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Management of Onion Thrips (*Thrips Tabaci*) Using Different Eco-friendly Management Approaches

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Abstract

Onion (*Allium cepa* L.), also known as the bulb onion or common onion is an important spicy vegetable that are used as food and medicinal purpose. It is infested by several types of insect pests that reduce the yield of onion. With a view to develop eco-friendly management approaches against onion thrips, a field experiment was conducted at the research farm of Sher-e-Bangla Agricultural University, Dhaka, during the Rabi season in 2023-24. The experiment followed a randomized complete block design (RCBD) with ten treatments, each replicated three times. The treatments were $T_{1=}$ onion intercropped with carrot, $T_{2=}$ onion intercropped with coriander, $T_{3=}$ onion intercropped with tomato, $T_{4=}$ onion + blue sticky trap, $T_{5=}$ onion + white sticky trap, $T_{6=}$ neem oil spray at 7-day interval, $T_{7=}$ Spirotetramat spry at 7-day interval, T_{8}= Abamectin spray at 7-day interval, $T_{9=}$ Spinosad at 7-day intervals, and $T_{10=}$ control. All treatments significantly reduced the thrips population and leaf infestation caused by thrips compared to the untreated control. The lowest thrips population (1.30 thrips/plant at 51 DAT, 2.20 thrips/plant at 100 DAT and cumulative mean population (2.20), percent reduction of thrips population over control (76.79%) and minimum leaf infestation (19.13% at 100 DAT, cumulative mean infestation (13.28%), and percent reduction of leaf infestation over control 64.36%) were observed in the plot treated with Spinosad and returned the highest bulb height (5.79 cm), bulb width (7.71 cm), bulb weight (45.00 g), and yield (18.33 t/ha). Besides, the results from correlation coefficient indicated that some parameters (thrips population and percent leaf infestation) are shown significantly negative correlation with yield and some parameters (thrips population) are significantly explored positive with percent leaf

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infestation. Therefore, the findings of present study suggest that applying Spinosad at seven-day interval from the initial thrips infestation is an effective strategy for managing thrips in onions.

Keywords: Eco-friendly managements, Onion, Thrips infestation, Yield

Introduction

Onion (*Allium cepa* L.) under Amaryllidaceae family, also known as the bulb onion or common onion is an important spicy vegetable that are used as food and medicinal purpose in worldwide. In Bangladesh, onion is used mainly as spicy material. That's why, the use of onion is increasing day by day. But it produces approximately 25.47 lakh tonnes onion from over 5.03 lakh acres land in 2022-23 fiscal year (BBS 2023). The global consumption of onions has been rising notably, largely due to their recognized health benefits (Havey et al. 2004; Wang et al. 2006). Onions contain high levels of flavonoids and alkenyl cysteine sulphoxides, which contribute to the prevention of heart disease and various other health conditions in humans (Gareth et al. 2002; Havey et al. 2004; Javadzadeh et al. 2009).

However, onion production is significantly decreased by both abiotic and biotic factors, with insect pests. Among insect pests, onion thrips (*Thrips tabaci*. L.) is one of them and it being a major threat in onion-growing regions worldwide (Muvea et al. 2014). Onion thrips are considered as a threaten pests due to their polyphagous feeding behavior, rapid reproduction, short life cycle, high survival rate of nonfeeding prepupal and pupal stages, ability to reproduce through parthenogenesis, capacity to transmit plant pathogens, and resistance to insecticides (Morse and Hoddle 2006, Diaz-Montano et al. 2011). Their extensive feeding leads to plant stunting and reduced bulb weight while also making onion plants more susceptible to fungal and bacterial infections, further impacting yield. Both nymphs and adults are the damaging stages which feed by rasping the leaves and other tissues of plants and suck the sap, as a result, reducing photosynthesis and nutrient transport, leading to yield losses ranging from 10% to 85% (Sharma et al. 2020; Gill et al. 2015). It leads to the formation of silver patches and streaks on the leaves. In addition to directly damaging the foliage, it can also exacerbate the occurrence of purple blotch. Additionally, they facilitate the spread of viral diseases such as Iris Yellow Spot Virus (IYSV), further reducing productivity (Leach et al. 2020).

In Bangladesh, farmers commonly rely on synthetic insecticides for controlling thrips that are costly, pose health and environmental risks, and contribute to pesticide resistance (Adesanya et al. 2020). On the other hand, they sprayed insecticides with overdoses; even two or three types of insecticides at a time, eventually, they used insecticides two or three times per week, and in some cases, twice a day to control thrips. However, the effectiveness of most insecticides is limited, as a significant number of thrips remain sheltered between the inner leaves of the onion plant, and the pupal stage occurs in the soil. In addition, *Thrips tabaci* is a highly prolific

species with multiple overlapping generations (Nault and Shelton, 2010). The reliance on pesticides not only raises production costs but also poses risks to both the environment and human health (Burkett-Cadena et al. 2008). Therefore, to avoid these issues and to build up an eco-friendly environment, an integrated pest management approach is essential for effective thrips and pest management (Hossain et al., 2015). Safer alternatives methods include botanical insecticides, biological controls and predatory mites, made some advice for controlling pests (Gagnon et al., 2024; Alcalá Herrera et al., 2022; Oliveira et al., 2022). The use of bio-rational insecticides has emerged as a modern approach to managing insect pests, gaining significant attention from entomologists worldwide. In programs to control insect pests, bio-rational strategies like plant extracts and oils are applied (Soares et al. 2019). Intercropping is widely recognized in developing countries as an essential strategy to reduce pest infestations in crop production systems (Sodiya et al. 2010). Therefore, the present study was designed to assess the efficacy of environmentally friendly management practices against thrips of onion where eco- friendly new generation insecticides, three intercropping and two sticky trap approach were used.

Methodology

Study site and period

With a view to assess the effectiveness of various eco-friendly management practices against onion thrips, the research was carried out at the agronomy farm of Sher-e-Bangla Agricultural University, Dhaka, during the Rabi season of 2023-24.

Research design, planting materials and details of treatments

A randomized complete block design (RCBD) was used to set up the experiment where ten treatments were applied. Each treatment was made of three replications. Ten treatments were T_1=Onion intercropped with carrot, T_2=Onion intercropped with coriander plant, T_3=Onion intercropped with tomato, T_4=Onion + blue sticky trap, T_5= Onion + white sticky trap, T_6= Neem oil spray at 7 days interval, T_7: = Spirotetramat at 7 days interval, T_8: =Abamectin at 7 days interval, T_9=Spinosad at 7 days interval, and T_{10}=Control). About 42-days old onion seedlings of BARI Piaz-4 were transplanted on 15th December 2023, while carrot and coriander were directly sown on 7th December 2023 and tomato seedlings were transplanted on 15th December 2023. Each unit plot measured 2.75 m × 2.5 m, with a planting spacing of 20 cm × 10 cm. Total number of plot were 30.

Crop husbandry

The experimental plot was prepared through five ploughings and cross ploughings, followed by laddering to break soil clods and ensure proper leveling using a tiny power tiller. Weeds and crop residues from previous seasons were removed. Fertilization included 5 t/ha of cow dung, along with urea (300 kg/ha), TSP (250 kg/ha), and MoP (160 kg/ha). All cow dung, TSP, and half of the urea and MoP were

applied during final land preparation, while the remaining urea and MoP were top-dressed in two equal splits at 25 and 50 days after transplanting (DAT). Onion and Tomato seedlings were transplanted and associate plant were sown according to the treatments. Weeding was performed at 25, 50, and 75 Days after planting. Irrigation, thinning and other interculture operations were done as needed to promote the growth and development of plants.

Collection of data and calculations

After thrips infestation appears, data were recorded based on parameters such as entomological features (Thrips populations & leaf infestation caused by thrips) and after maturing the crop properly, yield attributes like Bulb height (cm), width (cm) & weight (g) and yield of onion (t/ha). As regards of thrips population, a total number of thrips were counted from control and respective replication. Percent thrips population reduction over the untreated control was calculated using a standard formula (Alam et al., 2020).

$$\text{Thrips population reduction over control (\%)} = \frac{\text{Mean value of control} - \text{Mean value of the treatments}}{\text{Mean value of control}}$$

In case of leaf infestation, a total number of healthy and infested leaves were counted for each replication. And then, it was converted into percentage. In addition, percent increase in yield over control in various treatments was calculated using following formula (Alam et al., 2020).

$$\text{Increase of yield in treatment over control (\%)} = \frac{\text{Yield of treated plot} - \text{Yield of control plot}}{\text{Yield of control plot}} \times 100$$

Data analysis

Microsoft Excel 2010 was used to record, tabulate, process, and compile all experimental data for statistical analysis. The treatment effect was determined using analysis of variance (ANOVA) in R statistical software version 3.5.3, with mean differences determined by Least Significant Difference (LSD) Test (Gomez and Gomez, 1984). Pearson's Correlation Coefficient was used to calculate the association between entomological features (Thrips population & leaf infestation) and yield of onion using R statistical software version 3.5.3. All graphs were created using Microsoft Excel worksheet 2010.

Results and discussion

Effect of eco-friendly management approaches on thrips population

The results of Table 1 revealed that all tested eco-friendly practices showed efficacy on significantly reduction of thrips population. The present results also explored that the population of thrips was increased up to 86 DAT for all treatments. After that the

population of thrips were declined gradually. However, in case of 51 days after treatments (51 DAT), among, all tested practices, the highest number of thrips per plant was found in control with continuously increasing trend of thrips population which was ranged from 4.03 to 13.40 and cumulative mean of number population was 9.48. The lowest number of thrips population was observed in the treatment of T_9 having cumulative mean number of thrips per plant 2.20 ranged from 1.30 to 2.50 which was significantly differed than other tested treatments. Thus, T_9 showed the best performance on thrips population. Hence, The cumulative mean number of thrips population per plant for T_1, T_2. T_3, T_4, T_5, T_6, T_7 and T_8 was 5.30, 7.57, 6.71, 4.38, 7.03, 4.68, 4.21, and 3.62 respectively. On the other hand, the percent reduction of thrips population per plant over control was also calculated is shown in **Table 1** and the highest percent (76.79%) of thrips population were reduced in the plot treated with the application of treatment T_9 compared to other tested treatments. This result was followed by T_8, T_7, T_4, T_6, T_1, T_3, T_5 and T_2 in 61.81, 55.59, 53.79, 50.53, 44.09, 29.21, 25.84 and 20.14, respectively.

From the results of present study, it was evident that the population of thrips was increased up to 86 DAT at for all treatments. After that the population of thrips were declined. A decline in thrips populations occurs during the crop senescence stage due to the depletion of plant resources, prompting their migration to surrounding crops and weed plants (Nyasani et al. 2013; Ullah et al. 2010). Thrips numbers drop rapidly after onion plants mature, likely due to reduced nutrient and water availability (Mo et al. 2009). Additionally, Hossain et al. (2015) reported that thrips population was declined due to leaf hardened, plant matured, and thrips migrated to alternative host plants. Interestingly, the results of present study showed that, T_9 (Spinosad spray at 7 days interval) showed the best performance among all tested treatments while the absolute control (T_{10}) plot exhibited significantly the highest thrips per plant. Similar trend of results was also observed at 58, 65, 72, 79, 86 and 93 DAT. The present findings can also be compared with Hossain et al. (2017) who reported that Spinosad (Success 2.5SC) was effective against thrips population in onion field. Similar type of results was observed by Prasad and Ahmed (2009). They also reported that Spinosad 45SC @ 125 ml/ha was effective against thrips. The results of the present investigation are also in agreement with Hussein et al. (2015), they found in two study seasons that application of spinetoram 120SC reduced the population density of *T. tabaci* infesting garlic plants and gave the highest yield. In case of percent reduction of thrips population over control, among the treatments T_9 showed the best performance (67.85% at 51 DAT and 73.05% at 100 DAT, respectively). Similar trend of results was also observed at 58, 65, 72, 79, 86 and 93 DAT. The results are in line with the findings of Prasad and Ahmed (2009).

Table 1: Effect of treatments on thrips population incidence during onion production in the field

Treatments	51 DAT	58 DAT	65 DAT	72 DAT	79 DAT	86 DAT	93 DAT	100 DAT	Cumulative Mean	Percent reduction of thrip's population over control
T_1	2.27 de	4.00 d	4.80 e	5.50 d	6.30 d	7.63 e	6.70 d	5.20 e	5.30	44.09
T_2	3.10 b	5.67 b	7.10 b	7.87 b	9.70 b	11.17 b	8.77 b	7.20 b	7.57	20.14
T_3	2.57 bcd	4.57 c	6.00 d	6.83 c	8.87 c	10.37 d	7.87 c	6.60 d	6.71	29.21
T_4	1.60 g	2.90 ef	4.43 f	4.87 e	5.47 f	6.63 f	5.07 e	4.03 gh	4.38	53.79
T_5	2.7 bc	4.77 c	6.37 c	7.70 b	8.93 c	10.80 c	8.03 c	6.90 c	7.03	25.84
T_6	2.33 cde	3.90 d	4.60 ef	4.63 f	5.80 e	6.30 g	5.27 e	4.57 f	4.68	50.53
T_7	2.03 def	3.13 e	4.40 f	4.30 g	5.17 g	5.70 h	4.73 f	4.23 g	4.21	55.59
T_8	1.70 fg	2.67 g	3.53 g	3.63 h	4.57 h	4.80 i	4.17 g	3.87 h	3.62	61.81
T_9	1.30 g	2.13 h	2.33 h	2.23 i	2.47 i	2.53 j	2.37 h	2.20 i	2.20	76.79
T_{10}	4.03 a	7.27 a	9.60 a	10.73 a	11.97 a	13.40 a	10.70 a	8.17a	9.48	--
LSD	0.417	0.204	0.230	0.225	0.231	0.314	0.274	0.216		
CV (%)	10.31	2.91	2.52	2.253	1.949	2.314	2.512	2.496		

Mean followed by the different letter(s) in the same column differ significantly from each other at 5% level of probability. LSD= Least Significant Difference, CV= Co-efficient of variance. Here, T_1= Onion intercropped with carrot, T_2= Onion intercropped with coriander plant, T_3= Onion intercropped with tomato, T_4= Onion + blue sticky trap, T_5= Onion + white sticky trap, T_6= Neem oil spray at 7 days interval, T_7= Spirotetramat at 7 days interval, T_8= Abamectin at 7 days interval, T_9=Spinosad at 7 days interval, and T_{10}=Control

Effect of treatment against leaf infestation caused by thrips

Table 2 indicates that all evaluated eco-friendly practices significantly decreased thrips infestation more effectively than the control treatment. The results revealed that the onion leaf infestation caused by thrips was increased up to 86 DAT for all treatments. After that the percent leaf infestation caused by the thrips were declined from 93 days after treatments. Among the treatments T_4 (Onion + Blue sticky trap) showed the best performance (3.53%) at 51 DAT but from the 58 DAT to at 100 DAT, treatment T_9 (Spinosad spray at 7 days interval) showed the best performance (19.13%). The absolute control treatment exhibited significantly highest leaf infestation caused by the thrips (9.26% at 51 DAT and 55.14% at 100 DAT, respectively). On the other hand, percent reduction of leaf infestation caused by thrips population over control was also shown in Table 2. It was found from the results of this Table 2 that the highest percent (64.36%) leaf infestation caused by thrips were reduced in the plot treated with T_9 compared to other tested treatments. This result was followed by T_4, T_8, T_7, T_6, T_1, T_3, T_5 and T_2 in 55.54, 52.88, 49.69, 49.04, 47.24,34.85,32.84, and 25.51%, respectively. The results are in line with the findings of Hossain et al. (2017) and they reported that Spinosad (Success 2.5SC)

was effective against thrips in onion field. Another research was examined by Prasad and Ahmed (2009). They also reported that Spinosad 45SC @ 125 ml/ha was effective against thrips. The results of the present investigation are also in agreement with Hossain et al. (2017) and they showed that bio-pesticide Spinosad (Success 2.5 SC) @ 1.2 ml/litre of water three times at an interval of 10 days from the first appearance of thrips infestation may be recommended for the management of thrips of onion.

Table 2: Effect of treatments on leaf infestation caused by thrips during onion production in field

Treatments	51DAT	58DAT	65DAT	72DAT	79DAT	86DAT	93DAT	100DAT	Cumulative Mean	Percent reduction over control
T_1	7.27 abc	11.02 b	13.28 d	6.66 d	21.91 e	31.29 d	27.93 d	27.93 d	19.66	47.24
T_2	10.73 a	11.64 b	17.27 b	25.67 b	36.57 b	41.01 b	39.61 b	39.60 b	27.76	25.51
T_3	6.70 abc	10.63 b	15.22 c	23.13 c	29.94 d	36.74 c	35.94 c	35.94 c	24.28	34.85
T_4	3.53 c	8.07 b	13.18 d	3.18 ef	19.77 f	25.54 f	24.68 e	24.68 e	16.57	55.54
T_5	5.99 abc	10.33 b	16.90 b	24.30 bc	33.52 c	36.52 c	36.37c	36.37 c	25.03	32.84
T_6	6.16 abc	10.84 b	14.59 c	7.77 d	22.04 e	29.05 e	25.77 e	25.77 e	18.99	49.04
T_7	7.49 abc	9.13 b	14.19 cd	4.19 e	20.90 ef	28.48 ef	27.84 d	27.84 d	18.755	49.69
T_8	5.86 abc	8.83 b	14.10 cd	4.56 e	20.00 f	26.51 f	25.32 e	25.32 e	17.56	52.88
T_9	5.59 bc	8.81 b	10.72 e	2.57 f	16.49 g	19.67 g	19.13 f	19.13 f	13.28	64.36
T_{10}	9.26 ab	18.06 a	22.38 a	31.29 a	45.96 a	59.56 a	56.56 a	55.14 a	37.27	
LSD	5.05	3.717	1.19	.439	1.65	1.44	1.425	1.41		
CV (%)	42.74	20.18	4.59	4.34	3.608	2.511	2.60	2.60		

Mean followed by different letter(s) in the same column differ significantly from each other. LSD= Least Significant Difference, CV=Co-efficient of variance. Here, T_1= Onion intercropped with carrot, T_2= Onion intercropped with coriander plant, T_3= Onion intercropped with tomato, T_4= Onion + blue sticky trap, T_5= Onion + white sticky trap, T_6= Neem oil spray at 7 days interval, T_7= Spirotetramat at 7 days interval, T_8= Abamectin at 7 days interval, T_9= Spinosad at 7 days interval, and T_{10}= Control

Evaluation the efficacy of different eco-friendly practices on yield and yield contributing parameters of the onion

Results from the Table 3 revealed that bulb height, width and weight were significantly affected by applying different eco-friendly practices. Each bulb height (cm), bulb width (cm) and bulb weight (g) were varied between 3.26 to 5.79, 3.31to 7.71 and 23.60 to 45.00, respectively. As regards of bulb height, width & weight, it was evident that the treatment T_9 (Spinosad spray at 7 days interval) showed the best performance in bulb height (5.79 cm), bulb width (7.71 cm) and bulb weight (45.00 g) compared to control treatment T_{10}. Besides, the absolute control treatment exhibited significantly lowest bulb height (3.26 cm), width (3.31cm) and single bulb

weight (23.60 g) due to the highest infestation (cumulative mean leaf infestation 37.27% per plant) by the thrips. The results are in line with the findings of Hossain et al. (2017) and they reported that T_9= Spinosad (Success 2.5SC) was effective against thrips in onion field and returned higher yield. The results of present study are also agreed with Prasad and Ahmed (2009). They explained that Spinosad 45SC @ 125 ml/ha was effective against thrips, and they got higher safe plant. Nevertheless, Mandal et al. (2008) also reported that, Spinosad showed the best performance against thrips and increased the yield of onion. In case of percent increase of yield attributing characters over control, among the treatments T_9 (Spinosad spray at 7 days interval) showed the best performance in 77.56%, 133.50%, and 90.77% for each bulb height, bulb width and bulb weight, respectively. Similar type of results was found by Hossain et al. (2017).

Table 3: Effect of treatments on the yield attributing characters of onion

Treatments	Bulb		Bulb		Bulb	
	Height (cm)	% Increase over control	Width (cm)	% Increase over control	Weight (g)	% Increase over control
T_1	4.93 c	51.25 d	5.62 c	70.55 c	33.10 d	40.24 d
T_2	4.15 e	27.27 f	4.33 e	31.04 e	28.60 e	21.14 e
T_3	4.45 d	36.45 e	4.93 d	49.07 d	31.66 d	34.17 d
T_4	5.19 b	59.17 b	5.94 bc	80.01 bc	37.23 b	57.70 b
T_5	4.39 d	34.42 ef	4.74 d	43.26 de	29.53 e	25.08 e
T_6	4.94 c	51.51 cd	5.67 c	71.53 c	35.23 c	49.26 c
T_7	5.14 bc	57.65 bcd	5.84 bc	76.93 bc	36.30 bc	53.79 bc
T_8	5.18 b	58.86 bc	6.08 b	84.36 b	37.76 b	60.02 b
T_9	5.79 a	77.56 a	7.71 a	133.50 a	45.00 a	90.77 a
T_{10}	3.26 f	-	3.31 f	-	23.60 f	-
LSD	0.215	0.379	0.352	12.67	1.486	6.94
CV (%)	2.651	8.44	3.793	10.29	2.56	8.36

Mean followed by different letter(s) in the same column differ significantly from each other. LSD= Least Significant Difference, CV= Co-efficient of variance. Here, T_1= Onion intercropped with carrot, T_2= Onion intercropped with coriander plant, T_3= Onion intercropped with tomato, T_4= Onion + blue sticky trap, T_5= Onion + white sticky trap, T_6= Neem oil spray at 7 days interval, T_7= Spirotetramat at 7 days interval, T_8= Abamectin at 7 days interval, T_9= Spinosad at 7 days interval, and T_{10}= Control

Significant difference was noticed among all tested eco-friendly practices in this study (Figure 1). All tested eco-friendly practices showed significant effect on yield of onion. The bulb yield of onion (t/ha) was varied between 9.61-18.33 t/ha. From the

results of Figure 1, it was evident that the treatment T_9 (Spinosad spray at 7 days interval) showed the best performance in case of average yield (18.33 t/ha). This result was followed by 15.38, 15.17, 14.78, 14.35, 13.48, 12.89 12.03 and 11.65 in T_8, T_4, T_7, T_6, T_1, T_3, T_5, and T_2, respectively. The absolute control treatment exhibited significantly lowest yield (9.61 t/ha) due to the highest infestation by the thrips (Cumulative mean leaf infestation 37.27% per plant). In addition, the highest percent increase of yield over control was recorded in the plot treated with T_9 (Spinosad spray at 7 days interval) than other tested treatments and the minimum percent increase of yield (21.14%) over control was observed in T_2. Similar type of results was observed by Hossain et al. (2017). They found that Success 2.5SC was most effective against thrips in onion field and it produced higher yield. Another experiment was conducted by Prasad and Ahmed (2009) and they also reported that Spinosad 45SC @ 125 ml/ha was the best performed for controlling thrips in onion field and returned higher yield. The results are in line with the findings of Mandal et al. (2008). They also reported that spinosad showed best performance against thrips and increased the yield of onion. The results of the present investigation are also in agreement with those of Hussein et al. (2015), who found in two study seasons that application of spinetoram 120SC reduces the population density of *T. tabaci* infesting garlic plants and gave the highest yield. Patil et al. (2009) found that treatment with Spinosad 45SC recorded a higher yield t/ha compared to the other treatments.

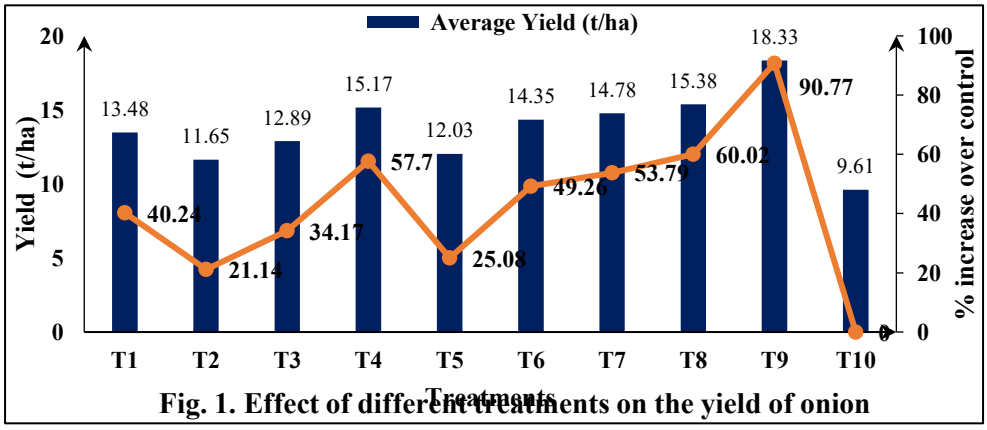

Fig. 1. Effect of different treatments on the yield of onion

Correlation matrix between onion yield and infestation caused by thrips

Experimental information on correlation coefficient is particularly useful for measuring the relationship among onion yield and infestation caused by thrips. Onion yield was found significantly negative correlated with thrips population per plant (-0.765**) and percent leaf infestation (-0.743*). Besides, thrips population per plant showed positive correlation with percent leaf infestation (Figure 2). The results from correlation coefficient indicated that some parameters are exhibited negative

correlation with yield of onion (Figure 2). Besides, the results from correlation coefficient also indicated that some parameters are shown positive correlation between thrips population and leaf infestation. The results are in line with the finding of Hussein et al. (2015). They found that some parameters are explored the negative correlation between onion yield and thrip infestation in onion field.

	Thrips population/plant	% Leaf infestation	Yield (t/ha)
Thrips population/plant	1		
% Leaf infestation	0.969***	1	
Yield (t/ha)	-0.765**	-0.743*	1

Fig. 2. Correlation co-efficient of onion yield and infestation caused by thrips applied by different levels of eco-friendly management practices

Conclusion

The study suggests that applying the bio-pesticide Spinosad at seven-day intervals from the initial appearance of thrips infestation can be recommended for effective thrips management in onions while ensuring higher yield. It may be concluded from the finding of the present study that all treatments significantly reduced the thrips population and leaf infestation caused by thrips compared to the untreated control. The lowest thrips population (1.30 thrips/plant at 51 DAT, 2.20 thrips/plant at 100 DAT and cumulative mean population (2.20), percent reduction of thrips population over control (76.79%) and minimum leaf infestation (19.13% at 100 DAT, cumulative mean infestation (19.13%) and percent reduction of leaf infestation over control (64.36%) were observed in the plot treated with Spinosad and returned the highest bulb height (5.79 cm), bulb width (7.71 cm), bulb weight (45.00 g), and yield (18.33 t/ha). Therefore, the findings of present study suggest that applying Spinosad at seven-day interval from the initial thrips infestation is an effective strategy for managing thrips in onions.

Author's contribution

Professor Dr. Md. Abdul Latif conceived, design, formulation and supervision of the experiments. Rita Dey performed the experiments, collected and analyzed the data.

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