AATCC Review

06 March 2024: Received
11 April 2024: Revised
05 May 2024: Accepted
19 June 2024: Available Online

www.aatcc.peerjournals.net

Research Article | Open Access

Assessment of economic threshold level for onion thrips

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ABSTRACT

The present experiment was carried out the to determine the economic threshold level of onion thrips. The economic threshold level of T. tabaci is determined using the pesticide application technique. So the Economic Injury Level (EIL) of T. tabaci on onion plants can be determined as the number of thrips follows the value of ET levels for the detected peaks ranging between 4-5 individuals/leaf during the study. As the results of the pesticide application technique, the thrips mean numbers and mean yield of onion plants were correlated significantly during the two years. Results of chi-square analysis (R^2) indicated that the values of the economic damage threshold of T. tabaci infested onion plants were 7 thrips/plant, while the economic injury level was 9.6 thrips/ plant during the study.

Keywords: *Thrips tabaci, insecticides, economic threshold level, economic injury level, Yield infestation relation, gross yield kg/plot and q/ha, marketable yield kg/plot and q/ha.*

INTRODUCTION

Onion (*Allium cepa* L.) is the most important commercial bulb crop grown all over the world and consumed in various forms. It is generally used fresh, spices, as important elements of the Mediterranean diet and as medicines (Mishra *et al.*, 2014) [14]. Onion thrips,(*Thrips tabaci* Lindeman) is a polyphagous pest that causes serious damage to vegetables and ornamentals all over the world Murai, (2000)[12]. Its population is usually high on plants from the *Alliaceae* family, especially onion (*Allium cepa L.*).The nymphs and adults feed mostly on green leaf tissue, causing direct damage by destroying epidermal cells. They feed by piercing the surface tissue and imbibing exuded cellular contents. The empty cell on attacked plants creates silvery white spots, referred to as silver damage Koschier *et. al.*, (2002)[8]. Srinivas and Lawande (2004) reported that *thrips tabaci* could cause yield loss in the range of 46-87% in onion [22]. Mohite *et. al.*, (1992) estimated the loss to be around 50% in that crop [11]. Onion thrips are an important vector for several plant viruses such as tomato spotted wilt virus Kritzman *et. al.*,(2002)[9]. Pathak *et.al.,* (2020) reported that a spray of spinosad@0.3ml/L at 10 day intervals is effective for the control of onion thrips[17]. Shweta et. al., (2019) reported that thiamethoxam 25WG@25g ai./ha is effective for the control of onion thrips[25]. According to Gangwar *et. al.*,(2016) insecticides along with surfactants reduced the thrips damage severity and increased the bulb yield compared with the insecticides without surfactant[6]. Pathak *et.al.,* (2021) reported that a spray of Fipronil @1.0ml/L + silica based surfactant@0.5ml/L at 15 days intervals was effective for control of onion thrips and increased the onion yield as well as the quality of onion[18].

The onion thrips *T. tabaci* feeds directly on leaves, causing silver blotches and premature senescence as well as distorted and undersized bulbs that reduced yield by 30-50% (Diaz *et. al.*, 2011; Shiberu and Mohammed, 2014; Nault *et al.*, 2012)[4][24][13][16] and is considered as a limiting factor for the bulb yield as well as reducing its quality (Jenser and Szenasi, 2004; Eltez and Karasavuran, 2006; Mahmoud, 2008)[7][5][13]. The action threshold is one of the most important decision making elements in integrated pest management (Nault and Shelton, 2010)[15]. So, many authors tend to determine damage threshold levels and concluded that the levels varied as host plant and host growth stage (Bird *et al.*, 2004)[3]. The application of insecticides at an economic threshold not only reduces the thrips infestation but also increases the bulb yield and quality of onion (Tripathy *et al.*, 2014)[27]. Ahmed H *et.al.*,(2021) reported that economic threshold levels of onion thrips 6-8 thrips /plant as well as economic injury levels 8-13 thrips /plant[2]. Way (2003) recommended the development and implementation of an economic threshold as a rational approach to pest control management designed to aid farmers in making pest control decisions [28]. Sherwat *et. al.,* (2007) assessed the economic threshold level of rice stem borer infestation in rice as 7.5 % infestation [25]. However, the economic threshold level was determined by Suhail *et. al.,* (2008) at a lower level, i.e. 5 % infestation [26]. Reji *et. al.*, (2008) reported that the variations in economic threshold levels are due to locations and circumstances dominant in conducting the assessment[21]. Researches by Litsinger (2008) indicated that the stem borer economic threshold level is only 2-4 % white heads for high-value rice varieties[10]. Amany S.EL hefny(2016) reported that the economic threshold level is 8-10% in rice stem borer[1]. Patel H. C. *et.al.,(*2020) reported that EIL and ETL values of *M. vitrata* were 0.77 and 0.58 larva per meter row (*i.e.* ETL ≈ 1 larva/2-meter row) in green gram[20].

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DOI: https://doi.org/10.58321/AATCCReview.2024.12.02.127

MATERIAL AND METHODS

A field experiment was conducted at the Regional Research Station, National Horticultural Research and Development Foundation (NHRDF), Karnal, Haryana, India for two consecutive years during *rabi* 2019-20 and 2020-21. The seedlings of onion variety NHRDF Red were transplanted in 15 cm x 10 cm spacing. A randomized Block Design with 3 replications was followed. The treatments evaluated were T_1 (When more than 5 thrips appeared spray of fipronil @1.0ml/L as needed). T_2 (When more than 10 thrips appeared spray of fipronil @1.0ml/L as needed). T_3 (When more than 15 thrips appeared spray of fipronil @1.0ml/L as needed). T_4 (When more than 20 thrips appeared spray of fipronil @1.0ml/L as needed). T_5 (When more than 25 thrips appeared spray of fipronil @1.0ml/L as needed) T_6 ((When more than 35thrips appeared spray of fipronil @1.0ml/L as needed) and T_7 (Control no spray). The thrips population will be recorded, number of thrips/plant at 30,40,50,60 and 70 DAT with the help of a hand lens. The application of fungicides viz. Mancozeb @ 2.5g/L and Carbendazim @1.0g/L were sprayed at 15 day interval alternatively in all treatments to protect the crop from diseases. All other agronomical practices were performed uniformly as needed in all the treatments. The crop was harvested after attaining maturity. The data from two consecutive years were combined, analyzed statistically and are presented in Table- 1.

RESULT AND DISCUSSION

a) Thrips

The pooled data presented in Table-1 revealed that the lowest thrips population (1.0 nymphs/plant) was recorded in treatment T_1 (When more than 5 thrips appeared spray of fipronil @1.0ml/L as needed) and the highest thrips population (1.75 nymphs/plant) were recorded in treatment T_7 (Control) at 30 DAT and 40 DAT lowest thrips population was also recorded in same treatment in T_1. At 40 DAT lowest thrips population (4.52 nymphs/plant) was recorded in treatment T_1 while the highest thrips population (18.95 nymphs/plant) was recorded in treatment T_4 (When more than 20 thrips appeared spray of fipronil @1.0ml/L as needed). At 60 DAT lowest thrips population (5.43 nymphs/plant) in treatment T1 and the highest thrips population (30.28 nymphs/plant) in control treatment. The lowest thrips population was also recorded in the same treatment T_1 at 70 DAT. The data further revealed that the overall average lowest thrips population (5.50 nymphs/plant) in treatment T_1 and highest thrips population (20.44 nymphs/plant) in control treatment was recorded.

b) Gross and marketable yield

The data for two consecutive year were presented in Table -1 the highest gross yield (300.60 q/ha) and marketable yield (283.42q/ha) were recorded in treatment T_1 (When more than 5 thrips appeared spray of fipronil @1.0ml/L as needed) while lowest gross yield (243.79q/ha) and marketable yield (222.68q/ha) was recorded in control plot treatment T_7 (no spray). The highest cost - benefit ratio (6.45:1) was recorded in treatment T_1.

c) Yield infestation relation

At 30 DAT yield infestation relation was non- significant, however at 40,50, 60&70DAT yield infestation relation was significant

At 40Days (y40) =360.0-11.72 X (R^2=0.98)
At 50Days (y50) =294.3-3.255 X (R^2=0.85)
At 60Days (y60) =279.8-1.811 X (R^2=0.79)
At 70Days (y70) =281.7-2.021 X (R^2=0.59)

The best thrips infestation and yield relationship was recorded at 40 DAT.

Y= Spray days after transplanting
R^2=Regression coefficient

d) Gain threshold and Economic injury level

The gain threshold levels were recorded as per formula control expenditure (Rs/ha)/Market price (Rs/q). The yield obtained with 5 sprays was significantly more than that with other sprays at various stages which mean that 5 sprays were essential for protecting onion thrips. Therefore, EIL was calculated with the best yield infestation relationship which was found at 40 DAT and control expenditure required for 5 sprays market price of onion was taken Rs.1165.50 per quintal, which was the average of two years market of Karnal, Haryana, India.

Gain threshold (kg/ha)= Control expenditure(Rs./ha) / Market price (Rs. q/ha)
=10970/1165.50
9.41

Economic injury level= Threshold / Regression coefficient
= 9.41/0.98
=9.60 thrips (nymphs/plant)

The EIL was recorded at 9.60 thrips nymphs/plant and ETL at 7.0 thrips(nymphs/plant) (75% of EIL).

The data showed that the best yield infestation relationship was recorded in treatment T1 (When more than 5 thrips appeared spray of fipronil @1.0ml/L as needed) at 30,40,50,60 and 70DAT and marketable yield was higher 283.42q/ha with 5 sprays. The five sprays are essential for protecting of thrips population of onion. The economic injury level of 9.60 thrips nymphs/plant and economic threshold of 7.0 thrips nymphs/plant was recorded.

The present study conforms with the result obtained by Birdet *et.al.,* (2004) who concluded that the economic threshold level of *T. tabaci* ranged from 4–10 and 10 –15 thrips/plant is recommended for onion plant[3]. Ahmed H. A.Atia *et.al.,* (2021) confirmed the above finding that the *T. tabaci* economic threshold onion plants ranged between 6 - 8 thrips/plant, while the economic injury level ranged between 8-13 thrips/plant[2]. Mishra *et. al.,* (2014) reported that the threshold of *T. tabaci* was 3 thrips/green leaves [14]. Rueda et *al.,* (2006) suggested that the action threshold of *T. tabaci* ranged between (0.5-1.6 thrips/leaf) [20] .

Conclusion

The present study concluded that the economic damage threshold of *T. tabaci* infested onion plants was 7.0 thrips/plant, while the economic injury level was 9.6 thrips/ plant during the study. Farmers are suggested to use pesticides for control of the thrips population after ETL.

Table-1 Developing Economic Threshold Level for onion thrips (Combined rabi, 2019-20 & 2020-21)

Treatments	Thrips population (Nymphs/plant) at					Overall thrips population	Gross yield (q/ha)	Marketable yield (q/ha)	B:C ratio
	30 DAT	40 DAT	50 DAT	60 DAT	70 DAT				
T1	1.00	6.37	4.52	5.43	8.55	5.50	300.60	283.42	6.45:1
T2	1.62	7.72	5.25	7.85	11.43	6.96	286.99	269.21	6.17:1
T3	1.55	8.88	14.93	8.08	11.80	9.13	284.26	260.64	5.04:1
T4	1.38	10.52	18.95	12.62	14.85	11.75	258.38	237.92	2.69:1
T5	1.38	10.80	17.72	27.03	16.85	14.81	255.78	235.46	2.26:1
T6	1.40	10.68	18.15	29.48	16.73	15.62	250.92	230.37	2.04:1
T7	1.75	11.63	18.92	30.28	34.73	20.44	243.79	222.68	-
S.Em±	**0.28**	**0.78**	**0.92**	**1.21**	**0.93**	**0.37**	**3.54**	**3.91**	-
CD at 5%	**0.57**	**1.61**	**1.89**	**2.49**	**1.91**	**0.76**	**7.32**	**8.08**	-

Details of treatments

T_1 (When more than 5 thrips appeared spray of fipronil @1.0ml/L as needed). T_2 (When more than 10 thrips appeared spray of fipronil @1.0ml/L as needed). T_3 (When more than 15 thrips appeared spray of fipronil @1.0ml/L as needed). T_4 (When more than 20 thrips appeared spray of fipronil @1.0ml/L as needed). T_5 (When more than 25 thrips appeared spray of fipronil @1.0ml/L as needed) T_6 ((When more than 35thrips appeared spray of fipronil @1.0ml/L as needed) T_7 (Control no spray).

ACKNOWLEDGEMENTS

The authors are thankful to the National Horticultural Research and Development Foundation (NHRDF) for providing all the necessary facilities. I also thank my co-authors who helped me during the entire research and manuscript preparation.

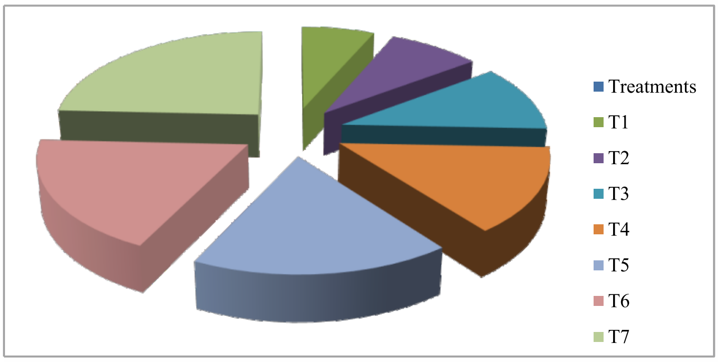

Fig1.Overall thrips population

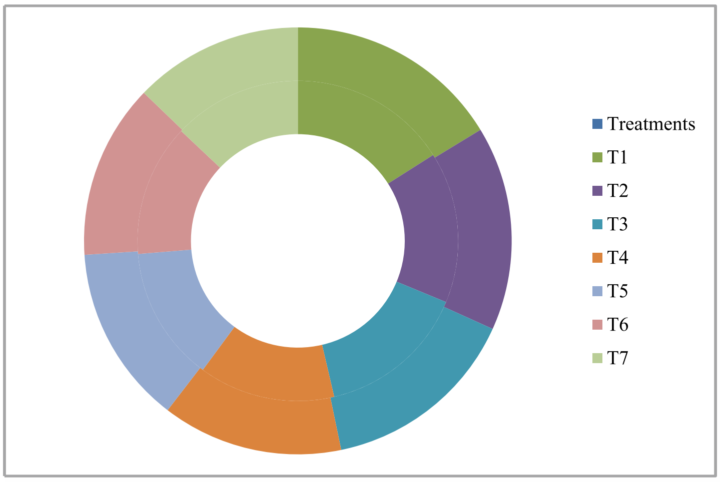

Fig.2 Gross and marketable yield

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