

DESIGN A SOLAR LIGHT TRAP FOR CONTROL OF FIELD CROP INSECTS

Swapnil A. Meshram¹, Shubham A. Kapade², Akshay D. Chaudhari³, Kirti B. Nagane⁴

^{1,2,3}Student, Dept. of Electrical Engineering, DES'S COET, Dhamangaon Rly

⁴Professor, Dept. of Electrical Engineering, DES'S COET, Dhamangaon Rly

Abstract - In this paper, new models of solar light trap was proposed which will be the most effective IPM tool for the monitoring of insect pests and their mechanical control in the field of agriculture, provide no harm to the nature and also have low cost involvement so that it can be utilized by most of the farmers. For that purpose firstly a model of light trap box with iron structure was developed, then a solar light system including solar panel, charging unit, battery and LED bulb installed with the light trap box so that this solar light trap can monitor and control the insect pests of different crops effectively. It is the most effective IPM tool which provide better safeguard to the nature in comparison to the other method of pest control.

Key Words: Agriculture, IPM, Solar light trap, UV light.

1. INTRODUCTION

Green revolution technologies have now been widely adopted and the process of diminishing returns to additional input usage has set in. At present, different schemes on green revolution technology in different crops are successfully going on in the different states of India, and recently a special drive has taken up in the states of the eastern region of India. Concurrently, agricultural production continues to be constrained by a number of biotic and abiotic factors. For instance, insect pests, diseases and weeds cause considerable damage to potential agricultural production. Evidences indicate that pests cause 25 percent loss in rice, 5-10 percent in wheat, 30 percent in pulses, 35 percent in oilseeds, 20 percent in sugarcane and 50 percent in cotton. The losses though cannot be eliminated altogether, these can be reduced. The declining trend in pesticide use in agriculture during the 1990s can be attributed to central government's fiscal policy and technological developments in pest management. During 1990s, taxes were raised on pesticides and phasing out of subsidies was initiated. Programs on training of both the extension workers and farmers in the IPM were started throughout the country.

There are a number of IPM practices that work best when applied by the entire community and in a synchronized mode. This is unlikely to happen without demonstrating benefits of group approach, and external motivation and support to the farmers. Though many technology programs are based on community approach, they do not have any proper exit policy to sustain the group approach. Hence the old concept of proper monitoring of

insect pests at the early stage of pest attack and control of those pests at early stage becomes most important. For proper monitoring and control at the early stages of pest attack, different types of techniques are adopted i.e. survey through damage estimation, sweeping and pest population study, use of traps, etc. Among several types of traps, pheromone trap, light trap, poison bait, alternate hosts are commonly used in the field of agriculture. Present research study is mainly based on development and use of solar light trap in the field of agriculture which may be well adopted by the farmers due to its several field advantages and low cost involvement.

1.1 What is the best lamp for attracting insects?

It has been found that the fluorescent black light lamp is the most effective and efficient lamp (efficient from standpoint of power use) for attracting the adults of most species of nocturnal insects. Insects attracted include many species injurious to cotton, grain, tobacco, vegetables, and other field crops as well as stored-products insects.

1.2 What is a fluorescent black light lamp?

The fluorescent black light lamp is a commercially available lamp used primarily in photo-reproduction equipment and for decorative lighting. The principal emission of this lamp is in the near-ultraviolet region of the electromagnetic spectrum. It can be noted from the chart of Fig. 1 that the near ultraviolet region occupies a position in the spectrum which is just below the violet of our visible spectrum. The term black light (a misnomer, since near-ultraviolet radiation in is not light) apparently derives from the fact that this

2. IMPORTANCE OF SOLAR ENERGY

Solar energy is energy from the Sun in the form of radiated heat and light. It drives the climate and weather and supports life on Earth. Solar energy technologies make controlled use of this energy resource. Solar power is a synonym of solar energy or refers specifically to the conversion of sunlight into electricity by photovoltaic cells, concentrating solar thermal devices or various experimental technologies.

2.1 Energy from the sun

About half the incoming solar energy is absorbed by water and land, the rest is reradiated back into space. Earth continuously receives 340 Wm^2 of incoming solar radiation at the upper atmosphere. Approximately 30% is reflected back to space while the rest is absorbed by the atmosphere, oceans and land masses. After passing through the atmosphere, the insolation spectrum is split between the visible and infrared ranges with a small part in the ultraviolet. The absorption of solar energy by atmospheric convection and evaporation and condensation of water vapor powers the water cycle and drives the winds. Sunlight absorbed by the oceans and land masses keeps the surface at an average temperature of 14°C . The conversion of solar energy into chemical energy via photosynthesis produces food, wood and the biomass from which fossil fuels are derived.

2.2: Applications of Solar Energy Technology

Solar energy technologies use solar radiation for practical ends. Solar technologies such as photovoltaic and water heaters increase the supply of energy and may be characterized as supply side technologies. Technologies such as passive design and shading devices reduce the need for alternate resources and may be characterized as demand side. Optimizing the performance of solar technologies is often a matter of controlling the resource rather than simply maximizing its collection.

2.3: Photovoltaic Basics

First used in about 1890, the word has two parts photo, derived from the Greek word for light, and volt, relating to the electricity pioneer Alessandro Volta. So, photovoltaic could literally be translated as light-electricity. And that is what photovoltaic materials and devices do they convert light energy into electrical energy as discovered by renowned physicist Albert Einstein.

2.4: Electric Trap Light

Farmers encounter the problems of various types of insect pests that harm crops and result in loss of productivity each year. Therefore, it is necessary for farmers to use pesticides to prevent crop damage. However, when pesticides are used in large quantity, they cause adverse impacts on people, animals and the environment. Instead of using pesticides, the government has to support other ways to prevent insect pests, including the use of biological agents and some insects etc. Most light traps are used in the field of agriculture for monitoring the insect pests of different crops is electrically operated and stationery in nature due to its dependence of electric connection. Besides, there is no possibility to avail the electric connection in the entire area of any field crops

for smooth operation of the electrical light trap. Hence the solar light trap may be considered as the alternate solution that has several advantages over the electrical light trap. To fulfill the purpose of a suitable model of solar light trap was developed considering the following characteristics portable in nature, easily fixed at any place in the field by the help of two bamboo poles or one concrete pole as available in the locality.

3. CIRCUIT DESCRIPTION

3.1: Circuit Diagram of Solar Light Trap

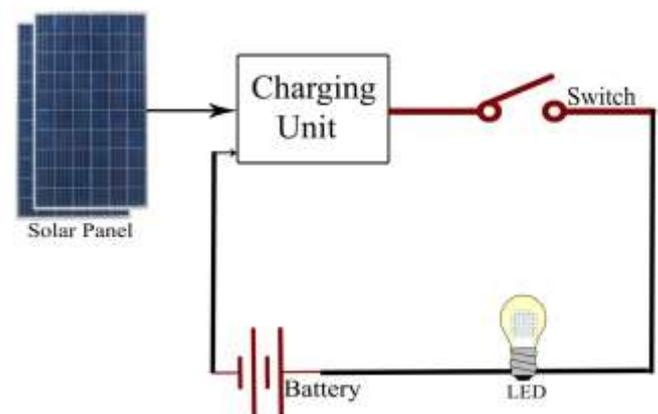


Fig. 3.1: Circuit Diagram of Proposed Work

Here, solar panel is used for generating electricity as shown in figure 3.1. Solar panel is connected to the charging unit for indication purpose. There is switch connected to ON/OFF the light. The UV light used for attract the pest and battery is used to store electricity and provide to the UV light for control of pest in farm.

First, select the appropriate LED light as a light source to trap pests, the boost circuit should make the high-pressure of pest control net over 6KV voltage, thus killing most of the pests toward the light and ensuring the body safety at the same time based on the load power of LED lamps, high-voltage network and control circuit, make a reasonable choice for the capacity of batteries and solar panels to guarantee of 8h design a control circuit for the solar panels to control the battery charging and discharging as well as protect the system. Meanwhile, it could control the LED pest control light which means the light could automatically turn on at night and off during the daytime, coupled with the lightning protection, anti-rain, short circuit prevention of high-voltage network caused by the dew, the prevention of accidentally injure of human and animals caused by the high-voltage network, the prevention of electric shock accident caused by the pest control light.

3.2: Flow Chart of Proposed System

Most light traps used in the field of agriculture for monitoring the insect pests of different crops is electrically operated and stationary in nature due to its dependence of electric connection. Besides, there is no possibility to avail the electric connection in the entire area of any crop field for smooth operation of the electrical light trap. Hence the solar light trap may be considered as the alternate solution that has several advantages over the electrical light trap.

The solar panel and the charging unit is fixed on one side of v-shaped structure of fiber or plastic body facing the panel toward south. Then the battery is placed within the light trap box and the LED bulb is placed funnel structure at middle under the shed structure. The solar system is connected with each other through proper wires as shown in figure 3.4.

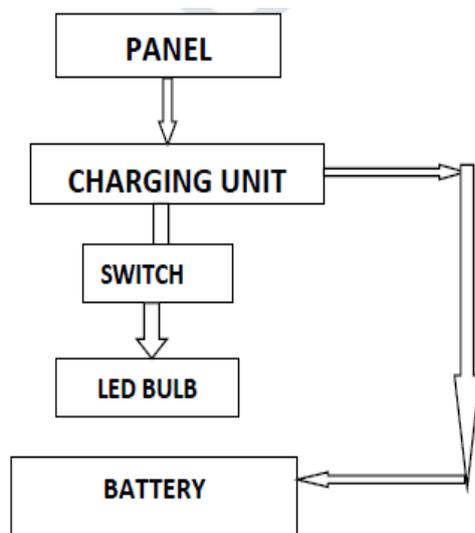


Fig. 3.2: Block Diagram of Solar Light Trap Model

The operation of the solar light trap is very easy. There is a switch above the LED bulb. A farmer has to switch on the bulb every evening time and switch-off in the morning and the solar light trap will be charged during day time and provide light at night. This solar light attract the insect pests and the same will be collected in the light trap box through funnel and will be stored in a plastic jar placed within the box.

A little amount of water with a few drops of kerosene oil or even a few drops of liquid soap may be placed in the jar so that the insect pests caught by the trap cannot fly away through the same hole.

4. CONCLUSION

The development of this solar light trap and successful demonstration of this tool in different crop areas by the farmers resulted that as an alternate of chemical pesticide, this tool may be considered as important for its

ecofriendly nature and low cost involvement to both the farmers and agricultural experts. The solar light trap model will be very much effective for the control of different insect pests of all crops without any use of chemical pesticides in the agricultural fields in near future. Many organizations may also utilize this useful IPM tool for successful implementation of green revolution technology in the crop field for providing necessary safeguard to the nature. Hence we have concluded that, this is the best IPM tool for control of field crop insects.

REFERENCES

- [1] G. A. Ficht, T. E. Hienton, and J. M. Fore, "The use of electric light traps in control of the European corn borer", *Agri. Engrg.*, vol. 21, pp. 87-88, March 1940.
- [2] G. A. Mazkhin-Porshnyakov, "Why insects fly to light by night", *Entomol. Obozrenie*, vol. 39, pp. 32-36, January-March 1960.
- [3] H. M. Graham, P. A. Glick, and J. P. Hollingsworth, "Effective range of argon glow lamp survey traps for pink bollworm adults", *J. Econ. Entomol.*, vol. 54, pp. 788-789, August 1961.
- [4] J. G. Taylor and H. O. Deay, "Electric lamps and traps in corn borer control", *Agri. Engrg.*, vol. 31, pp. 503-505, 532, October 1950.
- [5] J. M. Stanley and C. B. Dominick, "Response of tobacco and tomato-hornworm moths to black light", *J. Econ. Entomol.*, vol. 51, pp. 78-80, February 1958.
- [6] J. M. Stanley and E. A. Taylor, "Population suppression of tobacco hornworms and budworms with blacklight traps in large-area tests", *Conf. Proc. 1965 Electromagnetic Radiation in Agriculture*, pp. 39-41
- [7] J. P. Hollingsworth, "Recent Developments in large scale use of electric light trap for control of field crop insects", *U. S. Department of Agriculture*, vol. 3, May-June 1967.
- [8] L. W. Noble, P. A. Glick, and W. J. Eitel, "Attempts to control certain cotton, corn, and vegetable-crop insects with light traps", *U. S. Department of Agriculture, ARS 33-28*, July 1956.
- [9] R. J. Anderson, "The value and safe use of pesticides", talk delivered to the Scientists Institute for Public Information, Chicago, Ill., December 4, 1964.
- [10] T. C. Shirley, "Developing an area insect-control project using blacklight insect traps", *Conf. Proc. 1965 Electromagnetic Radiation in Agriculture*, pp. 42-44, 49.