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Evaluation of different insecticides for management of onion thrips (*Thrips tabaci* Lindeman)

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Abstract
A field experiment was conducted at Regional Research Station, National Horticultural Research and Development Foundation, Nashik in three consecutive years during *rabi* 2015-16, 2016-17 and 2017-18. The seedlings of onion variety NHRDF Red-2 were transplanted in a bed size of 3.0 x 1.20 m at 15 cm x 10 cm spacing. Randomized Block Design with 4 replications was followed. The treatments evaluated were T_1 (Chlorantarniliprole @0.30 ml/L), T_2 (Emamectin Benzoate @ 0.40 gm/L), T_3 (Buprofezin@1.0 ml/ L) T_4 (Spinosad@0.3ml/ L), T_5 (Fenpropathrin@0.6ml/ L) and T_6 (Control). The applications were started at 30 DAT and a total of 4 sprays were given at 10 days interval. Silicon based sticker @0.5ml/L invariably mixed in each spray as sticky agent. The data on thrips population (Nymphs/plant) were counted at the inner most leaves visually with the help of hand lens on 10 plants marked randomly in each treatment at ten days interval after appearance. The application of fungicides *viz*. Mancozeb @2.5g/L and Carbendazim @1.0g/L were sprayed at 15 days interval alternatively in all treatments to protect the crop from diseases.
All other agronomical practices were performed uniformly as per need in all the treatments. The crop was harvested after attaining the maturity. The statistical analysis data was done.

Keywords: Onion, thrips, insecticides, management

Introduction
Onion (*Allium cepa* L.) is an important vegetable or spices crop cultivated in almost all the states of the country. In India onion is cultivated in 3 seasons *viz*. *rabi*, *kharif* and late *kharif* seasons and maximum area under cultivation is being covered in *rabi* season (about 65%). Thrips attack 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. Waiganjo *et al*. (2008) [20] estimated the foliage damage of crop around 40-60% which led to yield losses of 10-20% in the crop. Shibru and Negeri (2014) [13] recorded that onion thrips cause loss in yield as 23-85%. Asgar *et al.* (2018) [6] reported that the bifenthrin 10 EC and dimethoate 40EC proved to be significantly effective against onion thrips. Khanzada *et al. (*2018) [5] found that cholorphenpyre 5SC@50g a.i./ha was most effective for control of onion thrips. This study was, thus, undertaken to evaluate the efficacy of different insecticides for the management of onion thrips during the *rabi* 2015-16, 2016-17 and 2017-18 seasons.

Materials and Methods
A field experiment was conducted at Regional Research Station, National Horticultural Research and Development Foundation, Nashik in three consecutive years during *rabi* 2015-16, 2016-17 and 2017-18. The seedlings of onion variety NHRDF Red-2 were transplanted in a bed size of 3.0 x 1.20 m at 15 cm x 10 cm spacing. Randomized Block Design with 4 replications was followed. The treatments evaluated were T_1 (Chlorantarniliprole @0.30 ml/L), T_2 (Emamectin Benzoate @ 0.40 gm/L), T_3 (Buprofezin@1.0 ml/L) T_4 (Spinosad@0.3ml/ L), T_5 (Fenpropathrin@0.6ml/ L) and T_6 (Control). The applications were started at 30 DAT and a total of 4 sprays were given at 10 days interval. Silicon based sticker @0.5ml/L invariably mixed in each spray as sticky agent. The data on thrips population (Nymphs/plant) were counted at the inner most leaves visually with the help of hand lens on

10 plants marked randomly in each treatment at ten days interval after appearance. The application of fungicides *viz*. Mancozeb @2.5g/L and Carbendazim @1.0g/L were sprayed at 15 days interval alternatively in all treatments to protect the crop from diseases.

All other agronomical practices were performed uniformly as per need in all the treatments. The crop was harvested after attaining the maturity. The statistical analysis data was done.

Results and Discussion

I year: Data presented in Table-1 and Fig.1 revealed that lowest thrips population (13.0 nymphs/plant) at 30 DAT were recorded in treatment T_3 (foliar spray of buprofezin@1.0ml/L) while highest (15.65 nymps/plant) in control plot. At 40 DAT, the lowest thrips population (13.50 nymphs/plant) were recorded in treatment T_4 (foliar spray of spinosad@0.30ml/L) and it was found at par with treatment T_3 while the highest thrips population (37.10 nymphs/plant) were recorded in control plot. At 50 DAT, the lowest thrips population (11.55 nymphs/plant) were recorded in treatment T_4 and highest thrips population (35.0 nymphs/plant) in control plot. At 60 DAT, the lowest thrips population (15.05 nymphs/plant) was recorded in treatment T_4 and it was found at par with treatment T_2 and highest thrips population (29.55 nymphs/plant) in control plot. At 70 DAT, the lowest thrips population (17.10 nymphs /plant) were recorded in treatment T_4 and it was found at par with treatment T_2 while highest thrips population (34.80 nymphs/plant) were recorded in control plot. At 80 DAT, the lowest thrips population (13.0 nymphs/plant) were recorded in treatment T_4 while highest thrips population (41.15 nymphs/plant) in control plot. The overall lowest thrips population (14.16 nymphs /plant) was recorded in treatment T_4, while highest was recorded (32.21 nymphs /plant) in control plot. The highest gross yield (361.05 q/ha) and marketable yield (343.10q/ha) were recorded in treatment T_4, while lowest gross yield (295.88q/ha) and marketable yield (290.68q/ha) were recorded in control plot. The present study is in conformity with the result obtained by Pathak *et al.* (2018) [8] who reported lowest thrips population and highest onion seed yield with the application of fipronil insecticide. Tirkey and Kumar, (2017) [18] reported that the insecticides reduced thrips population as compared to control and highest yield was obtained by the use of dimethoate. Pandey *et al.* (2013) [7] recorded that lowest thrips population and highest bulb yield by applying fipronil.

Thrips population control over control plot (%)

Data revealed that the thrips population could be controlled by 56.03% in treated plot with spray of spinosad@0.3ml/L at 10 days interval in comparison to the control.

Yield increase over control plot (%)

The data showed that the yield was increased by 22.02% in treated plot of onion with spray of spinosad@0.3ml/L in comparison to the control plot.

II year

Data presented in Table-2 and Fig.2 revealed that lowest thrips population (32.25 nymphs/plant) at 30 DAT was recorded in treatment T_2 (Emmamectin benzoate @ 0.40 gm /L) while it was highest (42.28 nymps/plant) in treatment T_5 (Fenpropathrin@0.6ml/L). At 40 DAT, the lowest thrips population (19.95 nymphs/plant) was recorded in treatment T_4 (Spinosad@0.30ml/L) while the highest thrips population (40.13 nymphs/plant) was observed in control plot. At 50 DAT, 60 DAT, 70 DAT and 80 DAT lowest thrips populations were recorded in treatment T_4. The overall lowest thrips population (12.42 nymphs /plant) was recorded in treatment T_4, while highest (46.99 nymphs /plant) was found in control plot. The highest gross (316.08q/ha) and marketable (299.31q/ha) yield were recorded in treatment T_4, while lowest gross (265.67q/ha) and marketable (245.89q/ha) yield were found in control. The present study is in conformity with the result obtained by Ibrahim and Adesiyum, (2010) [4] reported that planting early is the best way to achieve higher yield of onion and using Lambdacyhalothrin reduced thrips population as well as increased the yield. Aslam *et. al.* (2018) [1] reported that Profenofos @4.0 ml/L was more effective for control of onion thrips and bud worm. Ansari *et. al*. (2016) [2] reported that insecticides caused significant reduction of thrips as compared to control.

Thrips population control over control plot (%)

The data revealed that the thrips population was reduced by 73.56% with spray of spinosad@0.3ml/L at 10 days interval in comparison to the control plot.

Yield increase over control plot (%)

The data showed that the yield was increased by 18.97% in treated plot of onion with spray of spinosad@0.3ml/L in comparison to the control plot.

III year

Data presented in Table -3 and Fig.3 revealed that lowest thrips population (19.70 nymphs/plant) at 30 DAT was recorded in treatment T_1 and it was found at par with treatment T_5 and highest (22.08 nymphs/plant) population was recorded in control plot. At 40 DAT, the lowest thrips population (32.43 nymphs/plant) was recorded in treatment T_4 (Spinosad@0.30ml/L) while highest thrips population (61.23 nymphs/plant) was observed in control plot. At 50 DAT, 60 DAT, 70 DAT and 80 DAT, the lowest thrips populations were also recorded in T_4. Similarly the overall lowest thrips population (15.23 nymphs /plant) was recorded in treatment T_4, while highest (75.39 nymphs /plant) was recorded in control plot. Further, highest gross yield (315.36q/ha) and marketable yield (295.60q/ha) were recorded in treatment T_4, while lowest gross yield (234.10q/ha) and marketable yield (210.12q/ha) were recorded in control plot. The present study is in conformity with the results obtained by Das *et al.* (2017) [3] who found the spry of imidacloprid treatment at 15 days interval with lowest thrips population as well as highest gross yield. Patil and Patil (2018) [10] reported that fipronil was effective for control of onion thrips. Shweta *et al*. (2019) [14] confirmed that the spray of spinosad at 10 days interval was effective for managing onion thrips.

Thrips population control over control plot (%)

The data revealed that the thrips population was controlled by about 79.79% in treated plot of onion with spray of spinosad@0.3ml/L at 10 days interval in comparison to the control plot.

Yield increase over control plot (%)

The data showed that the yield increased by 34.71% in treated plot with spray of spinosad@0.3ml/L in comparison to the control plot.

Combined result of three years

The pooled data presented in Table 4 and Fig.4 revealed that the overall lowest thrips population (13.94 nymphs/plant) was recorded in treatment T_4 (Spray of spinosad @0.3 ml/ L) while it was highest (51.93 nymphs /plant) in treatment T_6 (control). The highest gross yield (330.0 q/ha) and marketable yield (312.70q/ha) were recorded in treatment T_4, while the lowest gross yield (265.22q/ha) and marketable yield (248.89q/ha) were observed in control plot. The highest B:C ratio of 4.5:1 was recorded in treatment T_5. The present study is in conformity with the result obtained by Pandey *et al.* (2014) [9] and Singh *et al.* (2011) [15] who reported that spinosad at 10 days interval was effective for managing onion thrips. Similarly, Ullah *et al.* (2010) [19] reported that the insecticides thiodan, imidacloprid and spinosad were more effective against onion thrips as compared to control. Patil *et al.* (2009) [11] reported that spray of deltamethrin + triazophos and spinosad reduced the thrips population as well as increased yield. Seal *et al.* (2006) [16], Srinivas *et al.* (2007) [17], Prasad and Ahmed, (2009) [12] also advocated that spinosad is an effective insecticide against thrips.

Combined over all thrips population control over control plot (%)

The data revealed that the overall thrips population was controlled by about 72.94% in treated plot of onion with spray of spinosad@0.3 ml/L at 10 days interval in comparison to control Fig.6.

Yield increase over control plot (%)

The data showed that the overall yield was increased by 24.73% in treated plot with spray of spinosad@0.3ml/L in comparison to the control plot Fig.5.

Table 1: Evaluation of different insecticides for management of onion thrips 2015-16

Treatments	Average number of thrips/plant						Average of Nymphs Population	Gross yield (q/ha)	Marketable yield (q/ha)
	30 DAT	40 DAT	50 DAT	60 DAT	70 DAT	80 DAT			
T_1	15.15	18.40	18.20	26.30	24.95	25.15	21.36	336.00	325.33
T_2	17.50	18.55	19.60	18.50	19.55	22.43	19.35	330.23	310.60
T_3	13.00	17.05	20.15	22.90	24.60	32.45	21.69	341.30	321.48
T_4	14.75	13.50	11.55	15.05	17.10	13.00	14.16	361.05	343.10
T_5	15.83	20.15	16.65	20.65	22.95	30.35	21.10	308.35	294.88
T_6	15.65	37.10	35.00	29.55	34.80	41.15	32.21	295.88	290.68
S. Em±	1.27	2.00	0.93	1.68	2.25	1.84	0.83	2.96	1.99
CD at 5%	NS	4.26	1.98	3.58	4.80	3.92	1.77	6.31	4.24
CV %	11.74	13.58	6.54	10.74	13.25	9.50	5.42	1.27	0.90

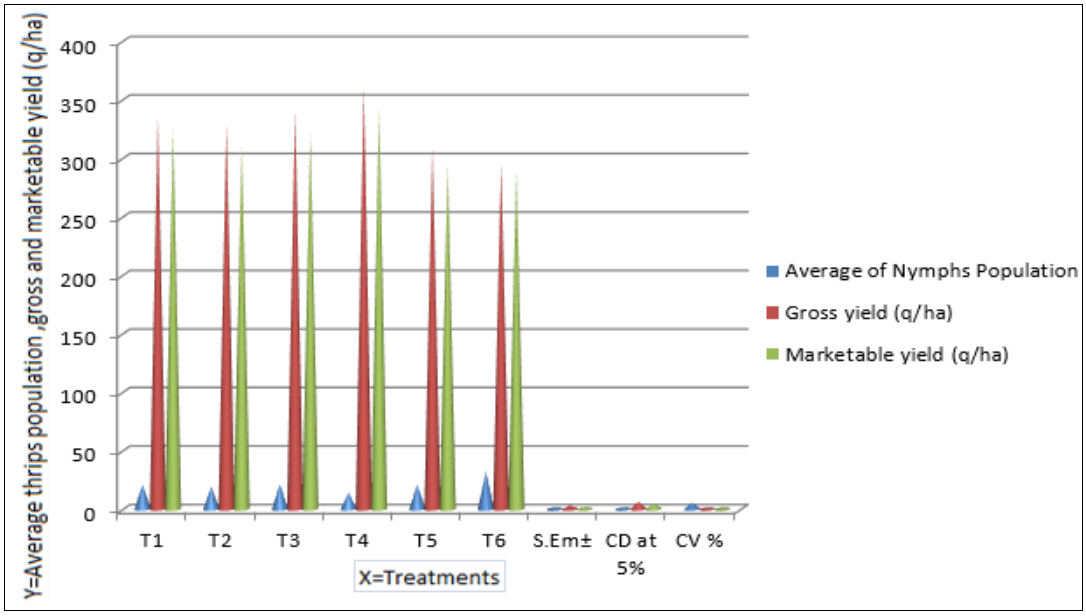

Fig 1: Revealed that lowest thrips population

Table 2: Evaluation of different insecticides for management of onion thrips 2016-17

Treatments	Average number of thrips/plant							Average of Nymphs Population	Gross Yield (q/ha)	Market Able yield (q/ha)
	30 DAT	40 DAT	50 DAT	60 DAT	70 DAT	80 DAT	90 DAT			
T_1	34.23	30.80	25.18	32.75	34.40	31.75	22.23	30.19	273.33	255.80
T_2	32.25	31.10	28.03	42.10	38.43	31.60	20.58	32.01	279.91	262.64
T_3	35.78	33.23	28.53	45.65	41.58	39.03	22.08	35.12	275.21	261.83
T_4	42.03	19.95	12.48	4.10	2.30	4.08	2.00	12.42	316.08	299.31
T_5	42.28	33.48	29.03	45.15	40.45	28.38	21.68	34.35	295.92	290.61
T_6	38.68	40.13	43.63	50.85	55.60	61.75	38.33	46.99	265.67	245.89
S. Em±	3.02	1.94	1.04	1.38	2.12	2.66	1.39	0.60	6.50	5.52
CD at 5%	6.436978	4.14	2.22	2.94	4.52	5.67	2.96	1.28	13.85	11.77
CV %	11.38	8.71	5.30	5.31	8.44	11.48	9.28	2.67	3.23	2.90

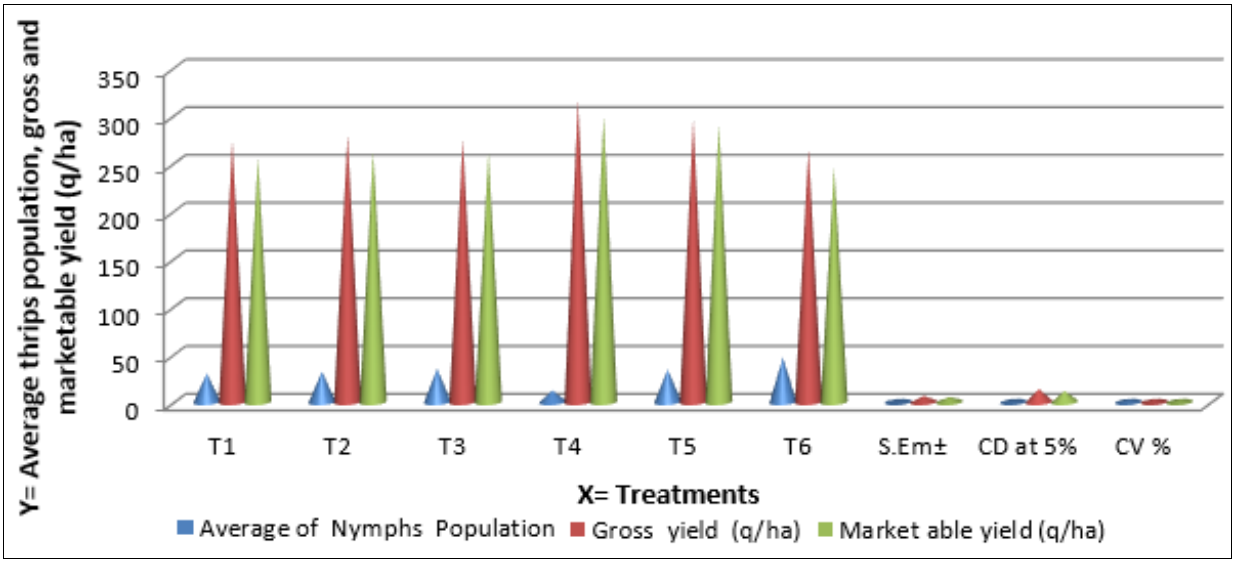

Fig 2: Effect of different treatments on thrips population, gross and marketable yield 2016-17

Table 3: Evaluation of different insecticides for management of onion thrips 2017-18

Treatments	Thrips (Nymphs/plant)							
	30 DAT		40 DAT		50 DAT		60 DAT	
T_1	19.70	(4.49)	41.58	(6.43)	53.20	(7.31)	80.90	(9.02)
T_2	20.55	(4.58)	48.48	(6.99)	61.65	(7.88)	81.70	(9.07)
T_3	20.25	(4.55)	52.68	(7.29)	69.05	(8.33)	88.15	(9.41)
T_4	20.83	(4.61)	32.43	(5.73)	15.85	(4.04)	19.25	(4.44)
T_5	19.78	(4.50)	46.20	(6.81)	84.48	(9.22)	88.43	(9.43)
T_6	22.08	(4.75)	61.23	(7.85)	99.38	(9.99)	117.73	(10.87)
S. Em±	-	0.07	-	0.37	-	0.24	-	0.16
CD at 5%	-	0.15	-	0.79	-	0.51	-	0.34
CV %	-	2.27	-	7.56	-	4.30	-	2.66

Treatments	Thrips (Nymphs/plant)				Gross yield (q/ha)	Marketable yield (q/ha)	Overall average Thrips	
	70 DAT		80 DAT					
T_1	96.20	(9.83)	82.03	(9.08)	254.38	227.67	53.37	(7.34)
T_2	99.38	(9.99)	78.88	(8.91)	262.53	246.32	55.80	(7.50)
T_3	101.03	(10.07)	85.58	(9.28)	243.87	236.59	59.53	(7.75)
T_4	11.60	(3.47)	6.68	(2.67)	315.36	295.69	15.23	(3.97)
T_5	107.55	(10.39)	88.50	(9.43)	238.01	217.66	62.13	(7.91)
T_6	119.15	(10.93)	108.18	(10.42)	234.10	210.12	75.39	(8.71)
S. Em±	-	0.21	-	0.13	4.71	4.67	-	0.09
CD at 5%	-	0.45	-	0.28	10.04	9.95	-	0.19
CV %	-	3.20	-	2.14	2.58	2.77	-	1.81

Note: Data in the parenthesis shows Square root transformed values

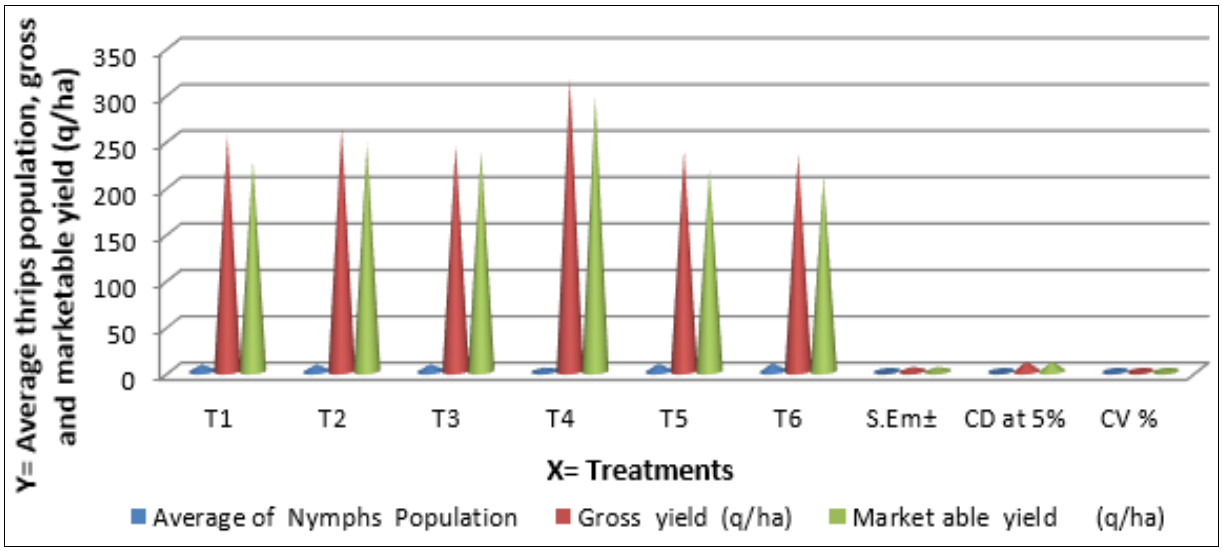

Fig 3: Effect of different treatments on thrips population, gross and marketable yield 2017-18

Table 4: Evaluation of different insecticides for management of onion thrips (2015-18)

Treatment	Thrips population (Nymphs/plant)							
	30 DAT		40 DAT		50 DAT		60 DAT	
T_1	23.03	(4.78)	30.26	(5.45)	32.19	(5.57)	46.65	(6.65)
T_2	23.43	(4.85)	32.71	(5.66)	36.43	(5.90)	47.43	(6.65)
T_3	23.01	(4.75)	34.32	(5.76)	39.24	(6.09)	52.23	(7.01)
T_4	25.87	(5.01)	21.96	(4.65)	13.29	(3.70)	12.80	(3.50)
T_5	25.96	(5.02)	33.28	(5.73)	43.38	(6.26)	51.41	(6.93)
T_6	25.47	(5.00)	46.15	(6.78)	59.33	(7.53)	66.04	(7.84)
S.E. m±	-	0.10	-	0.15	-	0.10	-	0.09
CD at 5%	-	0.20	-	0.31	-	0.20	-	0.18

Treatment	Thrips population (Nymphs/plant)				Gross yield (q/ha)	Market-Able yield (q/ha)	Overall Average thrips population	B: C ratio
	70 DAT		80 DAT					
T_1	51.85	(6.92)	46.31	(6.60)	287.90	269.60	34.97	1:2.9
T_2	52.45	(6.90)	44.30	(6.45)	290.89	273.19	35.72	1:3.9
T_3	55.73	(7.18)	52.35	(7.10)	286.79	273.28	38.78	1:4.04
T_4	10.33	(3.11)	7.92	(2.82)	330.83	312.70	13.94	1:2.47
T_5	56.98	(7.21)	49.08	(6.79)	280.76	267.72	39.19	1:4.50
T_6	69.85	(8.12)	70.36	(8.26)	265.22	248.89	51.53	-
S.E. m±	-	0.12	-	0.11	2.85	2.50	0.54	-
CD at 5%	-	0.24	-	0.22	5.74	5.03	1.08	-

Note: Data in the parenthesis shows Square root transformed values

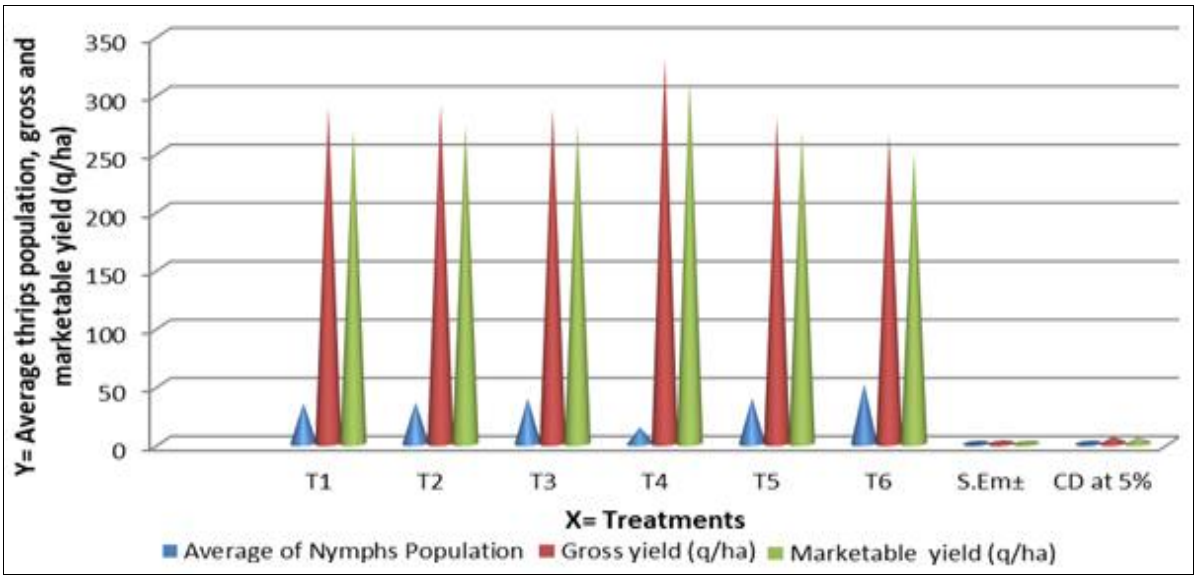

Fig 4: Effect of different treatments on thrips population, gross and marketable yield (2015-2018)

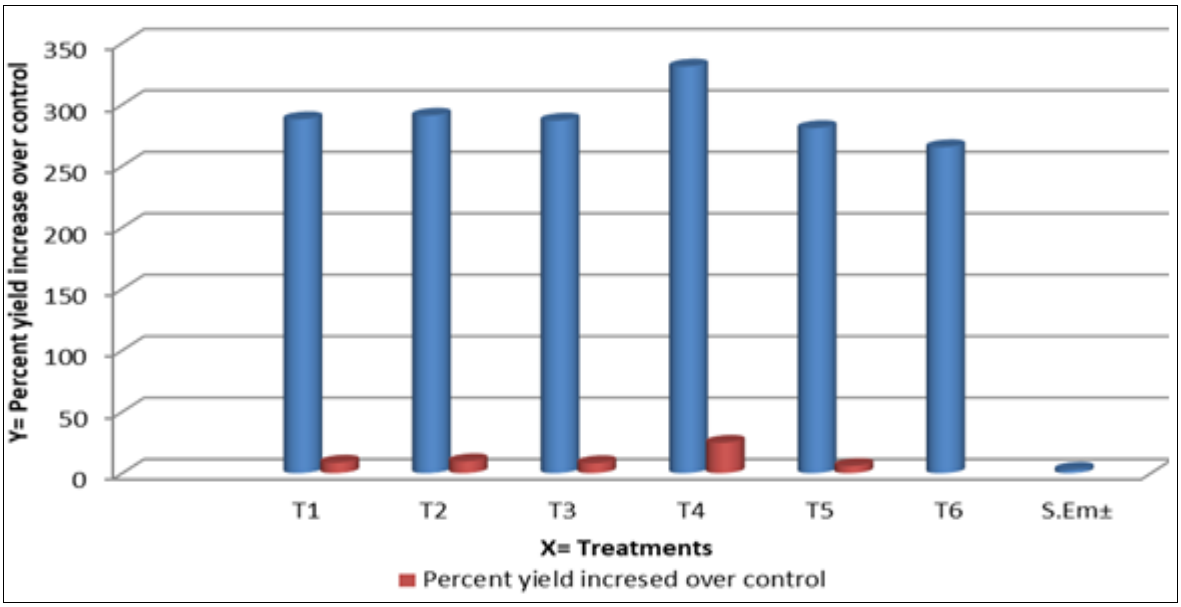

Fig 5: Percent yield increased over control in different treatments (2015-2018)

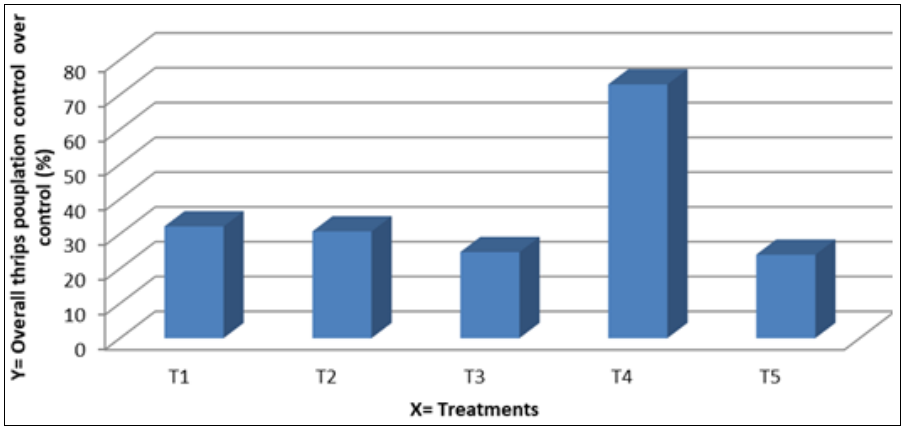

Fig 6: Overall thrips population control (%) (2015-2018)

Conclusion

Based on the studies made during *rabi* 2015-16, 2016-17 and 2017-18 it could be concluded that the spray of spinosad@0.3 ml/L at 10 days interval can be advocated as an effective strategy for management of thrips in onion during *rabi* season.

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