Development of a New Solar Light Trap Model and Its Utilisation as IPM Tool in Agriculture

P. K. BERA
Joint Director of Agriculture (Entomology)
Zonal Adaptive Research Station
Mohitnagar, Jalpaiguri, WB

Abstract : **This innovative work was conducted to develop a new model of solar light trap 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 utilised 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. After that 20 number of this newly developed solar light trap models were prepared and distributed for installation and farmers' demonstration in different crops in four districts (Coochbehar, Jalpaiguri, Siliguri subdivision of Darjeeling and Murshidabad) of West Bengal including ZARS, Mohitnagar, Jalpaiguri during *boro* and *kharif* seasons of this year, 2014. The results of this study at ZARS, Mohitnagar and farmers' demonstration in different crops in four districts revealed that the newly developed solar light trap model is very much effective for the monitoring of insect pests and their mechanical control in the field of agriculture and as it has low cost involvement so it can be utilised by most of the farmers. Lastly it is the most effective IPM tool which provide better safeguard to the nature in comparison to the other method of pest control.**

Keywords: ***Solar light trap, IPM, Agriculture***

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 (Dhaliwal and Arora, 1996). 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. Programmes on training of both the extension workers and farmers in the Integrated Pest Management (IPM) were started throughout the country. Notwithstanding these initiatives, adoption of IPM has not been encouraging as bio-pesticides capture hardly 2 percent of the
agrochemical market.

For IPM to be a success, it must be sound on technical and economic parameters. Technical feasibility of IPM is judged on two criteria: change in the pesticide use, and yield change over the conventional chemical control. As far as change in pesticide use is concerned, it is the basic goal of IPM to reduce pesticide use, and this evidence is well established under experimental as well as field conditions. Generally, the farmers adopt those components that show immediate effect, and are easily available. Bio-pesticides comprise a major component of IPM. Most of the bio-pesticides are host-specific, slow in action and have short shelf-life. Besides, application of some of the components is labour intensive compared to conventional chemical control (Birthal *et al*., 2000).

Community participation is key to successful adoption of IPM, and needs to be sustained by devising an appropriate exit policy. Local bodies, such as Panchayats, Non-Governmental Organisations, Self Help Groups, etc. should be encouraged to shoulder this responsibility. Incentives and awards should be given to those farmers/groups who are following IPM approach.
Supply of bio-pesticides is critical to sustainability of IPM, India has successfully reduced pesticide consumption without adversely affecting the agricultural productivity. This was facilitated by appropriate policies that discouraged pesticide use, and favoured IPM application. Despite it, adoption of IPM is low owing to a number of socio-economic, institutional and policy constraints. On the supply side, lack of commercial availability of bio-pesticides and inappropriate institutional technology transfer mechanisms are the critical impediments to increased application of IPM. The presence of private sector in bio-pesticide production and marketing is marginal, and needs to be improved through economic incentives. On the demand side, farmers though are aware of technological failure of pesticides to control pests, and their negative externalities to environment and human

health, pest risk is too high to experiment with newer approaches to pest management. IPM is a complex process and farmers lack understanding of biological processes of pests and their predators and methods of application of new technology components. The socio-economic environment of farming is also an important factor in adoption of IPM. 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 (Pratap S. Birthal, O. P. Sharma, 2004).

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 viz- survey through damage estimation, sweeping and pest population study, use of traps, etc. Among several types of traps, pheromone trap, light trap (electrical or solar), poison bait, alternate host (trap crop) 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.

Materials and Methods

Most light traps 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 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. To fulfil the purpose of development of a suitable model of a solar light trap research studies has been made and the first solar light trap is developed considering the following characteristics (Fig.-1) –

1. Portable in nature,
2. May be easily fixed at any place of the crop field by the help of two bamboo poles or one concrete pole as available in the locality,
3. May be shifted easily, if required,
4. The model is an iron body to provide necessary safety of the solar materials associated with the model,
5. A standard solar light system is attached with the model which will supply a continuous light up to 24 hrs if the battery is charged fully,
6. The solar light system includes a 12volt 7.5 amp battery, 10 watt-pc solar panel, solar charging unit, 12watt LED lamp (dc).

Fig-1
(First model of Solar Light Trap for the farmers of WB, presented in Paribesh Mela of Chandannagar, December, 2013)

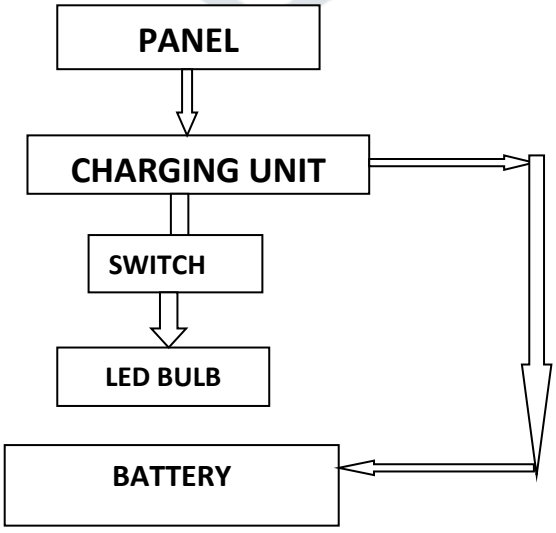
The model is further modified considering some practical problems and cost involvement and the final model most suitable for farmers' use in any crop field is developed (Fig.-2)-

Fig.-2
(Solar Light Trap at ZARS, Mohitnagar, inaugurated by DAWB, govt of WB)

The dimension of the above light trap box is as following-

1. Size- 8'' X 8'' X 8'' box at the base with a door at one side with lock system,
2. Upper side of the box is with a square hole of 2'' size,
3. A funnel made of glass or iron sheet of 8'' height, 8'' square upper end and 2'' square lower end is fixed on the square hole of the upper surface of box,
4. On the above portion of the funnel 6'' gap is maintained for easy entrance of the insect pests,
5. Lastly a v-shaped iron structure is fixed above the funnel with light trap box which provide shed to the funnel and box when covered with a plastic or fibre sheet of appropriate size,

The solar panel and the charging unit is fixed on one side of v-shaped structure of fibre or plastic body facing the panel toward south. Then the battery is placed within the light trap box and the LED bulb is placed at 3'' above funnel structure at middle under the shed structure. The solar system is connected with each other through proper wires as following-



Then 20 number of the same model of solar light trap are made and distributed to the districts of Coochbehar, Jalpaiguri, Mursidabad and Darjeeling (Siliguri subdivision) for farmers demonstration during *boro* and *kharif* seasons of 2014 (Fig.-3, Fig.-4, Fig.-5, Fig.-6).

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.

Fig.-3
(Solar Light Trap in Coochbehar district)

Fig.-4
(Solar Light Trap in Coochbehar district)

Fig.-5
(Solar Light Trap in Jalpaiguri district)

Fig.-6
(Solar Light Trap in Murshidabad district)

Results and Discussion

The innovative development of this solar light trap model and introduction of the same in different crop fields of four districts of West Bengal during *boro* and *kharif* seasons of this year (2014) reveals the following results-

1. The model is very much suitable for the farmers to be utilised easily at any portion of area of their single or multiple crop fields in a village surroundings,
2. As most of the crop areas in a village are lacking any electric connection, the use of this solar light trap model is the most suitable instrument for monitoring and partial control of insect pest population of all crops at the village surroundings,
3. As an important part of IPM, this solar light trap model may be utilised by the experts for farmers' demonstration at any type of crop field,
4. As an alternate of chemical pesticide, this tool will be considered as important for its eco friendly nature and low cost involvement to both the farmers and agricultural experts,
5. One year of preliminary study in the farmers' field in four districts of West Bengal including ZARS, Mohitnagar, Jalpaiguri reveals that 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,
6. Considering the safety of crop, nature including beneficial insects and biodiversity and economy of chemical pesticide use, this instrument may be the best weapon in the hand of farming community for its low cost involvement, so the govt may also utilise this useful tool for successful implementation of green revolution technology in the crop field for providing necessary safeguard to the nature.

Conclusion

The development of this solar light trap and successful demonstration of this tool in different crop areas by the farmers in four districts of West Bengal including ZARS, Mohitnagar resulted that as an alternate of chemical pesticide, this tool may be considered as important for its eco friendly 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. Government and other non-govt organisations may also utilise this useful IPM tool for successful implementation of green revolution technology in the crop field for providing necessary safeguard to the nature.

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