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Evaluation of Insecticide and Pheromone Trap Efficacy for Management of Fruit Borer (*Helicoverpa armigera*) in Tomato

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ABSTRACT

Taking into account importance of tomato cultivation in Chomu block of Jaipur district, an experiment was conducted to evaluate field efficacy of Indoxacarb 14.5 SC and pheromone trap. Per cent fruit infestation in farmer's practice (T1) was 15.35 whereas only 2.74 per cent fruit infestation was documented in assessed treatment (T2). Larval population per plant was high (3.14) in T1 treatment and recorded significantly lower (0.57) in T2 treatment. Number of adult moth trapped per trap was 12.50 only. Average fruit yield in assessed treatment was 510q/ha and 530q/ha during year 2021 and 2022, respectively. Fruit yield of farmer's practice was 450 q/ha for year 2021 and 460q/ha for 2022.Net return of assessed technology (Rs. 2, 80,550) was high for year 2021 as compared to farmer's practice (Rs.2, 23,000). Similarly, for year 2022 net return of assessed technology was Rs. 3, 09,750 and Rs. 2, 44,000 of farmer's practice. Both the year economic performance of assessed technology of superior to farmer's practice In-case of benefit cost ratio, it was recorded 2.22 and 2.40 for assessed treatment during year 2021 and 2022, respectively. However, it was 1.98 and 2.13 for farmer's practice during year 2021 and 2022, respectively.

Key Words: Tomato, *Helicoverpa armigera*, On farm trials, yield and B:C ratio

INTRODUCTION

Tomato (*Lycopersicon esculentum* Mill.) is an integral part of Indian kitchen and consumed as raw and cooked vegetable due its nutritional property. Tomato is rich source of lycopene and contains minerals, fibers, protein and essential amino acids (Ali *et al,* 2021). In India, tomato is being cultivated in 8.45 lakh hectare area with 21.18 Mt production (Anonymous, 2021). Tomato is one of the important crops of Chomu block of Jaipur district and mainly cultivated in *Kharif* and summer season. Among different biotic constraint of tomato cultivation, *Helicoverpa armigera* Hübner is an important and key pest. *H. armigera* is voracious feeder that feed on tomato fruit and make them unfit for human consumption. Infested fruit ultimately rooted by saprophytic action of microorganism. Yield losses due to *H. armigera* ranging from 23-74% have been documented under Indian condition in tomato crop (Rai *et al,* 2014). Most of time management of this pest solely depends on use of chemical insecticides. The use of insecticides for pest control has negative consequences, such as the development of insecticide resistance in the pests, resurgence of the pests, environmental contamination, and health risks. In recent years, integrated pest management (IPM) has become viable and sustainable approach for managing pests in agro-horti ecosystem. Now, the situation is shifting toward environmental friendly agriculture with more eco-friendly tactics and pest specific insecticides that are harmful only to pests and have no adverse effect on beneficial organism. Therefore, strategies that reduces heavy load of insecticide and comprises of environmental safer approaches are prerequisite toward sustainability. Hence, an on farm trial was designed to evaluate field efficacy of insecticide and pheromone trap.

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MATERIALS AND METHODS

An on farm trial was formulated to assess efficacy of Indoxacarb 14.5 SC and pheromone trap for management of fruit borer in tomato crop during summer 2021 and 2022. Farmers were randomly selected from Narshinghpura village of Chomu block and area under each trial was 1000 m^2. The trials were carried out in Randomized Block Design (RBD) with 7 replications for each treatment. Tomato hybrid Damini-3 was cultivated and all the agronomic practices recommended by SKN agricultural university, Jobner were followed. Experiment was conducted by adopting different management practices *e.i.* T1-One spray of Profenofos 50 EC@1.0 ml/l of water usually after outbreak of pest (farmer's practice), T2- installation of pheromone trap @ 5.0/ha for monitoring purpose + Need based two sprays of Indoxacarb 14.5 SC @ 1.0 ml/l of water first at 50% bud formation and second after 20% fruit setting. Pheromone trap were installed at 40 d of transplanting and made daily observation for trapped adult. Data of pheromone trap was used for spray scheduling. In order to determine the percentage of fruit infested with fruit borer, the number of fruits with borer holes and the total number of fruits inspected from each plot were recorded. Additionally, the yield of each harvest was recorded separately, and the total yield was estimated in quintals per hectare.

Number of larva per plant was also recorded; the marketable yield was used to determine a benefit/cost ratio for the economic feasibility of the most appropriate management strategy against fruit borer. Data were subjected to analysis of variance and least significant difference (LSD) determined at 5 and 1 per cent probability. The following formula (Baral *et al,* 2006) was used to calculate the B/C ratio based on the market price of tomato fruits, the rate of pesticides, and the cost of labour:

RESULTS AND DISCUSSION

Percent fruit infestation, larva/plant and trapped adult per trap were observed and presented in table 1. Results depicted 15.35 per cent fruit infestation in farmer's practice (T1), whereas only 2.74 per cent fruit infestation was documented in assessed treatment (T2). Larval population per plant was high (3.14) in T1 treatment and recorded significantly lower (0.57) in T2 treatment. Number adult moth trapped per trap was 12.50. Application of indoxacrb 14.5 SC found best effective as compare to profenofos 50EC, where it was kept larval population per plant bellow economic threshold level and low fruit infestation. Hasan *et al* (2016) also found significant result of indoxacarb application and recorded only 7% tomato fruit infestation with *H. armigera*. Among different tested insecticide, indoxacarb efficiently managed *H. armigera* of tomato crop in Nepal (Rijal and Dahal, 2019). Results of these finding were in accordance with our results. Various insecticides are being employing in *H. armigera* management strategies and among these indoxacrb preferred by famers due to its field efficacy. Indoxacarb capable to paralyzed *H. armigera* larva and paralyzed larvae die within 48 to 120 hours (Hasan *et al,* 2016).

Larval population per plant for both the year was under ETL in our assessed treatment (T2).

Table 1. Performance of Indoxacarb 14.5 SC topical spray and pheromone trap on fruit borer.

Technical Observations	Percent fruit infestation	Larva/Plant	Trapped adult/ trap
Treatment T-1	15.35	3.14	-
Treatment T-2	2.74	0.57	12.50
Control	22.42	5.14	-
SEm±	0.73	0.29	-
CD(5%)	2.25	0.90	-
CV(%)	14.34	26.13	-

Table 2. Overall economic comparison between farmer's practice and assessed technology.

Technology Option	Year	Yield (q/ha)	Yield increased (%)	Gross Return (Rs./ha.)	Cost of Cultivation (Rs./ha.)	Net Return (Rs./ ha.)	B:C Ratio
Farmer's Practice (T1) One spray of Profenofos 50 EC@1.0 ml/liter of water (after outbreak of pest)	2021	450	--	4,50,000	2,27,000	2,23,000	1.98
T2- Pheromone trap @ 5.0/ha (Monitoring) + Need based two sprays of Indoxacarb 14.5 SC @ 1.0 ml/liter of water		510	13.34	5,10,000	2,29,450	2,80,550	2.22
Farmer's Practice (T1) One spray of Profenofos 50 EC@1.0 ml/liter of water (after outbreak of pest)	2022	460	--	4,60,000	2,16,000	2,44,000	2.13
T2- Pheromone trap @ 5.0/ha (Monitoring) + Need based two sprays of Indoxacarb 14.5 SC @ 1.0 ml/liter of water		530	15.21	5,30,000	2,20,250	3,09,750	2.40

Likewise, Ravi *et al* (2008) experiment outcomes pointed that treatment comprised of application of three insecticides kept *H. armigera* larval count bellow 0.50 and 0.25 for first and second spray, respectively. Thilagam and Gopikrishnan (2020) reported 1.43 and 1.14 larvae per plant during flowering and pod formation stage, respectively. In assessed technology, we observed trapped moth per pheromone trap was 12.50, however average moth trapped per trap varies from 4.50 to 20.50 during 33 to 49 standard meteorological weeks (Reddy *et al,* 2020).

The data of economic performance (Table 2) indicated that average fruit yield in assessed treatment was 510q/ha and 530q/ha during year 2021 and 2022, respectively. However, in farmer's practice fruit yield was low, 450 q/ha for year 2021 and 460q/ha for 2022, as compared to assessed technology. It was documented that 13.34 per cent increase in yield during 2021 and increase in yield was 15.21 per cent during 2022. Dhaka *et al* (2010) observed highest fruit yield of tomato and lowest fruit infestation with Indoxacarb application. Similar to our results, Ravi *et al* (2008) recorded highest 49.77 t/ha yield of tomato with insecticide based management option. Net return of assessed technology for year 2021 was Rs. 2, 80,550/- and that was Rs.57, 550/- more as compared to farmer's practice (Rs.2, 23,000/-). Similarly, for year 2022 net return of assessed technology was Rs. 3, 09,750/- and Rs. 2, 44,000/- of farmer's practice. During aforesaid year, net return of assessed technology was Rs. 65,750/- higher to farmer's practice. Both the year economic performance of assessed technology of superior to farmer's practice. In case of benefit cost ratio, it was recorded 2.22 and 2.40 for assessed treatment during year 2021 and 2022, respectively whereas, it was 1.98and 2.13 for farmer's practice during year 2021 and 2022, respectively. Pandey and Chaturvedi (2020) reported highest benefit cost ratio with chemo-intensive pest management and these results are parallel to our findings.

CONCLUSION

Judicious pesticide application saved extra cost of cultivation and also maintains ecological equilibrium. Results of present study clearly inferred that topical spray of Indoxacarb 14.5 SC, based on trapped adult moth, significantly lower down larval population of *H. armigera*, lowest

fruit infestation, highest yield and higher Benefit cost ratio as compared to blanket application of profenofos 50EC.

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