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Integrated management of tomato fruit borers in Krishna district of Andhra Pradesh

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Abstract
On farm trials in ten locations were conducted to evaluate the efficacy of cost effective and eco friendly IPM strategies for the management of fruit borers in tomato and to create awareness among the farmers during rabi, 2014-15 to 2016-17 in the farmer's fields in Krishna District of Andhra Pradesh. Fruit borers cause major damage to tomato causing reduction in production. Indiscriminate use of insecticides has resulted in negative effects like insecticide residues in the fruits, resistance development in insects against insecticides and pest resurgence etc. By adoption of IPM practices in three consecutive years, fruit borer damage was reduced on an average by 9.73 per cent compared to 16.7 per cent in farmers practice and the yield levels improved by 5.92 per cent on an average in three years compared to farmers practice. The average cost of cultivation was reduced by Rs. 9662.00 and net returns improved on an average by Rs.34612.00 per hectare compared to famers practice, thus showing the superiority of IPM practices in helping the farmers in realization of high net returns in tomato cultivation.

Keywords: Tomato, fruit borer, *Spodoptera litura, Helicoverpa armigera,* IPM

Introduction
Tomato (*Lycopersicon esculentum* Mill.) is one of the most important vegetable crops grown in India for fresh market and processing. It is cultivated though out the year due to the fact that it is adoptable to variable climatic conditions and remunerative to the farmers. In India, tomato is grown in an area of 8.09 lakh hectares and with production of 196.97 lakh tones, where as in Andhra Pradesh, it is cultivated in area of 0.55 lakh hectares and production of 21 lakh tonnes [1]. Tomato, like other vegetables, is more prone to insect pests and diseases mainly due to its tenderness and softness as compared to other crops. It is devastated by an array of pests like borers and sucking pests; however, the major damage is caused by fruit borers. Realization of the highest crop yield potential is significantly hindered by the attack of fruit borers *viz.*, *Helicoverpa armigera* (Hubner) and *Spodoptera litura* Fabricius. They cause damage to the developing fruits with a resultant yield loss ranging from 20 to 60 per cent [2, 3]. Solely dependence on synthetic pesticides and their indiscriminate use to control these pests resulted in development of resistance in target pests [4] and harmful pesticide residues in fruits. It also results in erosion of sustainability and ill effects like pesticide residues on produce, pest resurgence, secondary outbreak of this pest [5, 6] environmental pollution and health hazards to consumers as well to the farmers**.**
Since employment of single strategy proved to be a disaster with several adverse effects with variable efficacy levels of pest control, promotion of adoptable strategies in an integrated approach is the need of the hour to contain these borers. Such integrated pest management practices need to be promoted and popularized for adoption at field level on a wider scale to reduce reliance on pesticides. IPM module with components *viz.,* use of pheromone traps for monitoring and mass trapping in combination with use eco-friendly bio-control agents like SlNPV, HaNPV and adoption of cultural practices are effective techniques to bring down pest infestations and can help in ensuring growth of healthy crops. Proper adoption of these IPM technologies with care from the nursery stage of the crop will ensure efficient management of the pest at a low cost, thus helping the resource poor farmers. Hence, an attempt was made to evaluate on the use and adoption of IPM modules for management of tomato fruit borers in the farmers' fields and to popularise these technologies among the farmers.

Materials and Methods
The present investigation was carried out in the farmer's fields of adopted villages of KVK,

Ghantasala in Mopidevi mandal of Krishna district for three successive years from 2014-15 to 2016-17, where farmers cultivate tomato in large area during *rabi* season. The trials were conducted in 10 selected farmers' fields with an intention to evaluate the performance of integrated pest management practices for the management of fruit borers in tomato.

T_1: Integrated pest management

a. Growing of trap crops like marigold and castor @ 100 per acre
b. Installation of pheromone traps @ 4 per care
c. Erection of bird perches @ 10 per acre
d. Use of SlNPV or HaNPV @ 250 LE per acre
e. Need based application of flubendiamide @ 0.3 ml/ lt or chlorantraniliprole @ 0.3 ml/ lt or spinosad @ 0.3 ml/ lt

T_2: Farmers practice (Non IPM) – use of chemicals alone or in combination.

Each treatment was imposed in 0.4 ha with prominent hybrid tomato cultivars. All the recommended package of practices were followed for cultivating the crop. Trap crops like marigold and castor were grown against *H. armigera* and *S. litura*, respectively. Regular monitoring on the incidence of fruit borers was done by installation of pheromone traps for both *H. armigera* and *S. litura* (Pheromone traps supplied by Pheromone Chemicals, Hyderabad) at random places in the field. Bird perches were also installed all over the field so that the birds resting on the perches may catch over the fruit borer larvae. Insecticides *viz.,* flubendiamide or chlorantraniliprole or spinosad were sprayed at recommended doses for management of fruit borers as and when need arise.

The data on fruit borer damage was recorded from ten randomly selected plants from each field leaving border rows. The percentage of fruit borer infestation was calculated by using the following formula. The fruit yield, cost of cultivation, net benefit and benefit – cost ratio were also calculated.

$$\text{Per cent fruit damage} = \frac{\text{Number of damaged fruits}}{\text{Total number of fruits observed}} \times 100$$

Results and Discussions

A comparison of productivity levels between IPM practices in demonstration trials and farmers practices is shown in Table: 1. The results indicate that adoption of eco-friendly IPM strategies were effective in reducing the fruit damage caused by fruit borers as there is increase in yields in demonstration plots over farmers practice. During 2014-15, the per cent fruit damage in IPM plot was 8.0, whereas in the farmers practice, it was 19.5 per cent. The tomato fruit yield in the IPM plot was 368.75 q ha^{-1} with 4.24 per cent increase in yield when compared to farmers practice *i.e.,* 353.75 q ha^{-1}. During 2015-16, the per cent fruit damage in IPM plot was 12.0, whereas in the farmers practice, it was 18.0 per cent. The tomato fruit yield in the IPM plot was 382.50 q ha^{-1} with 3.61 per cent increase in yield when compared to farmers practice *i.e.,* 369.15 q $ha^{-1.}$ During 2016-17, the per cent fruit damage in IPM plot was 9.2, whereas in the farmers practice, it was 12.6 per cent. The tomato fruit yield in the IPM plot was 411.50 q ha^{-1} with 9.9 per cent increase in yield when compared to farmers practice *i.e.,* 374.50 q $ha^{-1.}$

Various components of IPM module if implemented properly are very effective in reducing the pest load, damage and reduce the cost of cultivation. Marigold as trap crop was found to be effective in reducing the larval population as it divert the pest from crop plants thus helps in reduction of damage and pesticide usage compared to tomato crop grown alone [7-9]. Use of bird perches is another component having profound effect in reducing the larval population. Planting of sunflower and sorghum as live bird perches are more effective by recording lower larval number (0.35 larvae/m row) over no live bird perch (4.12 larvae/m row) [10]. Application of viral formulations *viz.,* SlNPV and HaNPV are effective in control of larval populations. Effectiveness of combination of NPV + Nemark in reducing the larval load and damage of noctuid pest like *H. armigera* was reported [11], [12] and they are equally effective as synthetic chemical insecticides in reducing the larval population [13]. In the IPM plots insecticides *viz.,* flubendiamide or chlorantraniliprole or spinosad were used against fruit borers as and when necessary and were proven to be effective in reducing the damage [14]. The economics of tomato crop under demonstration (IPM) and farmers' practice were estimated and presented in Table: 2. On an average in all the three years, the cost of cultivation was reduced by Rs. 9662.00 and the net returns were increased by Rs. 34612.00 per hectare. The average benefit cost ratio was improved with 3.80 in treatment compared to 3.26 in farmers practice.

Conclusion

On farm trials are the most suitable method for assessing the performance of the improved technology as it directly involves the scientists in conducting the demonstrations at the farmer's fields which enables them to have first hand information related to the technology. The trials conducted in Krishna district by KVK, Ghantasala on tomato crop showed the potential of implementing integrated pest management to set up the productivity significantly by reducing the losses due to fruit borer and increasing the income of the farmers. In order to scale up the demonstration and speed up the dissemination of the technology on IPM, there should be a multi pronged strategy of educating the farmers on various aspects like identifying the damaged symptoms of pests, ensuring timely availability of quality inputs and use of eco friendly methods of pest management will go a long way in preventing the losses from biotic stresses which enhance its production and productivity.

Table 1: Details of tomato crop yields and fruit borer damage

Year	Hybrid	No. of Farmers	Yield (q ha^{-1})		Increase in yield (%)	Per cent fruit damage	
			Demo	Check		Demo	Check
2014-15	Chirayu	10	368.75	353.75	4.24	8.0	19.5
2015-16	Chirayu	10	382.50	369.15	3.61	12.0	18.0
2016-17	Abhilash	10	411.5	374.5	9.9	9.2	12.6

Table 2: Details of cost of cultivation, gross returns and net returns

Year	Average Cost of cultivation (Rs ha^{-1})		Average Gross Return (Rs ha^{-1})		Average Net Return (Rs ha^{-1})		BC ratio	
	Demo	Check	Demo	Check	Demo	Check	Demo	Check
2014-15	97500	100750	368750	353750	271250	253000	3.78	3.51
2015-16	100220	119850	387500	364650	287280	244800	3.86	3.04
2016-17	109520	115625	417605	374500	301980	258875	3.75	3.24

References

1. Indian Horticulture Database. National Horticulture Board, Ministry of Agriculture. 2017, 1-514.
2. Tewari GC, Krishnamoorthy PN. Yield loss in tomato caused by fruit borer. Indian journal of agricultural sciences. 1984; 54:341-343.
3. Lal OP, Lal SK. Failure of control measures against *Heliothis armigera* infesting tomato in heavy pesticidal application areas in Delhi and satellite towns in Western UP and Haryana. Journal of entomological research. 1996; 20(4):355-364.
4. Armes NJ, Jadhav DR, Bond GS, King ABS. Insecticide resistance in *Helicoverpa armigera* in South India. Pesticide Science. 1992; 34:355-364.
5. Fitt GP. The Ecology of *Heliothis* Species in relation to agro-ecosystems. Annual review of entomology. 1989; 34:17-53.
6. Mehrotra KN. Current status of pesticide resistance in India. Journal of Insect Science. 1991; 4:1-14.
7. Moorthy PNK, Kumar NKK, Prabhu Kumar S, Raghunatha R, Kumar GTP. Validation of the IPM of tomato fruit borer by using NPV sprays and marigold as trap crop. Biological control of lepidopteran pests. Proceedings of the symposium of biological control of lepidopteran pests. 2002, 261-265.
8. Karabhantanal SS, Awaknavar JS, Patil RK, Patil BV. Integrated management of the tomato fruit borer, Helicoverpa armigera Hubner. Karnataka journal of agricultural sciences. 2005; 18:977-981.
9. Hussain B, Bilal S. Marigold as a trap crop against tomato fruit borer (Lepidoptera: Noctuidae). International journal of agricultural research. 2007; 2:185-188.
10. Gopali, JB, Raju Teggelli DM, Mannur, Suhas Yelshetty. Bird perches for sustainable management of pod borer, *Helicoverpa armigera* (Hubner) in chickpea ecosystem. Karnataka journal of agricultural sciences. 2009; 22(3):541-543.
11. Mastoli BB, Moholkar PR, Mote UN. Studies on efficacy of bio-insecticides against bollworm complex of cotton. Pestology. 1995; 19:27-29.
12. Gopal S, Senguttuvan T. Integrated management of tomato fruit borer with insecticides, neem products and virus. Madras Agricultural Journal. 1997; 84:82-84.
13. Ravi M, Santharam G, Sathiah N. Ecofriendly management of tomato fruit borer, *Helicoverpa armigera* (Hubner). Journal of Biopesticides. 2008, 1(2):134-137.
14. Ghosal A, Chatterjee ML, Manna D. Studies on some insecticides with novel mode of action for the management of tomato fruit borer (*Helicoverpa armigera* Hub.). Journal of Crop and Weed. 2012; 8(2):126-129.