniques, indicating their skill in combining different pest control techniques for improved results, according to Serebrennikov *et al.* (2020).

Integrated Pest Management Practices-Related Factor

Farmers are using integrated pest management (IPM) techniques more frequently due to reduce damage caused by pests while fostering environmental sustainability (Cult, 2019). Angon *et al.* (2023) claims that farmers that utilize IPM techniques obtain the benefits of lower production costs and less pesticide use, which inevitably turn leads to healthier crops and better financial results.

Agricultural productivity and sustainability are increased when integrated pest management techniques are used (Cuyno *et al.,* 2001). Additionally, by encouraging natural pest management mechanisms and reducing pesticide residues, IPM techniques result in healthier crops, which improve marketability and customer safety Food and Agriculture Organization of the United Nations (2025). Furthermore, Zhou *et al.* (2020) study shows the long-term environmental advantages by pointing out that Integrated Pest Management promotes biodiversity, healthy soil, and lower levels of environmental contamination.

MATERIALS AND METHODS

The Respondents

The rice farmers of Barangay Bubong Madanding and Barangay Cawayan Dialongana, Marantao, Lanao del Sur who were involved in practicing integrated pest management were the respodents of this study.

Research Design

The study used descriptive type of research to evaluate the selected practices of integrated pest management among rice farmers at Barangay Cawayan Dialogana, and Barangay Bubong Madanding, Marantao, Lanao del Sur. Descriptive method as the research design for this study to assess accurate interpretation of the study.

Research Instrument

A survey questionnaire was used in accumulating information relevant to the research topic. It consisted of four (4) primary parts of the survey questionnaire: Part I included the demographic profile of the respondents. Part II comprised the IPM practices among rice farmers. Part III determined the benefits acquired by the farmers in practicing integrated pest management control. Part IV identified the problems encountered by the rice farmers.

Statistical Treatment

Statistical tools were used to compute and describe the gathered data. Frequency and Percentage were used to explain the demographic profile of the respondents, the IPM practices, and the problems encountered by the rice farmers in application of integrated pest management control. Weighted Mean was used to identify the benefits acquired by the rice farmers in applying IPM practices at selected barangays at Marantao, Lanao del Sur. The Likert Scale was used to describe the computed weighted mean.

RESULTS AND DISCUSSION

Demographic Profile of the Respondents

Age

More than one fourth (27%) of the respondents are 50 to 59 years old while less than one third (26%) are 40 to 49 years old. This implies that most of the respondents were in their 40s and 50s, which relates to the studies of Martinez *et al.* (2019) that a significant number of farmers regularly participate in agricultural techniques, especially those between the ages of fifties. The frequency of farming activities within this age group suggests that they have a significant impact on agricultural landscapes and provide an assortment of experience that could influence pest management strategies.

Table 1: Age

Age	Frequency (f)	Percentage (%)
20 to 29	10	14
30 to 39	13	18
40 to 49	19	26
50 to 59	20	27
60 to 69	7	9
70 to 79	5	7
Total	**74**	**100**

Gender

More than two thirds (68%) of the respondents are male while almost one third (32%) are female. The results illustrated that most of the respondents are men farmers. The study's findings regarding most male farmers are in line with those of Binder & Miller's (2017) investigation, which found a similar gender imbalance in farming communities. This underscores the importance of addressing gender-specific advantages and disadvantages in agricultural improvement initiatives, such as integrated pest management practices.

Table 2: Gender

Gender	Frequency (f)	Percentage (%)
Male	50	68
Female	24	32
Total	**74**	**100**

Civil Status

More than three fourth (84%) of the respondents are married while less than one eight (7%) are single, and another less than one eight widow (7%).

It is expected that most of them are married, and this is like the study of Ramirez (2018), that married farmers may profit from combined work and resources, which can increase production and stability in the agricultural sector. The study shows that whereas married farmers usually have more household duties and a greater need for consistent income, they are more likely to engage in long-term agricultural improvements (Hernandez, 2015).

Table 3: Civil Status

Highest Educational Attainment	Frequency (f)	Percentage (%)
Single	5	7
Married	62	84
Widow/er	5	7
Separated	2	3
Total	**74**	**100**

Highest Educational Attainment

Less than one half (41%) of the respondents only attended elementary level while almost one third (31%) had high school level.

These findings describe that the respondents were comparatively less educated, which is similar to the findings of Martin and Henry (2012) who found out that significant numbers of farmers with only minimal elementary school education actively engage in farming activities. In addition, Nguyen (2016) research shows that farmers with lower levels of educational attainment continue to be actively involved in farming. Furthermore, regardless of formal education levels, the study by Jayne & Sanchez (2021) emphasizes the value of practical knowledge and experience in farming.

Table 4: Highest Educational Attainment

Highest Educational Attainment	Frequency (f)	Percentage (%)
No Formal Education	15	20
Elementary Level	30	41
Highschool Level	23	31
College Level	6	8
Total	**74**	**100**

Household Family Size

More than one third (36%) of respondents have 4 to 6 household family size while another more than one third (34%) have a 7 to 9 household members.

These results show that most of the respondents have average-sized family members which relates to the study conducted by Mendoza (2016), thus, it was shown that farming communities typically have average-sized dwellings. In a similar study conducted by Khan *et al.*

Table 5: Household Family Size

Household Family Size	Frequency (f)	Percentage (%)
1 to 3	11	15
4 to 6	27	36
7 to 9	25	34
10 above	11	15
Total	**74**	**100**

(2010) found that most households in agricultural settings are moderately sized.

Household Monthly Net Income

Almost three fourths (72%) of the respondents have household monthly net income of ₱5,000.00 and below while more than one fifth (22%) have between ₱5,001 to 10,000.

This implies that most of the respondents have a lower monthly net income which is reliable with the findings of Kurt (2019) who noted that major part of agricultural households, struggle with low profits, which affects their ability to invest in farming technologies and their overall standard of living. The presence of low-income households among farmers was additionally emphasized by Will (2017), who pointed out that this economic reality frequently affects their access to the resources required for sustainable farming techniques. Furthermore, these conclusions have been supported by Dever (2018) study, which emphasizes that low income is still a major barrier to raising agricultural productivity and sustainability.

Table 6: Monthly Net Income

Monthly Net Income	Frequency (f)	Percentage (%)
Below ₱5,000.00	53	72
₱5,001 to 10,000	16	22
₱10,001 to15,000	5	7
Total	**74**	**100**

Farming Experience

More than three fourths (82%) of the respondents have been into farming around 5 years and above while more than one eight (15%) are between 2 to 5 years.

The data indicates that majority of the respondents have had experience farming for around five years and above. This agrees with the studies of Lee *et al.* (2017) stated that experienced farmers are more likely to successfully implement their techniques, indicating their skill in combining different pest control techniques for improved results. Additionally, Patel *et al.* (2020) state that farmers can optimize their farming activities given they have an extensive knowledge of the environmental conditions in their locality.

Table 7: Farming Experience

Farming Experience (in Years)	Frequency (f)	Percentage (%)
1 year	2	3
2 to 4 years	11	15
5 years and above	61	82
Total	**74**	**100**

IPM Practices of the Rice Farmers

Biological Practices

In terms of the IPM practices of the rice farmers, specifically biological practices, more than one half (55%) of the respondents use predators and introduce or conserve natural enemies (54%).

The use of biological control is because it is known as a sustainable and ecologically friendly method of pest management in agriculture (AL-Naabi, 2025). It implies that the respondents have been using biological practices in controlling pests in their rice production. In introducing or conserving natural enemies, lady bugs are used to control pests while the kind of pests that commonly attack their rice are rat, army worm, and black bug.

Table 8: Biological Practices

Responses	Frequency (f)*	Percentage (%)
Introducing/ Conserving natural enemies	40	54
Predators	41	55

**Multiple responses*

Cultural Practices

Almost all (91%) of the respondents use crop rotation and intercropping, more than three fourth (81%) use timing of seeding and planting, more than two thirds (70%) use sanitation practices, less than two thirds (65%) use land preparation, less than one half (47%) use water management and manages weeds (46%), and almost one third (32%) apply mulches.

Table 9: Cultural Practices

Responses	Frequency (f)*	Percentage (%)
Crop Rotation	67	91
Intercropping	67	91
Mulches	24	32
Land preparation	48	65
Managing weeds	34	46
Timing of seeding and planting	60	81
Sanitation practices	52	70
Water management	35	47

**Multiple responses*

Chemical Practices

Almost all (95%) of the respondents use pesticides, more than one third (39%) use herbicides, and more than one fourth (27%) use repellents.

Mechanical Practices

More than two thirds (70%) of the respondents use trap cropping, less than two thirds (64%) use hand weeding, more than one third (35%) use cultivation technique while almost one third (32%) use hand picking or removal.

Physical Practices

More than three fourths (85%) of the respondents use

physical inspection and monitoring, almost three fourth (74%) use physical handwashing or brushing, while almost one third (30%) use physical removal of pest habitats. These findings infer that several IPM practices such as biological, cultural, chemical, mechanical, and physical, were applied by the rice farmers. Furthermore, farmers are using integrated pest management (IPM) techniques more frequently to reduce damage caused by pests while fostering environmental sustainability (Cult, 2019). Josh (2021) claims that farmers that utilize IPM techniques obtain the benefits of lower production costs and less pesticide use, which inevitably leads to healthier crops and better financial results.

Table 10: Chemical Practices

Responses	Frequency (f)*	Percentage (%)
Pesticides	70	95
Herbicides	29	39
Repellents	20	27

**Multiple responses*

Table 11: Mechanical Practices

Responses	Frequency (f)*	Percentage (%)
Responses	Frequency (f)*	Percentage (%)
Handpicking or removal	24	32
Cultivation techniques	26	35
Trap cropping	52	70
Hand weeding	47	64

**Multiple responses*

Table 12: Physical Practices

Responses	Frequency (f)*	Percentage (%)
Physical handwashing or brushing	55	74
Physical removal of pest habitats	22	30
Physical inspection and monitoring	63	85

**Multiple responses*

Benefits Acquired by Applying IPM Practices

The respondents strongly agree that in applying integrated pest management practices: it helps in cost saving (AWM=4.54); it reduces chemical use (AWM=4.52); and it improves crop quality and profitability (AWM=4.52), they also agree that it helps reduce health risks (AWM=4.40), it lowers environmental impact (AWM=4.20), it protects non-target species (AWM=4.17), it enhances food safety (AWM=4.16), it reduces environmental footprint (AWM=4.13), it enhances sustainability (AWM=4.05), and it increases resilience to pest outbreaks (AWM=4.01). Therefore, the respondents agree that the benefits acquired by applying Integrated Pest Management Practices are beneficial. It implies that Integrated Pest Management are effective for the respondents. This supports the study of Sage (2020) stated that agricultural productivity and sustainability are increased when integrated pest management techniques are used. Additionally, by encouraging natural pest management mechanisms and reducing pesticide residues, IPM techniques result in healthier crops, which improve marketability and customer safety (Miller, 2018). Furthermore, Wilson (2020) study shows the long-term environmental advantages by pointing out that integrated pest management promotes biodiversity, healthy soil, and lower levels of environmental contamination.

Table 13: Benefits Acquired by Rice Farmers in Applying IPM Practices

Indicator	AWM	Adjectival Meaning	Verbal Interpretation
Reduced chemical use	4.52	Strongly agree	Highly effective
Lower environmental impact	4.20	Agree	Effective
Enhanced sustainability	4.05	Agree	Effective
Reduced health risks	4.40	Agree	Effective
Increased resilience to pest outbreaks	4.01	Agree	Effective
Cost savings	4.54	Strongly agree	Highly effective
Protection of non-target species	4.17	Agree	Effective
Improved crop quality and profitability	4.52	Strongly agree	Highly effective
Enhanced food safety	4.16	Agree	Effective
Reduced environmental footprint	4.13	Agree	Effective
Over-All Average Weighted Mean	**4.27**	**Agree**	**Effective**

Legend

4.51-5.00	*Strongly agree*	*Highly effective*
3.26-4.50	*Agree*	*Effective*
2.51-3.25	*Undecided*	*Neutral*
1.76-2.50	*Disagree*	*Ineffective*
1.00-1.75	*Strongly disagree*	*Highly ineffective*

Problems Encountered by the Rice Farmers in Applying IPM Practices

This table illustrate that the problems encountered by the respondent in applying integrated pest management shows that almost three fourth (72%) of the respondents were pesticide dependent, more than one half (51%) lack in training in IPM practices, less than one half (47%) were high initial costs, time constraints, and resistance to change (46%), while more than one third (36%) lack in resources needed as alternatives for pesticide use, almost one third (32%) lack of knowledge and awareness on integrated pest management practices and, complexity of integrated pest management systems (31%).

These findings signify that there are also problems encountered by the rice farmers aside from the benefits they have acquired as well.

Table 14: Problem Encountered

Problems	Frequency (f)*	Percentage (%)
Lack of knowledge and awareness on IPM practices	24	32
Lack of training in IPM practices	38	51
Lack of resources needed as an alternative for pesticide use	27	36
Complexity of IPM systems	23	31
Resistance to change	34	46
Time constraints	35	47
High initial costs	35	47
Pesticide dependence habits	53	72

**Multiple responses*

CONCLUSION

Based on the findings of the study, it can be concluded that the rice farmers from Barangay Bubong Madanding and Barangay Cawayan Dialongana of Marantao, Lanao del Sur, aged around 50 to 59 years old, dominated by male, married, experienced elementary level of school, have a four to six household family member with a household monthly net income of five thousand and below, and have had experienced farming for around five years and above. Integrated pest management practices such as biological practice using predators; for cultural practice using crop rotation, and intercropping; for chemical practice using pesticides; for mechanical practice using trap cropping; and for physical practice using physical inspection and monitoring were the highly practiced IPM practices among rice farmers. Cost savings, reduction in chemical use, and improves crop quality and profitability are among the benefits acquired by the rice farmers the most. Pesticide dependent, lacking training in IPM practices, time constraints, high initial costs, and resistance to change are among the problems encountered in the application of IPM practices.

Based on the conclusions made, the researcher recommends that there should be access to agricultural training programs and resources that could further enhance the farmer's skills and knowledge regarding IPM practices. This will help them reduce their reliance on pesticides. The Local Government Unit (LGU) should collaborate with agricultural experts and organizations to provide workshops or training and resources. This will help improve their knowledge and skills in IPM practices, ultimately leading to better crop yields, avoiding high initial costs and reliance on pesticides. Continuous adoption and implementation of IPM practices ensure successful sustainable crop production. Staying proactive and informed about new pest control methods and technologies regarding IPM helps protect crops from potential threats. Future researchers should conduct similar studies of integrated pest management in diverse regions and crop types to assess its effectiveness across various agricultural systems.

REFERENCES

Abrol, D. P. (2017). *Integrated Pest Management: Current concepts and ecological perspective.* Academic Press RELX India.

Alam MZ, Crump AR, Haque M, Islam M, Hossain E, Hasan SB, Hasan SB, Hossain M (2016) Effects of integrated pest management on pest damage and yield components in a rice agro-ecosystem in the Barisal Region of Bangladesh. *Front Environ Sci, 4*(22). https://doi.org/10.3389/fenvs.2016.00022

Allara, M., Kugbei, S., Dusunceli, F., & Gbehounou, G. (2012). Coping with changes in cropping systems: plant pests and seeds. *Building resilience for adaptation to climate change in the agriculture sector, 23*(91), 19.

AL-Naabi, S. (2025). Using Natural Enemies to Control Greenhouse Pests. *American Journal of Agricultural Science, Engineering, and Technology, 9*(1), 28–36. https://doi.org/10.54536/ajaset.v9i1.2588

Angon, P. B., Mondal, S., Jahan, I., Datto, M., Antu, U. B., Ayshi, F. J., & Islam, M. S. (2023). Integrated pest management (IPM) in agriculture and its role in maintaining ecological balance and biodiversity. *Advances in Agriculture, 2023*(1), 5546373. https://doi.org/10.1155/2023/5546373

Badstue, L., Petesch, P., Farnworth, C. R., Roeven, L., & Hailemariam, M. (2020). Women farmers and agricultural innovation: Marital status and normative expectations in rural Ethiopia. *Sustainability, 12*(23), 9847. https://doi.org/10.3390/su12239847

Bisaga, I., Parikh, P., & Loggia, C. (2019). Challenges and opportunities for sustainable urban farming in South African low-income settlements: A case study in Durban. *Sustainability, 11*(20), 5660. https://doi.org/10.3390/su11205660

Bowman, M. S., & Zilberman, D. (2013). Economic factors affecting diversified farming systems. *Ecology and society, 18*(1). http://dx.doi.org/10.5751/ES-05574-180133

Braganza, L. (2023). *Integrated Pest Management in the Philippines: How it works*. Retrieved from: https://www.pinoyfoodsecurity.com/agriculture/integrated-pest-management-in-the-philippines-how-it-works/

Cult, S. (2019). *Adoption of Integrated Pest Management Practices: Benefits and Challenges*. Retrieved from: https://ipm.sccgov.org/about-ipm/benefits-ipm

Carnoy, M., & Luschei, T. F. (2008). Skill acquisition in 'high tech'export agriculture: a case study of lifelong learning in Peru's asparagus industry. *Journal of Education and Work, 21*(1), 1-23. https://doi.org/10.1080/13639080801956982

Cuyno, L. C., Norton, G. W., & Rola, A. (2001). Economic analysis of environmental benefits of integrated pest management: a Philippine case study. *Agricultural Economics, 25*(2-3), 227-233. https://doi.org/10.1016/S0169-5150(01)00080-9

Ehi-Eromosele, C. O., Nwinyi, O. C., & Ajani, O. O. (2013). Integrated pest management. In Weed and pest control-conventional and new challenges. *IntechOpen*. http://dx.doi.org/10.5772/54476

Farm Biosecurity (n.d.). *What is Integration Pest Management? Morph Digital*. Retrieved from https://www.farmbiosecurity.com.au/what-is-integrated-pest-management.

Graeub, B. E., Chappell, M. J., Wittman, H., Ledermann, S., Kerr, R. B., & Gemmill-Herren, B. (2016). The state of family farms in the world. *World development, 87*, 1-15. https://doi.org/10.1016/j.worlddev.2015.05.012

Hajjar, M. J., Ahmed, N., Alhudaib, K. A., & Ullah, H. (2023). Integrated insect pest management techniques for rice. *Sustainability, 15*(5), 4499. https://doi.org/10.3390/su15054499

Herrera, J. P., Rabezara, J. Y., Ravelomanantsoa, N. A. F., Metz, M., France, C., Owens, A., ... & Kramer, R. A. (2021). Food insecurity related to agricultural practices and household characteristics in rural communities of northeast Madagascar. *Food security, 13*(6), 1393-1405. https://doi.org/10.1007/s12571-021-01179-3

Hillocks, R. J., & Cooper, J. E. (2012). Integrated pest management–can it contribute to sustainable food production in Europe with less reliance on conventional pesticides? *Outlook on Agriculture, 41*(4), 237-242. https://doi.org/10.5367/oa.2012.0107

Food and Agriculture Organization of the United Nations. (2025). *Pest and Pesticide Management. Food and Agriculture Organization of the United Nations*. https://www.fao.org/pest-and-pesticide-management/ipm/integrated-pest-management/en/

Jayne, T. S., & Sanchez, P. A. (2021). Agricultural productivity must improve in sub-Saharan Africa. *Science, 372*(6546), 1045-1047. https://doi.org/10.1126/science.abf5413

Kogan, M. (1998). Integrated pest management: historical perspectives and contemporary developments. *Annual Review of Entomology, 43*(1), 243-270. https://doi.org/10.1146/annurev.ento.43.1.243

Martin, M. J., & Henry, A. (2012). Building Rural Communities through School–based Agriculture Programs. *Journal of Agricultural Education, 53*(2), 110-123.

Moore, K., & Bradley, L. K. (Eds.). (2018). *North Carolina extension gardener handbook*. NC State Extension, College of Agriculture and Life Sciences, NC State University. https://doi.org/10.5032/jae.2012.02110

Ngeywo, J., Basweti, E., & Shitandi, A. (2015). Influence of gender, age, marital status and farm size on coffee production: a case of Kisii County, Kenya. *Asian Journal of Agricultural Extension, Economics & Sociology, 5*(3), 117-125. https://doi.org/10.9734/AJAEES/2015/15702

Ninh, L. K. (2021). Economic role of education in agriculture: evidence from rural Vietnam. *Journal of Economics and Development, 23*(1), 47-58.

Norton, G. W., Rajotte, E. G., & Luther, G. C. (2005). Integrated pest management: Dissemination and impact. in P. Pingali (Ed.), *Agricultural Development Economics Division* (pp. 247-270). CABI Publishing.

Poudel, S., & Dhakal, A. (2021). Integrated Pest Management (IPM) And Its Application in Rice–A Review. Reviews In *Food and Agriculture, 1*(2). http://dx.doi.org/10.26480/rfna.02.2020.39.43

Redfern, S. K., Azzu, N., & Binamira, J. S. (2012). Rice in Southeast Asia: facing risks and vulnerabilities to respond to climate change. *Build Resilience Adapt Climate Change Agri Sector, 23*(295), 1-14.

Rejesus, R. M., Palis, F. G., Lapitan, A. V., Chi, T. T. N., Hossain, M., & Moya, P. F. (2009). The impact of integrated pest management information dissemination methods on insecticide use and rice farmers' health: A multivariate regression analysis. *Journal of Agricultural and Applied Economics, 41*(3), 633-643. https://doi.org/10.1111/j.1467-9353.2009.01468

Rogers, E. M. (2003). *Diffusion of Innovations* (5th ed.). Free Press.

Sekhar, M., Rastogi, M., Rajesh, C. M., Saikanth, D. R. K., Rout, S., Kumar, S., & Patel, A. K. (2024). Exploring traditional agricultural techniques integrated with modern farming for a sustainable future: A review. *Journal of Scientific Research and Reports, 30*(3), 185-198

Serebrennikov, D., Thorne, F., Kallas, Z., & McCarthy, S. N. (2020). Factors influencing adoption of sustainable farming practices in Europe: A systemic review of empirical literature. *Sustainability, 12*(22), 9719. https://doi.org/10.9734/jsrr/2024/v30i31871

Zhou, W., Arcot, Y., Medina, R. F., Bernal, J., Cisneros-Zevallos, L., & Akbulut, M. E. (2024). Integrated pest management: an update on the sustainability approach to crop protection. *ACS omega, 9*(40), 41130-41147. http://dx.doi.org/10.1021/acsomega.4c06628