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Evaluation of Solar-Powered UV LED Insect Trap Efficiency in Paddy and Green gram Fields

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The solar-powered UV LED insect trap demonstrated remarkable efficacy in capturing major agricultural pests across both paddy and greengram cultivation systems. In paddy fields, the trap successfully collected three predominant pest species: Yellow Stem Borer with average catches of 45-50 moths per trap per night during peak infestation periods. Brown Plant Hopper showing significant capture rates of 150-200 individuals per trap night, particularly during the vegetative and reproductive stages of the crop; and Green Leaf Hopper with collection rates averaging 100-120 insects per trap night. The trap's effectiveness peaked during the evening hours between 6:00 PM and 10:00 PM, aligning with the nocturnal activity patterns of these pests. In green gram fields, the system proved equally effective, targeting two major pest species. Pod Borer with capture rates of 25-30 moths per trap night during flowering and pod formation stages, and Whitefly showing substantial catches of 180-200 adults per trap during daylight hours, particularly in the morning and late afternoon periods. Population dynamics analysis revealed peak trap catches during the reproductive phase of both crops, with notable variations corresponding to weather conditions and crop phenology. The trap's selective wavelength range (400-700 nm) proved particularly effective in attracting these specific pest species while minimizing the capture of beneficial insects, with trap efficiency rates showing 75% specificity for target pests. Weather monitoring during the study indicated optimal trap performance during clear nights with temperatures ranging between 22-28°C and relative humidity of 65-75%. The cumulative pest reduction achieved through continuous trapping resulted in a measurable decrease in crop damage, with paddy showing 28% less stem borer infestation and green gram exhibiting 32% reduction in pod damage compared to untreated control plots.

Table 1: Paddy Field Pest Collection Data

Pest Type	Catch Rate (per trap/night)	Active Period	Peak Crop Stage
Yellow Stem Borer	45-50 moths	6:00 PM - 10:00 PM	Reproductive
Brown Plant Hopper	150-200 hoppers	Continuous (night preference)	Vegetative
Green Leaf Hopper	100-120 insects	Throughout day (evening peaks)	Tillering

Table 2: Greengram Field Pest Collection Data

Pest Type	Catch Rate (per trap/night)	Active Period	Peak Crop Stage
Pod Borer	25-30 moths	Evening hours	Flowering
Whitefly	180-200 adults	Daylight hours	Morning & Late afternoon peaks

The solar-powered UV LED insect trap demonstrated varying effectiveness across different pest species and cropping systems. Brown Plant Hopper emerged as the most frequently captured pest in paddy fields, with impressive catch rates of 150-200 hoppers per trap per night, while Whitefly dominated the catches in greengram fields with 180-200 adults per trap during daylight hours. The study revealed a strong nocturnal preference among most pest species, with peak activity concentrated during evening and night hours (6:00 PM - 10:00 PM), particularly for Yellow Stem Borer and Pod Borer. This temporal pattern of pest activity aligned remarkably well with the trap's optimal functioning period. Notably, each pest species exhibited distinct peak activity periods that corresponded with specific crop growth stages – Brown Plant Hopper during the vegetative stage, Yellow Stem Borer during the reproductive stage, and Green Leaf Hopper during the tillering stage in paddy, while Pod Borer showed maximum activity during the flowering stage of greengram. The trap's effectiveness displayed significant variation depending on the pest species and time of day, with nocturnal pests showing higher capture rates compared to diurnal pests, suggesting the importance of 24-hour trap operation for comprehensive pest management.

 		
Fabrication of Insect Trap	**Trap in Paddy Field**	**Insect Collected in Paddy Field**

Conclusion

The implementation of the solar-powered UV LED insect trap has proven to be a highly effective and sustainable approach to pest management in both paddy and greengram cultivation. The study's findings demonstrate that this innovative technology successfully addresses multiple challenges in modern agriculture. The trap's ability to capture significant numbers of major pest species while operating on renewable energy makes it an environmentally sound alternative to conventional pest control methods. The observed patterns of pest activity and trap effectiveness provide valuable insights for optimizing pest management strategies. The correlation between pest activity and crop growth stages enables farmers to implement more targeted and efficient pest control measures. Furthermore, the trap's solar-powered design ensures consistent operation without additional energy costs, making it an economically viable solution for farmers. The success of this system suggests its potential for wider adoption in sustainable agriculture practices and its integration into comprehensive Integrated Pest Management (IPM) programs. Future developments could focus on enhancing trap design based on specific pest behavior patterns and incorporating smart monitoring systems for improved pest management decision-making.

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