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Chemical control of onion thrips with insecticides through sequential sprays

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Abstract
Field experiments were conducted at Regional Research Station, NHRDF, Karnal in three consecutive years during r*abi* 2010-11, 2011-12 and 2012-13 on onion variety Agrifound Light Red for the management of onion thrips through sequential sprays of different insecticides. The chemical insecticides comprising thiamethoxam 25 WG @ 0.2%, fipronil 05 SC @ 0.1%, carbosulfan 25 EC @ 0.2%, profenophos @ 0.1%, lambdacyhalothrin @ 0.05%, acetamiprid 10 EC @ 0.01%, alphamethrin 10 EC @ 0.15% and deltamethrin @ 0.095% were used in a different sequential manner. The application of the treatments was started just after appearance of thrips and total four sprays of different insecticides were given at fifteen days interval. The results showed that significantly lowest mean thrips population (9.71 nymphs/plant) and highest marketable yield (253.53 Q/ha) were recorded in sequential spray of carbosulfan 25 EC @ 0.2%, lambdacyhalothrin @ 0.05%, acetamiprid 10 EC @ 0.01% and alphamethrin 10 EC @ 0.15%. The highest cost benefit ratio (1:4.69) was also recorded in the same treatment. The study revealed that four sequential sprays of different insecticides at 15 days interval could be useful to minimize the thrips population and increase the yield of *Rabi* onion.

Keywords: Onion, thrips, chemical control, sequential sprays, insecticides

Introduction
Onion (*Allium cepa* L.) is an important export oriented vegetable crop among the cultivated *Alliums* in India. It is grown in *Rabi*, *Kharif* and late *Kharif* season in India with the maximum area under cultivation covered in *rabi* season. India is the second largest onion producing country in the world with approximately 13.2 lacks ha onion growing area with an annual production of 209.31 lacks tonnes during 2015-16 [1].

Thrips (*Thrips tabaci* Lindeman) being regular and potential pest of onion cause considerable losses as high as 90% in quality and yield [3, 5, 18]. Thrips attacks onion at all the stages of crop growth, but their count increases from bulb initiation and remain high up to bulb development and maturity. Both nymphs and adults cause damage directly through feeding and indirectly through the transmission of lethal plant viruses. It is difficult to control this pest with insecticides because of its small size and cryptic habits [12]. Failure to control this pest by timely and effective means causes considerable damage [1] and results in immense economic losses by remarkably reducing yield [10].

To find out the suitable management of thrips and avoid the losses caused by thrips in onion, a field experiment was conducted at Regional Research Station Karnal during three consecutive years in *Rabi* 2010-11, 2011-12 and 2012-13 on onion variety Agrifound Light Red through sequential sprays of different insecticides for thrips management.

Materials and Methods
The field experiment was conducted at Regional Research Station, Karnal during *Rabi*, 2010-11, 2011-12 and 2012-13 seasons. Seedlings of onion variety Agrifound Light Red were transplanted in a bed having size of 3.0m x 1.5m at 15cm X 10cm spacing. Randomized Block Design with 3 replication was followed. The treatments evaluated were T_1 (thiamethoxam 25 WG @ 0.2%, fipronil @ 0.1%, carbosulfan 25 EC @ 0.2% and profenophos @ 0.1%), T_2 (carbosulfan 25 EC @ 0.2%, lambdacyhalothrin @ 0.05%, acetamiprid 10 EC @ 0.01% and alphamethrin 10 EC @ 0.15%), T_3 (acetamiprid 10 EC @ 0.01%, alphamethrin 10 EC @ 0.15%, carbosulfan 25 EC @ 0.2% and fipronil @ 0.1%), T4 (profenophos @ 0.1%, thiamethoxam 25 WG @ 0.2%, deltamethrin @ 0.095 and acetamiprid 10 EC @ 0.01%), T5 (deltamethrin @ 0.095, carbosulfan 25 EC @ 0.2%, fipronil @ 0.1% and thiamethoxam 25 WG @ 0.2%), T6 (deltamethrin @ 0.095-check) and T7 (control). The application of

treatments started at appearance of the thrips and a total of 4 sprays were given at 15 days interval, alternatively. All other agronomical practices were performed as per need in all the treatments. The crop was harvested after attaining the maturity. The data on thrips (nymph) population were counted at the inner most leaves in 10 plants marked randomly in each treatment at 5 and 10 days after each spray. The cost: benefit ratio was worked out and data of three consecutive years i.e. *Rabi* 2010-11 and 2011-12 and 2012-13 were pooled, analyzed statistically and presented in Table-1, 2, 3 and 4.

Results

Rabi, 2010-11

Data presented in Table-1 and Fig.-1 revealed that 5th and 10th day after first spray significantly lowest thrips population (1.90 and 3.13 nymphs/plant, respectively) was recorded in T_1 (thiamethoxam 25 WG @ 0.2%, fipronil @ 0.1%, carbosulfan 25 EC @ 0.2% and profenophos @ 0.1%) which was found at par with all treatments except control. Five days after 4th spray minimum thrips population (1.37 nymph/plant) was recorded in T_5 (deltamethrin @ 0.095, carbosulfan 25 EC @ 0.2%, fipronil @ 0.1.% and thiamethoxam 25 WG @ 0.2%) and it was found at par with all treatments except control. The data further revealed that significantly highest gross yield (252.57 q/ha) was recorded in T_6 (deltamethrin @ 0.095-check) and it was found at par with all the treatments except control (178.96 q/ha).

Table 1: Thrips population (nymphs/plant)

Treatments	Pre-count	5 days after Ist spray	10 days after Ist spray	Before IInd spray	5 days after IInd spray	10 days after IInd spray	Before IIIrd spray	5 days after IIIrd spray	10 days after IIIrd spray	Before IVth spray	5 days after IVth spray	Gross yield (q/ha)
T1	0.77	1.90	3.13	7.37	0.57	1.57	2.60	1.57	5.53	4.37	1.57	237.65
T2	1.80	2.43	5.57	6.33	2.47	2.00	4.13	1.83	3.47	3.80	1.50	243.00
T3	1.27	2.57	6.90	5.23	3.10	2.37	6.43	1.17	2.53	3.00	1.40	246.40
T4	1.50	2.57	7.93	4.83	0.93	1.80	4.87	2.80	4.83	6.93	1.93	241.77
T5	1.53	4.27	10.67	9.17	1.87	1.73	5.20	5.40	6.53	3.57	1.37	251.02
T6	1.40	2.73	13.70	7.80	4.87	1.10	4.57	2.83	2.97	6.07	1.83	252.57
T7	1.60	10.93	17.23	25.83	25.63	20.37	22.90	28.00	18.47	13.20	7.50	178.96
S.Em±	0.16	0.49	0.93	0.65	0.38	0.07	0.55	0.60	0.68	0.73	0.26	10.09
CD at 5%	0.35	1.07	2.03	1.42	0.83	0.15	1.20	1.31	1.48	1.59	0.57	21.98

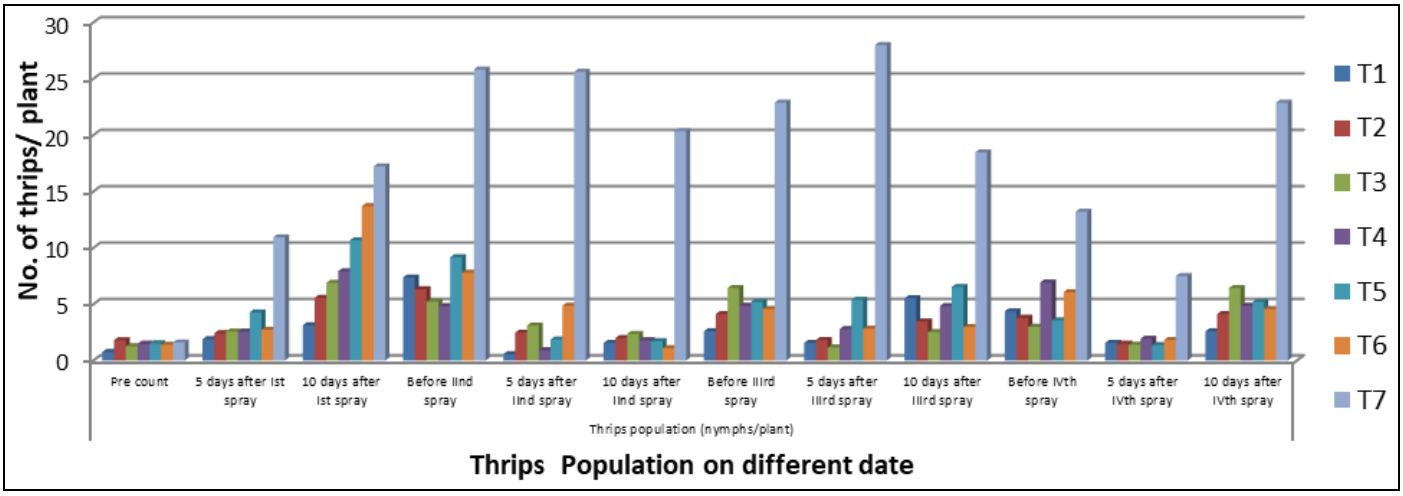

Fig 1: Chemical control of onion thrips with insecticides through sequential sprays at RRS, Karnal during *rabi*, 2010-11

Rabi, 2011-12

Based on the data presented in Table-2 and Fig.-2 revealed that significantly lowest mean thrips population (15.23 nymphs/plant) was recorded in T_2 (carbosulfan 25 EC @ 0.2%, lambdacyhalothrin @ 0.05%, acetamiprid 10 EC @ 0.01% and alphamethrin 10 EC @ 0.15%) and it was found to be at par with all the treatments except control, where highest mean thrips population (43.21 nymphs/plant) was recorded in control. The data further revealed that significantly highest gross yield (239.19 q/ha) was recorded in T_2 (carbosulfan 25 EC @ 0.2%, lambdacyhalothrin @ 0.05%, acetamiprid 10 EC @ 0.01% and alphamethrin 10 EC @ 0.15%) followed by T_4 (profenophos @ 0.1%, thiamethoxam 25 WG @ 0.2%, deltamethrin @ 0.095 and acetamiprid 10 EC @ 0.01%) and T_1 (thiamethoxam 25 WG @ 0.2%, fipronil @ 0.1% carbosulfan 25 EC @ 0.2% and profenophos @ 0.1%) with 221.29 q/ha and 217.59 q/ha, respectively, while lowest yield (187.75 q/ha) was recorded in control.

Table 2: Thrips population (nymphs/plant)

Treatments	Pre count	5 days after Ist spray	10 days after Ist spray	Before IInd spray	5 days after IInd spray	10 days after IInd spray	Before IIIrd spray	5 days after IIIrd spray	10 days after IIIrd spray	Before IVth spray	5 days after IVth spray	Mean thrips population	Gross yield (q/ha)
T1	0.34	3.43	8.20	26.97	6.00	29.90	39.70	35.57	22.63	16.93	10.40	15.35	217.59
T2	0.23	6.37	9.07	18.70	7.07	27.57	44.50	30.97	22.27	16.33	11.77	15.23	239.19
T3	0.20	7.93	7.43	17.13	4.93	31.47	38.40	38.87	22.00	17.23	9.13	16.02	214.50
T4	0.23	5.30	6.93	16.23	7.67	27.97	41.07	35.73	24.73	16.87	9.73	15.53	221.29
T5	0.10	8.03	6.40	17.83	9.97	32.20	39.13	37.17	25.67	18.53	13.60	17.33	203.19
T6	0.20	8.73	6.73	18.43	11.80	29.87	41.83	36.20	25.30	19.93	12.97	17.17	208.90
T7	0.30	15.43	23.47	44.47	54.93	71.83	81.27	85.07	49.47	39.80	26.40	43.21	187.75
S.Em±	0.02	0.81	0.87	1.69	1.49	4.36	3.82	3.71	2.12	2.23	1.35	1.48	5.15
CD at 5%	0.04	1.76	1.90	3.68	3.25	9.50	8.32	8.08	4.62	4.86	2.94	3.22	11.22

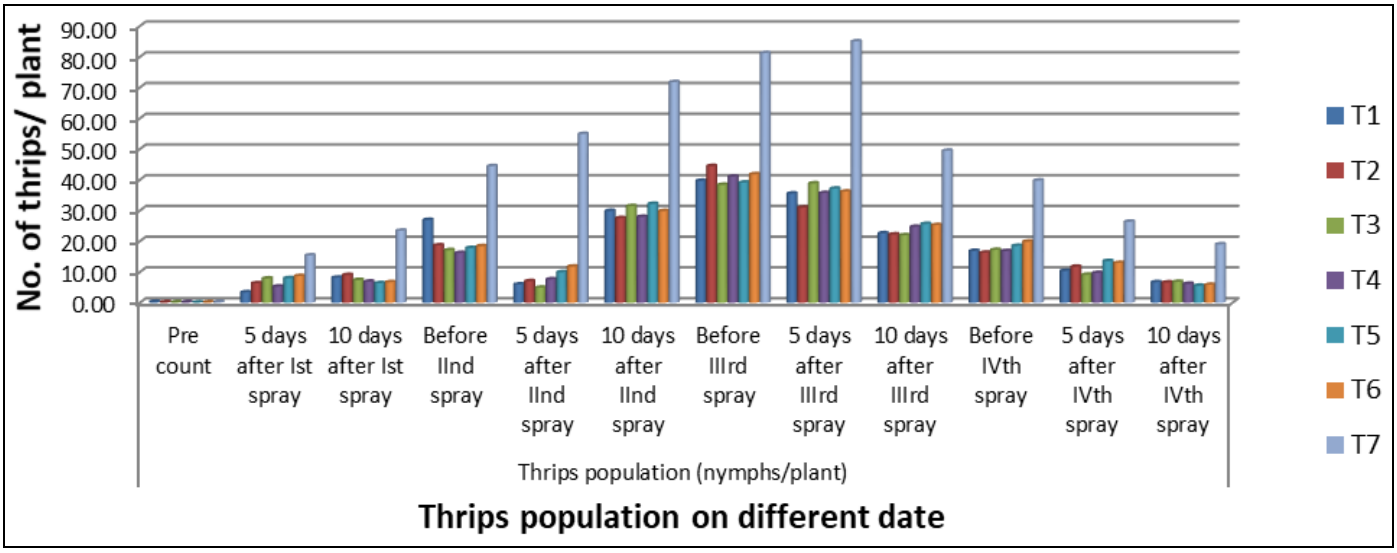

Fig 2: Chemical control of onion thrips with insecticides through sequential sprays at RRS, karnal during Rabi, 2011-12

***Rabi*, 2012-13**

Data presented in Table-3 and Fig.-3 revealed that significantly lowest mean thrips population (10.33 nymphs/plant) was recorded in T_4 (profenophos @ 0.1%, thiamethoxam 25 WG @ 0.2%, deltamethrin @ 0.095 and acetamiprid 10 EC @ 0.01%) and it was found at par with T_2 (carbosulfan 25 EC @ 0.2%, lambdacyhalothrin @ 0.05%, acetamiprid 10 EC @ 0.01% and alphamethrin 10 EC @ 0.15%), T_3 (acetamiprid 10 EC @ 0.01%, alphamethrin 10 EC @ 0.15%, carbosulfan 25 EC @ 0.2%, and fipronil @ 0.1.%) and T_6 (deltamethrin @ 0.095-check), while highest mean thrips population (25.42 nymphs/plant) recorded in control. Significantly higher gross yield (278.39 q/ha) was recorded in T_2 (carbosulfan 25 EC @ 0.2%, lambdacyhalothrin @ 0.05%, acetamiprid 10 EC @ 0.01%, and alphamethrin 10 EC @ 0.15%), while lowest yield (204.98 q/ha) was recorded in control.

Table 3: Thrips population (nymphs/plant)

Treatments	Pre count	5 days after Ist spray	10 days after Ist spray	Before IInd spray	5 days after IInd spray	10 days after IInd spray	Before IIIrd spray	5 days after IIIrd spray	10 days after IIIrd spray	Before IVth spray	5 days after IVth spray	Mean thrips population	Gross yield (q/ha)
T1	0.63	1.93	15.37	32.70	7.57	11.47	19.10	6.43	8.83	12.23	10.83	11.55	253.03
T2	0.73	2.23	14.27	25.47	6.30	12.07	21.23	5.80	9.43	9.20	10.73	10.68	278.39
T3	0.60	2.50	12.37	26.80	8.67	9.53	25.20	5.80	10.30	8.40	9.40	10.87	261.05
T4	0.37	2.23	14.27	27.30	5.00	6.53	20.77	6.60	9.70	9.50	11.37	10.33	266.46
T5	0.40	2.33	12.27	35.63	6.63	8.03	21.43	5.67	11.43	13.07	9.57	11.50	251.79
T6	1.10	2.60	11.63	28.43	5.67	9.03	20.80	7.47	7.53	13.03	9.93	10.66	250.51
T7	0.83	3.87	21.17	47.67	41.57	35.13	35.20	25.60	23.77	23.37	21.49	25.42	204.98
S.Em±	0.43	0.45	1.16	1.73	1.32	0.99	1.72	0.53	1.51	1.61	1.50	0.48	3.46
CD at 5%	NS	0.98	2.53	3.77	2.88	2.16	3.75	1.15	3.29	3.51	3.27	1.05	7.54

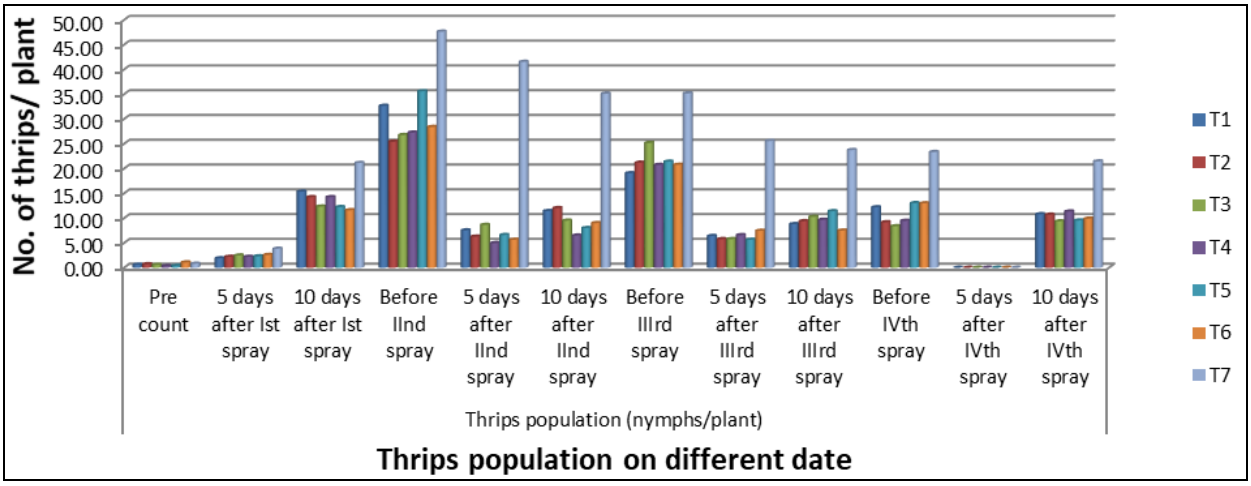

Fig 3: Chemical control of onion thrips with insecticides through sequential sprays at RRS, Karnal during rabi, 2012-13

Combined data of *Rabi*, 2010-11, 2011-12 and 2012-13

The combined result of three consecutive years revealed that variation in incidence and population of thrips before 1st spray did not differ significantly. During subsequent sprays and observations recorded upto 5 days after last spray, lowest mean thrips population (9.71 nymphs/plant) was found in treatment T_2 (carbosulfan 25 EC @ 2ml/lit. - lambdacyhalothrin @ 0.5 ml/lit. - acetamiprid 10 EC @ 0.1ml/lit. - alphamethrin 10 EC @ 1.5ml/lit.), however it was at par with all the treatments except control. Significantly highest gross yield (253.53q/ha) was also recorded in the same treatment, but was at par with treatments T_4 (profenophos @ 1ml/lit. - thiamethoxam 25 WG @ 2ml/lit. - deltamethrin @ 1.0ml/lit - acetamiprid 10 EC @ 0.1ml/lit. (243.17q/ha) and T_3 (acetamiprid 10 EC @ 0.1ml/lit - alphamethrin 10 EC @ 1.5ml/lit. - carbosulfan 25 EC @ 2ml/lit. - fipronil @ 1ml/lit.) i.e. 240.65q/ha. Significantly higher mean thrips population (28.68 nymphs/plant) and lowest yield (190.57q/ha) were recorded in control treatment. The highest cost: benefit ratio (1:4.69) was also recorded in treatment T_2 (carbosulfan 25 EC @ 2 ml/lit.- lambdacyhalothrin @ 0.5ml/lit. - acetamiprid 10 EC @ 1.5ml/lit. - alphamethrin 10 EC @ 1.5ml/lit.).

Table 4: Thrips population (nymphs/plant)

Treatments	Pre count	5 days after Ist spray	10 days after Ist spray	Before IInd spray	5 days after IInd spray	10 days after IInd spray	Before IIIrd spray	5 days after IIIrd spray	10 days after IIIrd spray	Before IVth spray	5 days after IVth spray	Mean thrips population	Gross yield (q/ha)	B:C Ratio
T1	0.58	2.42	8.90	22.35	4.71	14.31	20.47	14.52	12.33	11.18	3.99	9.90	236.09	1:1.19
T2	0.92	3.68	9.63	16.83	5.28	13.88	23.29	12.87	11.72	9.78	4.42	9.71	253.53	1:4.69
T3	0.69	4.33	8.90	16.39	5.57	14.46	23.34	15.28	11.61	9.54	3.51	10.05	240.65	1:3.17
T4	0.70	3.37	9.71	16.12	4.53	12.10	22.23	15.04	13.09	11.10	3.89	9.86	243.17	1:1.04
T5	0.68	4.88	9.78	20.88	6.16	13.99	21.92	16.08	14.54	11.72	4.99	11.16	235.33	1:0.91
T6	0.90	4.69	10.69	18.22	7.45	13.33	22.40	15.50	11.93	13.01	4.93	10.79	237.33	1:3.65
T7	0.91	10.08	20.62	39.32	40.71	42.45	46.46	46.22	30.57	25.46	11.30	28.68	190.57	-
S.Em±	0.27	0.61	1.00	1.45	1.17	2.58	2.44	2.19	1.55	1.65	0.80	0.90	6.84	-
CD at 5%	NS	1.32	2.17	3.15	2.55	5.63	5.32	4.77	3.38	3.59	1.73	1.97	14.91	-

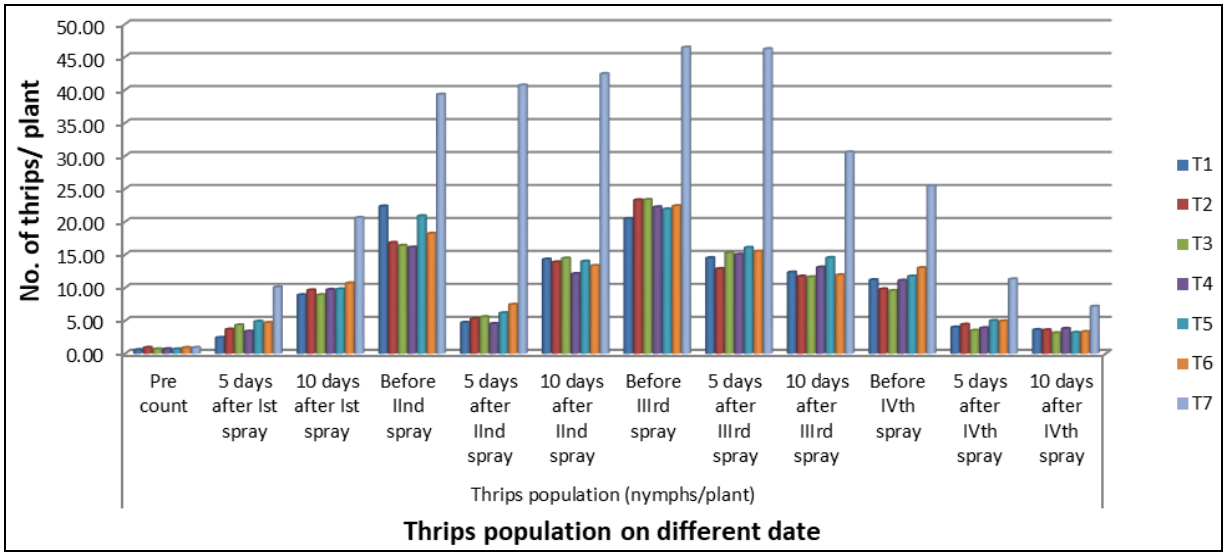

Fig 4: Chemical control of onion thrips with insecticides through sequential sprays at RRS, karnal (Pooled data, 2010-11, 2011-12 & 2012-13)

Discussion

The results obtained in this study are quite in conformity with the findings of previous workers [4, 8, 11] who used synthetic insecticides for the management of onion thrips in different parts of the world and got a considerable knockdown effect.

Ludger and Jean [13] suggested that the pyrethroid insecticide lambdacyhalothrin can be recommended in rotation with other classes of insecticides for the control of onion thrips. However, straight lambdacyhalothrin is not recommended because of the quick resistance buildup to the synthetic pyrethroids [9].

The effectiveness of deltamethrin at 7.5 g.a.i/ha was also reported [6] in onion against thrips. The results in respect of spinosad 45 SC and carbosulfan against onion thrips are in agreement with these of Holloway and Forrester [7] and Shitole [17].

Shaikh *et al.* [16] concluded that cypermethrin (0.025%) emerged as most effective insecticide by recording significantly higher thrips mortality and bulb yield.

Reddy *et al.* [15] found that Fipronil 5 SC (0.01%) followed by thiamethoxam 25 WG (0.005%) were the most effective treatments against chilli thrips. Rajkumar *et al.* [14] found that fipronil (0.01%) was the most effective chemical and protected the crop against thrips.

Conclusions

From the each year results, it can be concluded that across all parameters, the different chemical insecticides sprayed in a sequential manner alternatively, showed a significance effect in reducing the number of onion thrips. This saves the farmers yield and its value appreciably.

The combined, three years data showed still a significant yield increment in all treatments except control. Thus, it provides a better and wide control options, locally available, ecologically sound and cost effective solutions.

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