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Extension on The Use of Light Trap Technology for Rice Stem Borer Control in Swamp Land: A Case Study of The 2025 Brigade Pangan Program in South Sumatra

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Abstract

Rice production in Indonesia continues to face challenges related to pest attacks, environmental degradation, and the limited adoption of eco-friendly technologies at the farmer level. Strengthening farmers' capacity through targeted extension programs is therefore essential to support sustainable pest management and food security. The 2025 Brigade Pangan Program aims to strengthen national food self-sufficiency through the optimization of swamp land in South Sumatra. One of the pest management innovations introduced under this program is the use of light traps to control rice stem borer pests (*Scirpophaga innotata*). This activity was implemented in Rantau Durian I Village with the objective of enhancing farmers' knowledge and attitudes toward the adoption of environmentally friendly pest control technologies. The methods employed included extension activities, hands-on demonstrations, and evaluations using pre-test and post-test assessments. The results revealed a substantial increase in farmers' knowledge by 84% and an improvement in attitudes by 36%, indicating the effectiveness of the extension approach in promoting behavioral change and technology adoption. Furthermore, light trap technology proved effective in capturing an average of 30 adult pests per unit, demonstrating its potential to significantly reduce pest populations. This study highlights that a technology-based educational approach can effectively encourage the adoption of eco-friendly innovations in rice cultivation, thereby supporting the sustainable success of the Brigade Pangan Program and contributing to long-term agricultural resilience and food security.

INTRODUCTION

Increasing rice productivity is a strategic priority for achieving national food self-sufficiency (Ministry of Agriculture, 2022). South Sumatra Province possesses approximately 3.2 million hectares of wetlands, consisting of tidal and lebak land, much of which remains under-utilised (BPS, 2023a). To optimise these resources, the Ministry of Agriculture launched the 2025 Brigade Pangan Program, engaging groups of millennial farmers to manage a minimum of 200 hectares per group through a technology based and capacity building approach (Ministry of Agriculture, 2025). In Lempuing Jaya District, one of the target areas rice production in swamp land increased from 21,203 tons in 2023 to 34,342 tons in 2024, a 38.3 % rise driven largely by expanded planting areas and higher cropping indices (BPS, 2023).

Despite this progress, major constraints remain. One of the most significant is the rice stem borer *Scirpophaga innotata*, a pest capable of reducing yields losses of up to 38-80% by yellow stem borer and 95% by white stem borer (Rahimoon et al., 2023). Recent studies confirm that light-trap monitoring reveals consistent peak populations of *S. innotata* and related stem borers in rice ecosystems, underscoring the need for timely, targeted control measures (Atta et al., 2024). At the same time, farmers in the region typically rely on chemical pesticides as their primary control method; yet excessive pesticide use contributes to resistance, environmental degradation, and health risks (Sinambela, 2024). Literature from similar agro-ecosystems indicates that adoption of eco-friendly pest management strategies aligned with Integrated Pest Management (IPM) principles is increasing, but remains hindered by socioeconomic and informational barriers (Shrestha et al., 2024; Nguyen et al., 2024).

Against this backdrop, light trap technology emerges as a promising, environmentally friendly alternative. It exploits the phototactic behaviour of nocturnal pests drawn to light sources to monitor and reduce pest populations, particularly in rice fields. For example, a field trial in Bangladesh found that solar light traps, when installed at optimal height and time, captured significantly more stem borers and thereby supported reduced reliance on chemical pesticides (Uddin et al., 2025). However, for such technology to be effective in practice, farmers must have sufficient knowledge, understanding, and confidence in both the tool and its operational context. Extension services are therefore critical: studies show that extension activities combining demonstrations, group discussions, and pre/post-tests significantly improve farmers' knowledge, attitudes and adoption of technologies (Jamil et al., 2023; Hoa Sen, 2024). In view of these factors, this study evaluates the effectiveness of extension activities on the use of light trap technology for controlling rice stem borer pests in swamp land areas, as part of efforts to support sustainable rice production under the Brigade Pangan Program.

RESEARCH METHODOLOGY

MATERIALS AND METHODS

The extension program was conducted on April, 2025, in Rantau Durian I Village, Lempuing Jaya Subdistrict, Ogan Komering Ilir Regency. A Participatory Rural Appraisal (PRA) approach was applied to ensure active involvement of farmers throughout the planning, implementation, and evaluation stages. Data collection was carried out using structured questionnaires administered before and after the extension activity to assess changes in participants' knowledge and attitudes.

Pre-Activity Preparations

Pre-activity preparations were conducted from February to April 2025. The preparation stage included the following steps:

a. Assessment of Local Conditions
   Identification of agricultural potential, cropping practices, and key pest problems, particularly the prevalence of rice stem borer (*Scirpophaga innotata*) in swamp land rice fields.
b. Design of Extension Materials and Media
   Selection and development of appropriate learning materials, audiovisual aids, and demonstration tools tailored to participant characteristics such as age, education level, and farming experience.
c. Stakeholder Coordination
   Coordination with local agricultural extension worker (BPP Lempuing Jaya), village leaders, and Brigade Pangan groups to determine participant lists, demonstration sites, and logistical arrangements.

Implementation of Extension Activities

The core extension activities were implemented in four sequential stages:

a. Pre-Test Assessment
   Participants completed a baseline pre-test to measure initial levels of knowledge and attitudes related to rice stem borer control and light trap technology.
b. Delivery of Extension Materials
   Extension materials were presented through lectures, discussions, and visual media. Topics included: Biology and damage symptoms of the rice stem borer, Principles and components of light trap technology, and Advantages of light traps for monitoring and reducing nocturnal pest populations
c. Hands-On Demonstration and Practice
   A practical session was conducted in which participants constructed and installed light traps using simple, locally available materials. Participants were guided in determining trap placement, installation height, and optimal operating time.
d. Post-Test Assessment
   A post-test was administered immediately after the activity to measure changes in knowledge and attitudes. The participants consisted of members of the Brigade Pangan group, with an average age of 28 years and educational backgrounds ranging from senior high school to undergraduate level.

Post-Activity Monitoring and Evaluation

Monitoring and evaluation were carried out from April to May 2025 to assess both learning outcomes and the initial technical performance of the light traps in the field. The following activities were conducted:

a. Evaluation of Knowledge and Attitudes
   Knowledge was assessed using a Guttman scale, consisting of dichotomous (Yes/No) items. Attitudes were evaluated using a Likert scale with five response categories to measure levels of agreement and willingness to adopt light trap technology.
b. Field Observation of Light Trap Performance
   Installed light traps were observed periodically to record the number and type of insects captured. The average number of adult pests captured per unit was used as an indicator of the technology's effectiveness as a preventive pest control tool.

c. Follow-Up Discussion with Participants
   Informal interviews and group reflections were conducted to gather feedback on ease of use, perceived benefits, and interest in continued adoption of light traps in regular pest management practices.

RESULTS AND DISCUSSION

Pre-activity

The pre-activity stage served as the foundation for planning extension interventions by identifying local agricultural potential and key pest constraints through interviews with farmers, as shown in figure 1. Rantau Durian I Village, with an area of ±3,700 ha of which 1,250 ha are rice fields has strong potential for swamp-based rice development supported by a rice–rice–rice cropping pattern. According to Horgan et al. (2023); Anwar et al., (2024), swamp rice ecosystems with continuous planting cycles tend to experience higher pest pressure, including stem borers, due to year-round host availability. Although rice production in Lempuing Jaya increased from 21,203 tons in 2023 to 34,342 tons in 2024 (BPS, 2023b), the area remains vulnerable to outbreaks of *Scirpophaga innotata*, a major pest capable of causing 60–75% yield loss (Atta et al., 2024). Farmer dependence on chemical pesticides further exacerbates ecosystem imbalance and hampers long-term sustainability. Recent studies highlight that low technological literacy and limited access to extension services reduce farmer adoption of eco-friendly pest management methods such as IPM (Kumar & Singh, 2022; Nguyen et al., 2024; Shrestha et al., 2024).

Based on this assessment, the extension team designed an intervention using light trap technology as an ecological-based preventive method. Modern field studies show that solar light traps effectively attract and reduce adult stem borer populations when properly installed (Uddin et al., 2025). Therefore, extension and hands-on training were planned to strengthen farmer understanding and readiness to adopt the technology. Preparation activities included tailoring extension materials and methods to participant characteristics, primarily young members of the Brigade Pangan with high school to undergraduate education levels, who generally exhibit higher openness to innovation (Sharma et al., 2021; Hoa Sen, 2024). Limited extension personnel in the area made researcher involvement essential, ensuring accurate material delivery, appropriate demonstration setups, and more effective technology transfer. Jamil et al. (2023) emphasize that participatory demonstrations combined with facilitator support significantly improve farmers' learning and innovation adoption. Thus, the pre-activity phase played a critical role in diagnosing field conditions, designing suitable extension strategies, and ensuring that the technology introduced aligned with both farmer capacity and the swamp land agroecosystem.

Figure 1. Identification of Potential Areas Through Interviews with Farmers in Rantau Durian I

Core Activities

The core activity stage consisted of participatory extension and field practice designed to strengthen the capacity of Brigade Pangan members in adopting ecological-based pest control technologies. The main material delivered was the use of light trap technology as a preventive tool for controlling the rice stem borer *Scirpophaga innotata*. Light traps operate by exploiting the phototactic behaviour of nocturnal insects, allowing early monitoring and the capture of adult moths before they reproduce. Recent studies confirm that light traps are effective for detecting population peaks of rice stem borers and reducing the number of egg laying adults, thereby contributing to breaking the pest's life cycle (Atta et al., 2024; Horgan et al., 2023). This aligns with the Integrated Pest Management (IPM) approach, which emphasizes preventive, environmentally friendly control strategies to reduce reliance on synthetic pesticides.

Field practice included hands-on training where participants learned to construct and install light traps using locally available, low-cost materials. Demonstration-based learning is considered highly effective in increasing farmers' technological competence, as supported by Jamil et al. (2023); yan et al., (2023), who found that participatory demonstrations significantly enhance farmers' knowledge and motivation to adopt innovations. Light trap installation was tailored to swamp land conditions in Rantau Durian I, with guidance provided on optimal trap height, light intensity, and placement technical aspects shown to influence trap effectiveness in recent field research (Rashid et al., 2022; Uddin et al., 2025). This practical component not only improved technical skills but also encouraged a collective understanding of ecological pest management, reducing farmers' dependence on chemical pesticides, which continue to pose health and environmental risks (Shrestha et al., 2024).

The extension activities were delivered using presentations, discussions, and practical sessions, involving students from Polbangtan Malang, local agriculture extension worker, and all members of the Brigade Pangan, as shown in figure 2. A pre-test and post-test design was used to measure knowledge improvements, consistent with recommended extension evaluation methods (Eryanto et al., 2023). Nguyen et al. (2024) highlight that farmers with higher exposure to structured extension activities show significantly greater readiness to adopt agricultural technologies. The high enthusiasm and active participation during the discussion sessions indicated strong interest and readiness among farmers to integrate light trap technology into their rice cultivation practices. Overall, the participatory and dialogical approach used in this extension activity effectively supported behavioural change, strengthened farmer engagement, and increased the likelihood of sustained adoption of environmentally friendly pest management innovations.

Figure 2. The Extension Activity Using Presentation, Discussion, and Hands-On Practical Sessions to Demonstrate the Construction and Installation of Light Traps.

Post- Activity

The post-activity monitoring and evaluation stage was conducted to assess the effectiveness of the extension program and the initial field performance of the light trap technology. Monitoring focused on counting the number and types of pests captured by the light traps as an early indicator of their operational success. Light traps are widely recognized as effective tools for monitoring population dynamics of nocturnal pests, particularly rice stem borers, because they capture adults during peak activity periods and thereby help to disrupt the reproductive cycle (Atta et al., 2024; Horgan et al., 2023). Evaluation of learning outcomes was conducted using a Guttman scale to measure knowledge improvement and a Likert scale to assess attitudinal change.

The pre-test and post-test results (Table 1) showed substantial increases across all groups, indicating that the extension materials and delivery methods effectively improved participants' cognitive and behavioural readiness toward adopting light trap technology. Learning improvement was strongly supported by the use of visual media, hands-on practice, and participatory learning methods. Demonstration-based extension is widely acknowledged as one of the most effective approaches for enhancing farmers' understanding and willingness to adopt ecological innovations (Jamil et al., 2023). Younger and more educated participants characteristic of the Brigade Pangan groups tend to respond positively to interactive and practical learning formats, consistent with findings by Nguyen et al. (2024), who reported that farmer demographics and quality of extension exposure significantly influence technology adoption in rice ecosystems. Visual media and real objects make abstract concepts tangible, enabling participants to better observe pest behaviour, trap mechanisms, and expected field outcomes. These methods also strengthen long-term recall and practical application, a key factor in improving adoption rates of eco-friendly pest control practices (Shrestha et al., 2024).

Field observations further demonstrated the practical effectiveness of light traps. On average, a single light trap unit captured approximately 30 adult stem borers per night. Considering that a single female *Scirpophaga innotata* can lay between 50 and 150 eggs, the installation of one trap has the potential to prevent the development of 1,500–4,500 eggs per pest generation, as shown in figure 3. These findings align with field studies showing that optimized light trap installation can significantly reduce adult moth populations and complement IPM programs (Uddin et al., 2025). The initial adoption observed among farmers in Rantau Durian I Village indicates a shift toward more ecological pest management practices. If applied consistently, this technology can meaningfully suppress stem borer populations and contribute to sustainable rice cultivation in swamp-land agroecosystems.

Table 1. Pre-test and Post-Test Scores of Knowledge and Attitudes of the Brigade Pangan Towards the Utilization of Light Trap

Aspect	Material Utilization Lamp Trap Pest (*Light trap*)							
	BP Young Farmer Advance		BP Diamond Together		BP Serabuk Tangguh		BP Youth Farmer	
	Pre-Test	*Post-test*	Pre-Test	*Post-test*	Pre-Test	*Post-test*	Pre-Test	*Post-test*
Knowledge	54	199	40	192	27	216	38	213
Attitude	278	551	340	536	382	597	391	656

Note: BP= Brigade Pangan

Figure 3. Field application of light trap technology for monitoring rice stem borer population

CONCLUSIONS AND SUGGESTION

The extension program effectively enhanced the knowledge and attitudes of Brigade Pangan members, regarding the use of light trap technology for controlling the rice stem borer (*Scirpophaga innotata*) in swamp-land rice ecosystems, as evidenced by significant improvements in pre- and post-test scores and the successful field capture of an average of 30 adult pests per trap, indicating its potential to disrupt pest reproduction and support environmentally friendly integrated pest management. To ensure sustained impact, farmers and Brigade Pangan members are encouraged to apply light traps consistently during critical pest periods and integrate them with other IPM components; local extension worker and village authorities should provide continued support for materials and maintenance; further capacity building is recommended to optimize trap placement and data interpretation; community-wide monitoring networks should be developed to strengthen early-warning systems; and long-term evaluation is needed to assess ecological, technical, and economic benefits of the technology for sustainable rice cultivation.

REFERENCES

Anwar, R., Sartiami, D., & Rauf, A. (2024). Species investigation of rice stem borers and its parasitoids on fallowing rice fields at Karawang, Indonesia. *AGRIVITA Journal of Agricultural Science*, 46(1): 38-47.

Atta, B., Sabir, A. M., Gogi, M. D., Farooq, M. A., Ijaz, M., Awan, T. H., Ayub, M. A., & Saleem, M. U. (2024). Exploring the utility of light traps for early detection and management of rice insect pests. *Punjab University Journal of Zoology*, 39(1), 21-32.

BPS (2023a). Statistik Pertanian Kabupaten Ogan Komering Ilir. Badan Pusat Statistik.

BPS. (2023b). Statistik Pertanian Kecamatan Lempuing Jaya. Badan Pusat Statistik.

Eryanto, O., Kuswardani, R. A., Noer, Z., & Aulia, M. R. (2023). The influence of agricultural extension agents on pest management and farmer capability for enhanced productivity in Asahan Regency. *Universal Journal of Agricultural Research*, 11(5), 849-859.

Kumar, S., & Singh, R. (2022). Influence of farmers' education and extension exposure on adoption of eco-friendly pest management: a case in northern India. *Journal of Agricultural Extension*, 26(1), 45-57.

Ministry of Agriculture. (2022).*National Food Self-Sufficiency Strategy*. Jakarta: Ministry of Agriculture.

Ministry of Agriculture. (2025). *Guidelines for the Implementation of the Food Brigade Program*. Jakarta: Ministry of Agriculture.

Hoa Sen, L. T. (2024). Barriers and enablers of digital extension services in agriculture. *Journal of Rural Studies*, 106, 103050.

Horgan, F. G., Ramal, A. F., Bernal, C. C., & Almazan, M. L. (2021). Stem borers revisited: Host resistance, tolerance, and future directions. *Plant Science*, 303, 110846.

Jamil, M. H., Yonariza, Y., & Yulida, R. (2023). Effectiveness of agricultural extension programs on farmers' innovation adoption. *Sustainability*, 15(4), 3773.

Rahimoon, M. Y., Lanjar, A.G., Bukero, A., din Hajano, J., Rahimoon, S.A., Nahiyoom, S. A. (2023). Comparative efficacy of different botanicals for controlling white stem borer, *Scirpophaga innotata* (Walker) under field conditions. *Pure and Applied Biology*, 12(3), 1532-1540.

Nguyen, L. L. H., Yamada, S., & Nanseki, T. (2024). Factors influencing smallholder farmers' intention to adopt precision agriculture technologies in rice ecosystems. *Journal of Extension Systems*, 40(1), 57-72.

Rashid, M., Ridoy, M. K., Rahman, M. M., & Rahman, M. M. (2022). Does solar light trap reduce the cost of pesticides used in rice fields*? SAARC Journal of Agriculture*, 20(1), 171-183.

Sharma, P., Singh, J., & Mishra, K. (2021). Training and Farmer Field Schools: Impact on adoption of Integrated Pest Management practices among rice farmers in Uttarakhand, India. *International Journal of Pest Management,* 67(4), 345-356.

Shrestha, S., Aryal, S., & Pradhan, N. (2024). Adoption of integrated pest management practices among rice farmers in Nepal: factors and constraints. *Crop Protection*, 179, 106789.

Sinambela, B. R. (2024). Dampak penggunaan pestisida dalam kegiatan pertanian terhadap lingkungan hidup dan kesehatan. *Jurnal Agrotek*, 8(2), 179-191.

Uddin, A. B. M., Sultana, S., & Rahman, M. M. (2025). Optimizing light trap height and installation timing for effective monitoring of insect pests in rice fields. *Nova Geodesia*, 5(1), 322

Yan, A., Cagatay, G., Wang, X., & Li, Y. (2023). The effect of agricultural extension service need-supply fit on farmers' biological pesticide adoption behaviour. *Agriculture*, 13(11), 2074.