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FARMER REPORTED OCCURRENCE OF MAJOR INSECT PESTS AND PEST MANAGEMENT PRACTICES IN RICE (*Oryza sativa* L.) IN MEDAK DISTRICT, TELANGANA, INDIA

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ABSTRACT

Rice (*Oryza sativa* L.) is a major food crop in Telangana, where insect pests remain an important constraint to sustainable rice production. Understanding farmers' perceptions of pest occurrence, decision-making processes and pest-management practices is essential for developing location-specific integrated pest management (IPM) strategies. The present study was conducted during the *Kharif* season of 2024–25 in Medak district, Telangana, India, encompassing Narsapur and Kowdipally mandals and two rice production systems: rice monocropping and teak (*Tectona grandis* L.f.)-based rice agroforestry. A total of 120 rice-growing farmers were selected through simple random sampling, with 30 respondents from each mandal × production-system combination. Primary data were collected through personal interviews using a structured interview schedule to document farmers' socio-economic characteristics, perceived occurrence of major insect pests, crop growth stages associated with pest occurrence, criteria used for plant-protection decisions, pesticide-use awareness and pest-management practices. Yellow stem borer (*Scirpophaga incertulas*) was the most frequently reported insect pest (26.67%), followed by rice leaf folder (*Orseolia oryzae*) (23.33%) and brown planthopper (*Nilaparvata lugens*) (17.50%). Farmers most frequently reported pest occurrence during the panicle initiation (34.17%) and tillering (28.33%) stages. Plant-protection decisions were primarily based on visible pest occurrence (40.00%), while only 12.50% of respondents reported using economic threshold levels for initiating control measures. Chemical insecticides were the most commonly reported pest-management approach (45.83%). Awareness regarding pesticide labels, use of protective clothing, pesticide residues in soil and potential effects on soil microorganisms was comparatively limited. The findings highlight the need to strengthen farmer-oriented extension programmes on regular crop surveillance, economic-threshold-based pest-management decisions, judicious and safe pesticide use, conservation of natural enemies and adoption of location-specific IPM practices. Such interventions could contribute to more sustainable and ecologically sound pest management in rice-based production systems of Medak district.

Key words: Rice; Insect pests; farmer perception; yellow stem borer; leaf folder; brown planthopper; integrated pest management; pesticide safety; Medak; Telangana

Introduction

Rice (*Oryza sativa* L.) is one of the world's most important food crops and plays a central role in food and nutritional security, rural employment and farm livelihoods, particularly across Asia. In India, rice cultivation supports millions of farm households and contributes substantially

to agricultural production and rural income. Telangana is an important rice-producing state, where the crop is cultivated extensively during both monsoon and post-monsoon seasons under irrigated and, to a lesser extent, rainfed conditions. However, sustainable rice production is challenged by a diverse complex of insect pests that

attack the crop at different stages of development and can adversely affect crop growth, yield and grain quality.

The rice ecosystem is a dynamic agroecosystem comprising the crop, insect pests, predators, parasitoids, spiders, microorganisms and other biotic components. Among these, insect pests constitute an important biological constraint to rice productivity. Based on their feeding behaviour and mode of damage, rice insect pests are broadly classified as stem borers, defoliators, sap-sucking insects and grain-feeding pests. Their occurrence and abundance are influenced by several interacting factors, including rice variety, crop age, planting time, weather conditions, irrigation and nutrient management, cropping pattern, surrounding vegetation and pesticide-use practices. The yellow stem borer (*Scirpophaga incertulas*) is one of the economically important pests of rice, with larvae damaging the stem and producing characteristic dead-heart symptoms during the vegetative stage and white-ear symptoms during the reproductive stage. The rice leaf folder (*Cnaphalocrocis medinalis*) folds and scrapes the leaf tissue, thereby reducing the effective photosynthetic area. Among sap-sucking pests, the brown planthopper (*Nilaparvata lugens*) is particularly destructive because feeding by nymphs and adults at the plant base can result in yellowing, wilting and hopper burn. The green leafhopper (*Nephotettix virescens*) causes direct feeding damage and is also an important vector of rice tungro virus. Other pests, including rice gall midge (*Orseolia oryzae*), rice hispa (*Dicladispa armigera*), gundhi bug (*Leptocoris acuta*) and rice caseworm (*Nymphula depunctalis*), may become important depending on crop stage, location and prevailing environmental conditions.

Effective management of insect pests depends not merely on their presence but on timely surveillance, accurate pest identification, assessment of pest density, understanding of economic threshold levels and appropriate selection of management measures. Farmers are generally the first to observe pest incidence and crop damage and are therefore important sources of field-level information on pest occurrence. Their perceptions can provide valuable insights into the pests considered locally important, the crop stages at which pest problems are experienced and the management responses adopted under actual farming conditions. However, farmers' pest-management decisions may not always be based on quantitative assessment of pest populations or economic thresholds. Visible pest symptoms, previous experience, advice from neighbouring farmers, pesticide dealers and predetermined spraying schedules may strongly influence decisions to apply insecticides. Such practices can result

in unnecessary or excessive pesticide use, potentially contributing to insecticide resistance, pest resurgence, destruction of natural enemies and other non-target effects.

Farmers' pest-management practices are also closely associated with their socio-economic characteristics and access to agricultural information. Education, farming experience, farm size, extension contact, training exposure, access to reliable information and awareness of recommended plant-protection practices can influence how farmers perceive and respond to pest problems. Inadequate awareness of pesticide labels, recommended dosages, toxicity and safety precautions, use of protective clothing, pesticide residues and possible effects on beneficial organisms and soil microorganisms may increase the risks associated with inappropriate pesticide use. Consequently, assessment of farmers' socio-economic characteristics together with their awareness and pest-management practices is essential for identifying gaps in knowledge and determining the areas where extension interventions are required.

Cropping-system characteristics may further influence pest occurrence and management decisions. Diversified production systems, including agroforestry-based systems, can modify the crop microenvironment and provide habitat and resources for predators, parasitoids and other beneficial arthropods. Such ecological interactions may contribute to natural regulation of pest populations and reduce dependence on chemical insecticides. Therefore, understanding farmer-reported pest occurrence and management practices in relation to different rice production systems can provide a broader basis for developing locally relevant and ecologically sound integrated pest management (IPM) strategies. Previous farmer-based studies have reported yellow stem borer and rice leaf folder among the most commonly perceived insect pests of rice, followed by planthoppers and leafhoppers, while also indicating that farmers frequently initiate pesticide applications based on visible pest occurrence or advice from other farmers rather than economic threshold-based assessment (Hemanth *et al.*, 2021). Studies conducted in different rice-growing regions have likewise documented gaps in farmers' knowledge and adoption of scientific IPM practices, particularly with respect to pest identification, monitoring, pesticide safety and judicious insecticide use (Kumari *et al.*, 2016; Rahaman *et al.*, 2018; Deviprasad *et al.*, 2015; Stadlinger *et al.*, 2011; Ali *et al.*, 2020). These findings emphasize the importance of strengthening farmer awareness and extension support as an integral component of sustainable pest management.

Despite the importance of rice cultivation in Telangana, location-specific information on farmers' perceptions of major insect pests, pest-management awareness and pesticide-use practices remains limited in Medak district. In particular, there is a need to document farmers' socio-economic characteristics alongside their perceptions of pest occurrence, decision-making criteria and awareness of safe and effective pest-management practices. Such information can help identify priority pest problems, knowledge gaps and areas requiring targeted extension intervention. Therefore, the present study was undertaken to assess the socio-economic profile of rice-growing farmers and their awareness and practices related to major insect pests and pest management in rice production systems of Medak district, Telangana, India.

Materials and Methods

Study area

The investigation was conducted during the *Kharif* season of 2024–25 in Medak district of Telangana, India, covering Narsapur and Kowdipally mandals of the Central Telangana agro-climatic zone. Two contrasting rice-production systems were considered: (i) rice monocropping, and (ii) teak (*Tectona grandis*.) + rice agroforestry. Both systems were established in the selected villages, allowing a paired comparison of pest and natural-enemy communities under the two production environments.

Selection of respondents

A total of 120 rice-growing farmers were selected using simple random sampling from villages where rice monocropping and teak-based rice agroforestry were both well established, with 30 respondents drawn from each of the four location × production-system combinations (Table 1). Respondents varied in age, education, farming experience and landholding, reflecting the general farmer population of the study villages.

Data collection instrument

Primary data were collected through personal interviews using a structured interview schedule developed for this study. The schedule was framed in the local language. The schedule had three parts: (i) socio-economic profile of the respondent (age, educational status, farm size and main extension contact); (ii) the insect pests commonly noticed in the rice field during the *Kharif* season, the growth stage(s) at which pests were most noticed, and the basis on which farmers typically decided to apply plant-protection measures; and (iii) farmers' general awareness and practices relating to pesticide use, including label-claim compliance, awareness

Table 1: Distribution of respondents according to study location and production system.

Sr.	Mandal	Production system	TR	FR
1	Narsapur	Rice monocrop	T ₁	30
2	Narsapur	Teak + rice agroforestry	T ₂	30
3	Kowdipally	Rice monocrop	T ₃	30
4	Kowdipally	Teak + rice agroforestry	T ₄	30
			Total	120
TR: Treatment; FR: Farmers				

of insecticide classes and toxicity symbols, protective-clothing use, application method, soil-safety awareness, adoption of non-chemical pest-management approaches, sprayer type, and the broad classes of insecticide used. Reported pest names were cross-checked against locally recognized descriptions and classified to their corresponding scientific identity by the investigating team. All interviews for a given comparison were completed within a comparable time window to reduce recall bias across respondents.

Pest categories considered

The major insect pests considered in the analysis were:

- Yellow stem borer – *Scirpophaga incertulas*
- Leaf folder – *Cnaphalocrocis medinalis*
- Brown planthopper – *Nilaparvata lugens*
- Green leafhopper – *Nephotettix virescens*
- Gall midge – *Orseolia oryzae*
- Army worm – *Mythimna* spp.

Other rice-associated pests such as rice hispa, gundhi bug and rice caseworm were also recorded qualitatively where mentioned by respondents but are not included in the ranked comparison because farmer familiarity with these pests was inconsistent.

Assessment of pesticide-use awareness and practices

Farmers' general awareness of pesticide safety was assessed through eight yes/no items covering label-claim compliance, awareness of insecticide classes, awareness of coloured toxicity triangles, belief in the effectiveness of recommended doses, use of protective clothing, method of insecticide application, and awareness of soil-related precautions and effects (in line with Hemanth *et al.*, 2021). Farmers' pest-management practices were further assessed through their adoption of cultural methods, biopesticides, insecticides and resistant varieties; the type of sprayer(s) used; and the broad insecticide class(es) used, since a farmer could report more than one option for these items.

Table 2: Socio-economic profile of respondents.

Sr.	Characteristic	FQ	PC
A. Age			
1	Young age (<35 years)	22	18.33
2	Middle age (36-55 years)	76	63.33
3	Old age (>56 years)	25	20.83
B. Educational status			
4	Illiterate	35	29.17
5	Functional literate	26	21.67
6	Primary school (1st-5th class)	24	20.00
8	High school (8th-10th class)	15	12.50
9	Intermediate	12	10.00
10	Graduate & above	8	6.67
C. Farm size (landholding)			
11	Marginal (up to 2.5 acres)	51	42.50
12	Small (2.5-5 acres)	29	24.17
13	Semi-medium (5-7.5 acres)	17	14.17
14	Medium (7.5-10 acres)	14	11.67
15	Large (>10 acres)	9	7.50
D. Main extension contact			
17	Agriculture Extension Officer (AEO)	31	25.83
18	Mandal Agriculture Officer (MAO)	18	15.00
19	Scientist, Krishi Vigyan Kendra (KVK)	19	15.83
20	Progressive farmer	21	17.50
21	Input dealer	31	25.83
FQ: Frequency; PC: Percentage (%)			

Statistical analysis

The frequency (F) and percentage (P) of farmers in each socio-economic category, reporting each pest, each growth stage, each decision basis, and each awareness/practice item were calculated as $P = (F/N) \times 100$, where N is the total number of farmers interviewed (N = 120). Pests and growth stages were ranked in descending order of the percentage of farmers reporting them.

Results and Discussion

Respondent profile

An equal number of respondents (30 each) was drawn from every mandal × production-system combination, giving a total sample of 120 farmers (Table 1), which allowed direct comparison between rice monocropping and teak-based agroforestry systems.

Table 3: Major insect pests noticed by rice farmers (n = 120).

S.No	Insect pest	Scientific name	Farmers reporting	Percentage (%)	Rank
1	Yellow stem borer	<i>Scirpophaga incertulas</i>	32	26.67	I
2	Gall midge	<i>Orseolia oryzae</i>	28	23.33	II
3	Brown planthopper	<i>Nilaparvata lugens</i>	21	17.50	III
4	Leaf folder	<i>Cnaphalocrocis medinalis</i>	14	11.67	IV
5	Army worm	<i>Mythimna</i> spp.	14	11.67	IV
6	Green leafhopper	<i>Nephotettix virescens</i>	11	9.17	V

Socio-Economic Profile of the Respondents

The socio-economic characteristics of the 120 rice-growing farmers are presented in Table 2. The majority of respondents (63.33%) belonged to the 36–55 years age group, indicating the active involvement of middle-aged farmers in rice cultivation and farm-level decision-making. Regarding education, 29.17 per cent were illiterate, followed by functionally literate (21.67%) and primary-educated farmers (20.00%) Rahaman *et al.*, (2018) and Ali *et al.*, (2020). The relatively low educational status may limit farmers' understanding of technical information on pesticide labels, dosage, toxicity and safety precautions, emphasizing the need for simple and practical extension communication.

With respect to operational landholding, marginal farmers constituted the largest group (42.50%), followed by small farmers (24.17%). The predominance of small holdings reflects the smallholder nature of rice farming in the study area. Limited resources may influence farmers' ability to invest in improved pest-management technologies and may encourage reliance on easily available and quick-acting chemical insecticides. Among sources of pest-management information, AEOs and input dealers were the major sources (25.83% each), followed by progressive farmers (17.50%), KVK scientists (15.83%) and Mandal Agriculture Officers (15.00%) Hemanth *et al.*, 2021.

The findings indicate that farmers depended on a combination of formal extension agencies, private input dealers and informal farmer networks for pest-management information. The accessibility of input dealers and the practical experience shared by fellow farmers may explain their considerable influence. However, dependence on commercial or informal sources may sometimes result in recommendations that are not fully aligned with IPM principles. Therefore, strengthening regular extension contact, practical IPM training, pesticide-safety education and economic-threshold-based pest-management advice is essential for promoting scientific and sustainable pest management among rice farmers in Medak district.

Table 4: Farmer-reported pest occurrence at different crop-growth stages.

S.No	Crop-growth stage	FR	PC	Rank
1	Panicle initiation	41	34.17	I
2	Tillering	34	28.33	II
3	Nursery	28	23.33	III
4	Boot-leaf	12	10.00	IV
5	Milky stage	5	4.17	V
FR: Farmers reporting; PC: Percentage (%)				

Major insect pests reported by rice farmers

The major insect pests reported by rice farmers are presented in Table 3. Yellow stem borer (*Scirpophaga incertulas*) was the most frequently reported pest, with 32 farmers (26.67%) identifying it as an important pest. It was followed by rice gall midge (*Orseolia oryzae*) (23.33%) and brown planthopper (*Nilaparvata lugens*) (17.50%). Leaf folder (*Cnaphalocrocis medinalis*) and armyworm were each reported by 11.67 per cent of the farmers, while green leafhopper (*Nephotettix virescens*) was reported by 9.17 per cent.

The higher reporting of yellow stem borer may be due to its common occurrence in rice fields and the easily visible symptoms such as dead hearts and white ears. Gall midge was also commonly reported, possibly because its characteristic silver-shoot symptoms are easily noticed by farmers. Brown planthopper was another important pest, particularly under favourable crop and weather conditions. Leaf folder and armyworm were reported by a moderate proportion of farmers, whereas green leafhopper was reported less frequently (Hemanth *et al.*, (2021). Kumari *et al.*, (2016).

Overall, the findings show that yellow stem borer, gall midge and brown planthopper were the major insect pests perceived by farmers in the study area. The results also indicate the need for regular pest monitoring and timely extension advice to help farmers identify pests correctly and adopt appropriate management practices.

Pest occurrence according to crop-growth stage

Farmers reported that insect pests were most frequently observed during the panicle initiation stage (34.17%), followed by the tillering stage (28.33%) and nursery stage (23.33%). Pest occurrence was comparatively lower during the boot-leaf stage (10.00%) and milky stage (4.17%).

The higher occurrence reported during panicle initiation and tillering may be due to favourable crop conditions and the availability of succulent plant tissues during these stages. The relatively high reporting from the nursery stage also indicates the need for early pest monitoring before transplanting.

Table 5: Basis for farmers' plant-protection decisions.

S. No	Decision basis	FM	PC
1	Appearance of pest	48	40.00
2	Following neighbouring farmers	32	26.67
3	Calendar-based application	25	20.83
4	Economic-threshold level	15	12.50
5	Total	120	100.00
FM: Farmers; PC: Percentage (%)			

Overall, the findings indicate that greater attention should be given to pest surveillance during tillering and panicle initiation, with monitoring beginning from the nursery stage. Regular field visits and timely advisory services during these critical stages can help farmers identify pest problems early and adopt appropriate management measures.

Basis of plant-protection decisions

Visible pest occurrence was the main basis for plant-protection decisions, reported by 40.00% of farmers, followed by neighbouring farmers' practices (26.67%) and calendar-based applications (20.83%). Only 12.50% of farmers reported using economic-threshold levels. Farmers mainly relied on visible pest occurrence because symptoms are easy to identify and provide an immediate indication for spraying. Reliance on neighbouring farmers may be due to easy access to local experience and limited contact with technical experts.

Calendar-based applications may be preferred because they are simple and convenient, while the low use of economic thresholds may be due to limited knowledge of pest monitoring and difficulty in estimating pest populations. These findings indicate a gap in scientific pest-management practices and highlight the need for extension programmes on regular pest monitoring, economic thresholds and need-based pesticide application. Similar dependence on visible pest occurrence, neighbouring farmers and non-threshold-based decisions has been reported by Hemanth *et al.*, (2021) and Kumari *et al.*, (2016). Studies from other rice-growing regions

Table 6: Farmers' awareness of pesticide uses and safety (n = 120).

S. No.	Awareness/safety practice	Yes (F)	Yes (%)
1	Follows label claim before spraying	19	15.83
2	Aware of different insecticide classes	17	14.17
3	Aware of colored toxicity triangles	31	25.83
4	Believes recommended dose is effective	21	17.50
5	Uses protective clothing while spraying	11	9.17
6	Directs insecticide towards plant base	9	7.50
7	Aware of precautions to avoid soil residues	5	4.17
8	Aware of insecticide effect on soil microbes	7	5.83

Table 7: Adoption of pest-management approaches.

S.No	Pest-management approach	FM	PC
1	Insecticides	55	45.83
2	Biopesticides	31	25.83
3	Cultural methods	20	16.67
4	Resistant varieties	14	11.67
FM: Farmers; PC: Percentage (%)			

have also reported gaps in farmers' knowledge of scientific pesticide-use and IPM practices (Rahaman *et al.*, 2018; Stadlinger *et al.*, 2011).

Farmers' pesticide-use awareness and safety

The results presented in Table 5 indicate that farmers' awareness of pesticide use and safety was generally low across all assessed indicators. Awareness of coloured toxicity triangles was comparatively higher (25.83%), but only 15.83% of respondents reported checking or following label claims before pesticide application. The use of protective clothing was reported by only 9.17% of farmers. Awareness regarding precautions to minimize pesticide residues in soil was very low (4.17%), while only 5.83% of respondents were aware of the possible effects of pesticides on soil microorganisms. These findings indicate considerable gaps in farmers' knowledge of safe and environmentally responsible pesticide use.

The low awareness may be related to limited exposure to formal pesticide-safety training, low educational levels among some respondents and greater dependence on informal advice from fellow farmers and input dealers. Farmers may also focus mainly on achieving immediate pest control and may therefore give less attention to label instructions, personal protection and environmental consequences (Jallow *et al.*, 2017; Rahaman *et al.*, 2018). Deviprasad *et al.*, (2015). The low awareness of soil residues and effects on soil microorganisms is particularly important because repeated and improper pesticide use may adversely affect soil health and beneficial organisms. Regular extension contact, practical demonstrations on reading pesticide labels, proper dosage and application methods, use of protective clothing, safe disposal of containers and measures to protect soil and beneficial organisms should therefore be strengthened. Repeated, simple and locally relevant training programmes, supported by demonstrations and visual materials, could improve farmers' pesticide-safety awareness and promote safer and more judicious pesticide use.

Table 8: Type of sprayer used by rice farmers.

S. No	Sprayer type	Farmers	Percentage (%)
1	Power sprayer	65	54.17
2	Taiwan sprayer	55	45.83

Adoption of pest-management approaches

Chemical insecticides were the most commonly adopted pest-management approach, reported by 45.83% of farmers, followed by biopesticides (25.83%). Cultural methods were adopted by 16.67%, while 11.67% of respondents reported using resistant varieties. The higher dependence on chemical insecticides may be due to their quick action, easy availability and farmers' perception of providing immediate control of visible pest infestations Stadlinger *et al.*, (2011) and Ali *et al.*, (2020).

The comparatively lower adoption of cultural methods and resistant varieties may be associated with limited awareness, availability of suitable varieties and lack of technical guidance. The use of biopesticides by one-fourth of the farmers indicates some awareness of alternative pest-management options. However, the overall pattern shows greater reliance on chemical control than preventive and non-chemical approaches, highlighting the need to promote integrated pest management (IPM) through farmer training, demonstrations and regular extension support.

Type of sprayer used

Power sprayers were reported by 54.17% of respondents, whereas 45.83% used Taiwan sprayers. Since sprayer performance influences application efficiency and off-target losses, farmer training should include calibration, nozzle selection, spray coverage, operator safety and drift-reduction practices.

Insecticide classes used by farmers

Among the insecticide classes reported by farmers, phenyl pyrazoles were the most commonly used (24.17%), followed by chitin synthesis inhibitors (17.50%) and neonicotinoids (14.17%). Carbamates, organophosphates and synthetic pyrethroids accounted for 12.50%, 11.67% and 10.00%, respectively. Diamides (9.17%), organochlorines (7.50%) and pyridine azomethines (6.67%) were reported less frequently Ali *et al.*, (2020) and Jallow *et al.*, (2017).

Table 9: Major insecticide classes reported by farmers.

S.No	Insecticide class	FM	PC	Rank
1	Phenyl pyrazoles	29	24.17	I
2	Chitin synthesis inhibitors	21	17.50	II
3	Neonicotinoids	17	14.17	III
4	Carbamates	15	12.50	IV
5	Organophosphates	14	11.67	V
6	Synthetic pyrethroids	12	10.00	VI
7	Diamides	11	9.17	VII
8	Organochlorines	9	7.50	VIII
9	Pyridine azomethines	8	6.67	IX
FM: Farmers; PC: Percentage (%)				

The higher use of phenyl pyrazoles and other insecticide groups may be due to their availability, perceived effectiveness and recommendations from input dealers or fellow farmers. The use of several insecticide classes indicates considerable dependence on chemical control. Therefore, farmers need greater awareness of judicious insecticide selection, recommended doses and rotation of insecticides with different modes of action to reduce the risk of insecticide resistance and protect beneficial organisms. Integrating chemical control with biological and cultural methods would further strengthen sustainable IPM practices.

Conclusion

The present study documented farmers' perceptions of major insect pests and their associated pest-management practices in rice production systems of Medak district during Kharif 2024–25. Yellow stem borer was the most frequently reported pest, followed by rice gall midge and brown planthopper. Farmers most observed pest occurrence during the panicle initiation and tillering stages, highlighting the importance of regular monitoring during these critical crop stages. The study also revealed that plant-protection decisions were mainly based on visible pest occurrence, neighbouring farmers' practices and calendar-based spraying, whereas only a small proportion of farmers used economic-threshold levels.

Chemical insecticides were the predominant pest-management approach, while awareness of important pesticide-safety measures, including label compliance, protective clothing and environmental safety, was limited. These findings indicate the need to strengthen farmer-oriented extension programmes focusing on integrated pest management (IPM). Future interventions should emphasize regular crop scouting, correct pest identification, economic-threshold-based decision-making, biological and cultural methods, conservation of natural enemies, safe pesticide handling and judicious use of insecticides. Farmers should also be trained in proper label interpretation, use of protective equipment, sprayer calibration and rotation of insecticides with different modes of action to reduce resistance development.

Suitable habitat diversification and agroforestry

practices may also be explored as complementary ecological approaches for enhancing beneficial arthropods and supporting natural pest regulation. Further research involving direct field-based assessment of pest populations, natural-enemy abundance, actual pesticide-use records and production-system-wise statistical comparisons is recommended. Such studies would provide stronger evidence for developing location-specific and sustainable IPM strategies for rice production in Medak district.

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