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Management of thrips (*Scirtothrips dorsalis* Hood), infesting rose grown under naturally ventilated polyhouse

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Abstract
A field experiment was conducted in the naturally ventilated polyhouse of Mr. Raju More, at At/post Porle, Tarfe Thane, Tal-Panhala, Dist-Kolhapur, Maharashtra during the summer 2023. The experiment followed a randomized block design with three replications and included eight treatments: T_1-acetamiprid 20 WP, T_2- fipronil 5 SC, T_3 imidacloprid 17.8 SL, T_4 dimethoate 30 EC, T_5 clothianidin 50 WDG, T_6- thiamethoxam 25 WG, T_{7-} acephate 75 SP and T_8 -untreated control. The objective was to study the bio efficacy of pesticides against thrips (*Scirtothrips dorsalis* Hood,) infesting rose under naturally ventilated polyhouse. The results revealed that treatment with T_2- fipronil 5 SC @ 1ml/L found most superior for the management of rose thrips and the efficacy of pesticides for the management of rose thrips was as follows acetamiprid 20 WP @ 0.5g/L, T_3 imidacloprid 17.8 SL - @ 0.5ml/L, T_6-thiamethoxam 25 WG @ 1g/L, T_5 clothianidin 50 WDG - @ 0.25g/L, T_{7-} acephate 75 SP @ 0.5g/L and T_4 dimethoate 30 EC - @ 1ml/L against untreated control at 1, 7, and 15 days post-spraying. The maximum per cent reduction over untreated control was observed in fipronil 5 SC (62.37%) followed by acetamiprid 20 WP (61.27%). The highest incremental cost-benefit ratio(ICBR) were recorded in T_1-acetamiprid 20 WP 1:4.50 followed by T_2- fipronil 5 SC 1:4.12 *i.e.* T_1 acetamiprid 20 WP > T_2 fipronil 5 SC > T_3 imidacloprid 17.8 SL > T_7 acephate 75 SP > T_5 clothianidin 50 WDG >T_4 dimethoate 30 EC > T_6 thiamethoxam 25 WG > Untreated control.

Keywords: Rose (*Rosa* sp.), ventilated polyhouse, incremental cost-benefit ratio

1. Introduction
Rose (*Rosa* sp.) is one of the nature's lovely creation and is universally called as "Queen of flower". The word rose is derived from the word "Eros" which means the god of love. In Sanskrit literature, rose is referred as "Tarunipushpa", "Atimanjula" and "Semantika". Rose belongs to the family Rosaceae. The genus Rosa includes about 120 species out of which simplest seven species are cultivated *viz*., *Rosa chinensis*(Jacq), *Rosa damascene*(Mill), *Rosa foetida*, *Rosa gallica*, *Rosa moschara*, *Rosa multiflora* and *Rosa wischuriana*. It's miles appreciably grown in and across the cities of Delhi, Pune, Bangalore and Chandigarh. India has about 88,607 hectare of land under floriculture with a manufacturing of 6,80,600 of flowers(Anonymous, 2000). Cultivation of rose under protected conditions has won significance in current years because of its export capability rapidly extended in India. This is because of, yield under protected cultivation became realized greater than 100 per cent when in comparison to that of open field cultivation. Much like open field conditions, the pest occurrence mainly thrips became observed as a primary risk under polyhouse situations.
The thrips species(*Scirtothrips dorsalis* Hood) is a recognized pest of many plants, inclusive of vegetables, roses, greenhouse grown flowers and cotton, thrips(*Scirtothrips dorsalis* Hood) are the appreciably notorious pests and gaining great significance in latest years owing to their devastating nature and harm ability. The larvae and adults of *S. dorsalis* cause damage at all the stages of a flower. *Scritothrips dorsalis* alone cause 28-95% damage. It is essential to discover and manage thrips on rose because even at low densities on flower can cause petal discoloration. Thrips are tiny insect that reproduce rapidly and congregate in tight locations that may make tough pesticide coverage and feed with rasping type of mouth part and that may result in deformation of leaves and flowers.

Tolerance for thrips on floriculture plants is particularly low. While feeding *Scritothrips dorsalis* destroys plant epidermal and mesophyll cells a protease inside the saliva can also contribute to the damage, this consists of stunted, scarred, deformed boom, leaf drop, scorched, bronzed, and scarred leaves, sepals and petals, for that reason, high densities of *Scritothrips dorsalis* can cause severe decline or dying of host plants. Host plants are also economically sensitive to feeding harm because even minimum scarring can render the plant unattractive and unsalable.

Industrial rose cultivation under open-field and protected conditions is gaining significance, and area under its cultivation increasing daily. It's far crucial to recognise the insect pest in rose and there's a need to offer adequate protection against numerous insect pests to improve quality and yield of the flowers. Due to wide spread cultivation of rose by people, the crop now desires to be managed by the usage of less pollutant-chemicals. Keeping in view the monetary importance of the crop and the magnitude of the damage because of the insect, the present study has been taken up.

2. Materials and Methods

The present investigations were carried out in the naturally ventilated polyhouse of Mr. Raju More, at At/post Porle, T. Thane, Tal-Panhala, Dist-Kolhapur, Maharashtra during the *summer* 2023 to study the bio efficacy of seven pesticides *viz.*, acetamiprid 20 WP, fipronil 5 SC, imidacloprid 17.8 SL, dimethoate 30 EC, clothianidin 50 WDG, thiamethoxam 25 WG, and Acephate 75 SP against rose thrips (*Scirtothrips dorsalis* Hood,) infesting rose under naturally ventilated polyhouse. The rose variety Top secret was selected for experiment. An untreated control was also maintained. The standard agronomic practices were given at a proper time.

The experiment was laid out in Randomized Block Design (RBD) with three replications. The insecticidal sprays were given at fifteen days interval and observations were taken at 1, 7, and 15 days after spraying (DAS). The populations of *S. dorsalis* were recorded on five randomly selected plant from experimental plot. The observations were recorded from three leaves from top, middle and bottom leaves per plant, then population per leaf counted. The data on average pest population of pretreatment and posttreatment was transformed to $\sqrt{x+0.5}$ and then subjected to analysis of variance in RBD. The per cent efficacy of different treatment were worked out by comparing with untreated control. The average percent reduction of pest by using the Henderson and Tilon formula: Percent reduction = 100(1-Ta x Cb / Tb x Ca), Where, Ta = number of insects in treated plot after insecticide application and Tb = number of insects in treated plot before insecticide application.

3. Results and Discussion

3.1 First Spray

3.1.1 Incidence of thrips before spraying: The data on average number of surviving population of thrips per leaf with plant prior to pesticide application ranged from 11.97 to 13.90. Those observations had been statistically non-significant, there by way of indicating the thrips population to be uniformly dispensed in the experimental plot previous to the application of pesticides.

3.1.2 One day after spraying: The recorded data on the average survival of the thrips population indicated a range from 9.10 to 13.73 thrips per leaf in treated plots, contrasting with a higher count of 13.57 thrips per leaf in the untreated plot. Notably, Fipronil 5% SC emerged as the most effective treatment, displaying the lowest count of 9.10 thrips per leaf, significantly outperforming other treatments. Following closely, Acetamiprid 20% WP showed a population of 9.63, trailed by Imidacloprid 17.8% SL at 12.30 thrips per leaf. Thiamethoxam 25% WG, Clothianidin 50% WDG, and Acephate 75% SP demonstrated efficacy with population of 13.07, 13.10, and 13.40, respectively. However, Dimethoate 30 EC, with a population of 13.73 thrips per leaf, proved less effective in thrips control. On the first day after spraying, it was observed that Fipronil 5% SC is at par with Acetamiprid 20% WP and Imidacloprid 17.8% SL.

3.1.3 Seven days after spraying: Fipronil 5% SC stands out as the most effective treatment. This treatment demonstrated the lowest thrips count, of 7.70 per leaf, and exhibited significant superiority over all other treatments. Following closely, Acetamiprid 20% WP proved to be the next best treatment with a population of 8.40 thrips per leaf, succeeded by Imidacloprid 17.8% SL with 11 thrips per leaf. Thiamethoxam 25% WG, Clothianidin 50% WDG, and Acephate 75% SP showed efficacy values of 11.33, 12, and 12.20, respectively. In contrast, Dimethoate 30 EC, with a population of 12.33 thrips per leaf, demonstrated less effectiveness in thrips control. Notably, seven days after spraying, Fipronil 5% SC is observed at par with Acetamiprid 20% WP.

3.1.4 Fifteen days after spraying: Fipronil 5% SC emerged as the most effective, displaying the lowest count of 7.47 thrips per leaf, significantly surpassing other treatments. Acetamiprid 20% WP followed closely with a population of 8, while Imidacloprid 17.8% SL recorded 10.67 thrips per leaf. Thiamethoxam 25% WG, Clothianidin 50% WDG, and Acephate 75% SP reported populations of 10.83, 11.47, and 11.57, respectively. Dimethoate 30 EC, however, proved less effective, with a population of 11.80 thrips per leaf.

Fifteen days after spraying, Fipronil 5% SC is observed to be at par with Acetamiprid 20% WP. Overall, Fipronil 5% SC exhibited the highest effectiveness, achieving a 40.73% reduction in thrips population over the untreated control, followed by Acetamiprid 20% WP with a 35.01% reduction and Imidacloprid 17.8% SL with a 16.04% reduction. Thiamethoxam 25% WG, Clothianidin 50% WDG, and Acephate 75% SP showed reductions of 14%, 10.70%, and 8.20%, respectively, over the untreated control. In contrast, Dimethoate 30 EC demonstrated a less substantial reduction of 7.55% over the untreated control in controlling rose thrips population.

Table 1: Efficacy of pesticides treatment against rose thrips after first spray

Sr. No.	Treatments	Conc.% gm or ml/L	Survival population under Naturally ventilated polyhouse First Application					% reduction over untreated control
			Pre count	1 DAS	7 DAS	15 DAS	Mean	
1	Acetamiprid 20% WP	0.5	11.97(3.53)	9.63(3.11)	8.40(2.96)	8(2.91)	8.67(2.99)	35.01
2	Fipronil 5% SC	1	12.07(3.53)	9.10(3.09)	7.70(2.85)	7.47(2.79)	8.09(2.91)	40.73
3	Imidacloprid 17.80% SL	0.5	12.53(3.61)	12.30(3.58)	11(3.36)	10.67(3.34)	11.32(3.60)	16.04
4	Dimethoate 30% EC	1	14.40(3.86)	13.73(3.77)	12.33(3.56)	11.80(3.49)	12.62(3.60)	7.55
5	Clothianidin 50% WDG	0.5	12.10(3.54)	13.10(3.66)	12(3.52)	11.47(3.44)	12.19(3.54)	10.70
6	Thiamethoxam 25%WG	1	12.13(3.54)	13.07(3.68)	11.33(3.43)	10.83(3.34)	11.74(3.48)	14
7	Acephate 75%SP	0.25	13.90(3.79)	13.40(3.72)	12.20(3.55)	11.57(3.46)	12.53(3.59)	8.20
T8	Water spary	-	13.20(3.69)	13.57(3.74)	13.67(3.75)	13.73(3.75)	13.65(3.74)	
	SE+		0.12	0.17	0.16	0.15	0.16	
	CD at 5% level		NS	0.53	0.50	0.48	0.50	
	CV%		5.81	8.51	8.35	8.20	8.35	

DAS= Days after spraying, N.S. – Non-significant

*Figures in parentheses are $\sqrt{x+0.5}$ values.

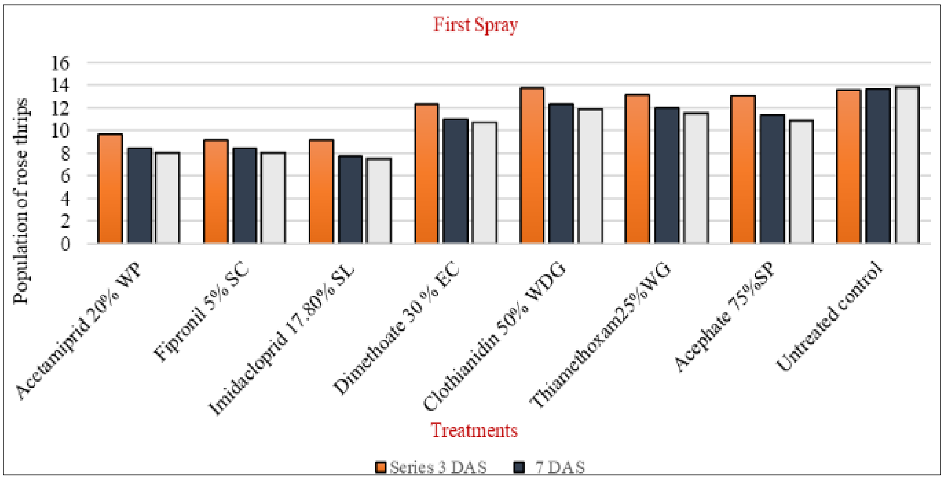

Fig 1: Efficacy of insecticides against rose thrips after first spray

3.2 Second Spray

3.2.1 Incidence of thrips before spraying: The recorded data, encompassing thrips population survival rates ranging from 7.47 to 11.80 per leaf across various treatments before pesticide application, demonstrated statistical significance. This suggests a non-uniform distribution of thrips population within the experimental plot prior to pesticide application.

3.2.2 One day after spraying: The recorded data on the average survival of thrips population indicated a range of 6.63 to 11.77 thrips per leaf in treated plots, contrasting with a higher count of 13.73 thrips per leaf in the untreated plot. Notably, among the assessed pesticides, Fipronil 5% SC demonstrated the most promising treatment, exhibiting the lowest count of 6.63 thrips per leaf, significantly surpassing all other treatments. Acetamiprid 20% WP followed as the second-best treatment with a population of 7, succeeded by Imidacloprid 17.8% SL with 9.47 thrips per leaf. Thiamethoxam 25% WG, Clothianidin 50% WDG, and Acephate 75% SP showed efficacies of 10.00, 10.27, and 10.33, respectively. However, Dimethoate 30 EC, with a population of 11.77 thrips per leaf, proved less effective in thrips control. Notably, on one day after spraying, Fipronil 5% SC found at par with Acetamiprid 20% WP.

3.2.3 Seven days after spraying: Fipronil 5% SC emerged as the most effective treatment, displaying the lowest thrips count at 6.33 per leaf, significantly surpassing all other treatments. Following closely, Acetamiprid 20% WP exhibited the next best treatment with a population of 6.40, succeeded by Imidacloprid 17.8% SL at 8 thrips per leaf. Thiamethoxam 25% WG, Clothianidin 50% WDG, and Acephate 75% SP demonstrated efficacies of 9.33, 9.47, and 9.57, respectively. However, Dimethoate 30 EC proved less effective, with a population of 11.67 thrips per leaf. Notably, at 7 days after of second spray, Fipronil 5% SC found at par with Acetamiprid 20% WP and Imidacloprid 17.8% SL.

3.2.4 Fifteen days after spraying: Fipronil 5% SC emerged as the most effective pesticide, displaying the lowest thrips count 6 per leaf and significant superiority over other treatments. The next best treatment is Acetamiprid 20% WP followed with a population of 6.10, and Imidacloprid 17.80% SL recorded 7.97 thrips per leaf. Thiamethoxam 25% WG, Clothianidin 50% WDG, and Acephate 75% SP demonstrated efficacies of 8.80, 8.90, and 9, respectively. Dimethoate 30 EC, however, proved less effective with a population of 11.33 thrips per leaf. At fifteen days after spraying, Fipronil 5% SC found at par with Acetamiprid 20% WP and Imidacloprid 17.8% SL.

Overall, Fipronil 5% SC exhibited the highest efficacy, resulting in a 52.23% reduction compared to the untreated control, followed by Acetamiprid 20% WP with a 50.87% reduction and Imidacloprid 17.8% SL with a 36% reduction. Thiamethoxam 25% WG, Clothianidin 50% WDG, and Acephate 75% SP showed reductions of 34.46, 27.90, and 27.13%, respectively. Dimethoate 30 EC displayed the least effectiveness with a 12.40% reduction compared to the untreated control in controlling rose thrips populations.

Table 2: Efficacy of pesticides treatments against rose thrips after second spray

Sr. No.	Treatments	Conc. Gm or ml/L	Survival population under Naturally ventilated polyhouse Second Application					% Reduction over untreated control
			Pre count	1 DAS	7 DAS	15 DAS	Mean	
1	Acetamiprid 20% WP	0.5	8(2.91)	7(2.73)	6.40(2.62)	6.10(2.56)	6.5(2.63)	50.87
2	Fipronil 5% SC	1	7.47(2.79)	6.63(2.67)	6.33(2.60)	6(2.53)	6.32(2.60)	52.23
3	Imidacloprid 17.80% SL	0.5	10.67(3.34)	9.47(3.15)	8(2.86)	7.97(2.87)	8.48(2.96)	36
4	Dimethoate 30% EC	1	11.80(3.49)	11.77(3.47)	11.67(3.45)	11.33(3.41)	11.59(3.44)	12.40
5	Clothianidin 50% WDG	0.5	11.47(3.44)	10.27(3.26)	9.47(3.16)	8.90(3.06)	9.54(3.16)	27.90
6	Thiamethoxam 25%WG	1	10.83(3.34)	10.00(3.21)	9.33(3.13)	8.80(3.03)	9.37(3.12)	34.46
7	Acephate 75%SP	0.25	11.57(3.46)	10.33(3.29)	9.57(3.16)	9.00(3.06)	9.64(3.17)	27.13
T8	Water spary	-	13.73(3.75)	13.77(3.76)	13.87(3.78)	14.07(3.81)	13.23(3.78)	
	SE+		0.15	0.15	0.17	0.16	0.16	
	CD at 5% level		0.48	0.47	0.52	0.49	0.49	
	CV%		8.20	8.43	9.56	9.18	9.12	

DAS= Days after spraying, N.S. – Non-significant

*Figures in parentheses are $\sqrt{x+0.5}$ values

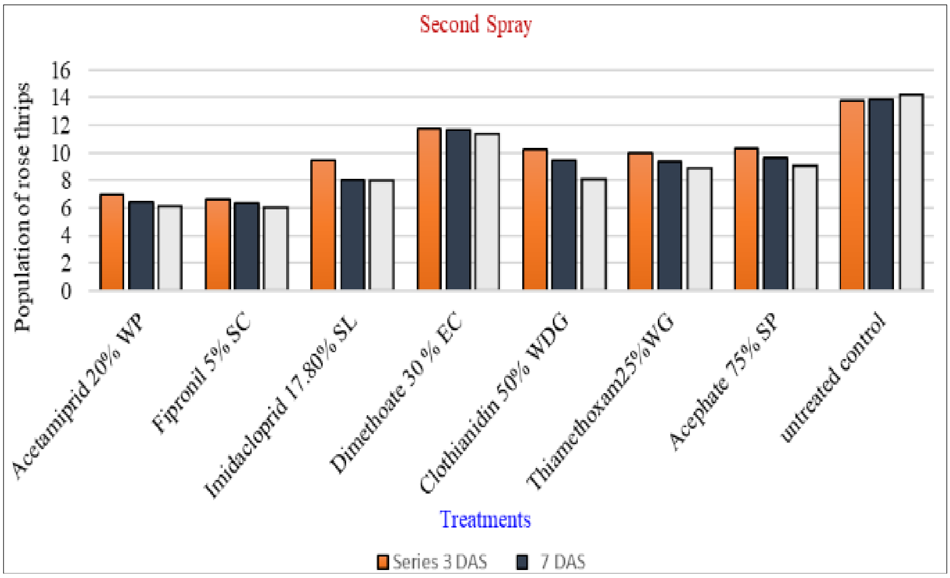

Fig 2: Efficacy of insecticides against rose thrips after second spray

3.3 Third Spray

3.3.1 Incidence of thrips before spraying: The recorded data for the average number of surviving thrips per leaf before pesticide application varied between 6 and 11.33 thrips per leaf across different treatments. Statistical analysis revealed significance, suggesting a non-uniform distribution of thrips population in the experimental plot before the application of pesticides.

3.3.2 One days after spraying: The data regarding the average survival of thrips populations indicated a range of 5.90 to 10.33 thrips per leaf in treat plot, contrasting with a higher count of 14.23 thrips per leaf in the untreated plot.
Notably, Fipronil 5% SC emerged as the most effective treatment, exhibiting the lowest count of 5.90 thrips per leaf, significantly outperforming other treatments. Following closely, Acetamiprid 20% WP recorded a population of 6, and Imidacloprid 17.8% SL showed a count of 7.63 thrips per leaf. Thiamethoxam 25% WG, Clothianidin 50% WDG, and Acephate 75% SP demonstrated efficacies of 8.30, 8.37, and 8.53, respectively. Dimethoate 30 EC, with a population of 10.33 thrips per leaf, proved less effective in thrips control. One day after spraying, Fipronil 5% SC found at par with Acetamiprid 20% WP and Imidacloprid 17.8% SL.

3.3.3 Seven days after spraying: Fipronil 5% SC emerged as the most effective treatment, exhibiting the lowest thrips count at 5.70 per leaf, significantly outperforming all other treatment. Following closely, Acetamiprid 20% WP demonstrated the next best results with a population of 5.80, succeeded by Imidacloprid 17.8% SL with 7 thrips per leaf. Thiamethoxam 25% WG, Clothianidin 50% WDG, and Acephate 75% SP showed efficacies of 7.90, 7.97, and 8.03, respectively. Dimethoate 30 EC, with a population of 8.17 thrips per leaf, exhibited lower effectiveness in thrips control.
At 7 days after spray (DAS), Fipronil 5% SC found at par with Acetamiprid 20% WP and Imidacloprid 17.8% SL.

3.3.4 Fifteen days after spraying: Notably, Fipronil 5% SC exhibited the highest efficacy, significantly reducing thrips to 4.70 per leaf, surpassing all other pesticides. Acetamiprid 20% WP followed closely with a population of 5, and then Imidacloprid 17.8% SL recorded 6.90 thrips per leaf. Thiamethoxam 25% WG, Clothianidin 50% WDG, and Acephate 75% SP showed efficacies of 6.93, 7.33, and 7.37, respectively. In contrast, Dimethoate 30 EC proved less effective treatment with a population of 7.63 thrips per leaf.
Fifteen days after spray, Fipronil 5% SC found at par with Acetamiprid 20% WP. Overall, Fipronil 5% SC exhibited the highest reduction in thrips population over the untreated control (63.37%), followed by Acetamiprid 20% WP (61.27%) and Imidacloprid 17.80% SL (50.41%).

Table 3: Efficacy of pesticides treatments against rose thrips after third spray

Sr. No.	Treatments	Conc.% gm or ml/L	Survival population under Naturally ventilated polyhouse Third Application					% Reduction over untreated control
			Pre count	1 DAS	7 DAS	15 DAS	Mean	
1	Acetamiprid 20% WP	0.5	6.10(2.56)	6.00(2.54)	5.80(2.51)	5(2.34)	5.60(2.46)	61.27
2	Fipronil 5% SC	1	6(2.53)	5.90(2.51)	5.70(2.47)	4.70(2.27)	5.44(2.41)	62.37
3	Imidacloprid 17.80% SL	0.5	7.97(2.87)	7.63(2.83)	7(2.70)	6.90(2.71)	7.17(2.74)	50.41
4	Dimethoate 30% EC	1	11.33(3.41)	10.33(3.28)	8.17(2.93)	7.63(2.85)	8.71(3.02)	39.55
5	Clothianidin 50% WDG	0.5	8.90(3.06)	8.37(2.97)	7.97(2.90)	7.33(2.78)	7.89(2.88)	45.43
6	Thiamethoxam 25%WG	1	8.80(3.03)	8.30(2.97)	7.90(2.89)	6.93(2.72)	7.71(2.89)	46.80
7	Acephate 75%SP	0.25	9.00(3.06)	8.53(2.95)	8.03(2.91)	7.37(2.77)	7.93(2.87)	45.15
T8	Water spary	-	14.07(3.81)	14.23(2.99)	14.43(3.86)	14.73(3.90)	14.46(3.58)	
	SE+		0.16	0.14	0.13	0.14	0.13	
	CD at 5% level		0.49	0.43	0.41	0.43	0.42	
	CV%		9.18	8.22	8.10	8.80	8.35	

DAS= Days after spraying, N.S. – Non-significant

*Figures in parentheses are $\sqrt{x + 0.5}$ values

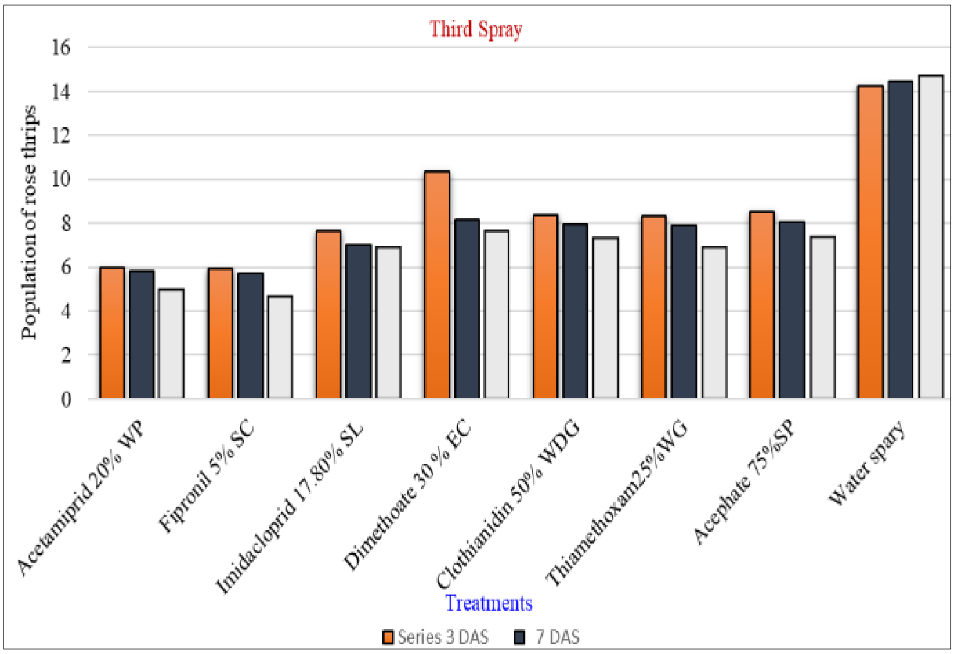

Fig 3: Efficacy of insecticides against rose thrips after third spray

3.3.5 Incremental cost benefit ratio: Table 4 presents the calculated additional yield, additional returns, net returns, and incremental cost-benefit ratios for various treatments. Fipronil 5% SC exhibited the highest benefit-cost ratio (1:2.06), followed by acetamiprid 20% WP with a ratio of 1:2.04, while the lowest ratio was observed in Dimethoate 30% EC (1:1.61). Furthermore, acetamiprid 20% WP reported the highest incremental cost-benefit ratio (ICBR 1:4.50), followed by Fipronil 5% SC with an ICBR of 1:4.12. These findings align with the results of Tripti Sahu and Ashwini Kumar N (2018) [20], who, in their study on insecticides against chilli thrips (*Scirtothrips dorsalis* Hood), identified Fipronil 5% SC @ 2ml/L (1:7.30) and Imidacloprid 17.80% SL 0.2 ml/L as the most effective treatments (1:6.23).

Table 4: Economics of different treatments in rose

Sr. No.	Cost of insecticide	Labor cost	Treatment cost	Yield q/ha	Gross Return/ha	Additional income	Total cost	Net return /ha	Benefit Cost Ratio	
									BCR	Incremental BCR
T_1	420	1500	1920	4408	13224	8664	6480	6744	2.04	1:4.50
T_2	850	1500	2350	4753	14259	9699	6910	7349	2.06	1:4.12
T_3	550	1500	2050	4312	13059	8499	6610	6449	1.97	1:4.10
T_4	430	1500	1930	3500	10500	5940	6490	4010	1.61	1:3.07
T_5	480	1500	1980	4005	12015	7455	6540	5475	1.83	1:3.76
T_6	1200	1500	2700	4150	12450	7890	7260	5190	1.71	1:1.29
T_7	420	1500	1920	4104	12312	7752	6480	5832	1.9	1:4.03
T8	-	-	1250		4560	0	4860	-300	1.00	1:0.0

4. Conclusion

Among all the treatments fipronil 1m/L proved to be the best treatment followed by acetamiprid 0.5g/L, imidacloprid 0.5 ml/L, thiamethoxam 1g/G, clothianidin 0.25 g/G, Acephate 0.5g/L and diamethoate 1ml/L is also effective in managing rose thrips (*Scirtothrips dorsalis* Hood). These insecticides are suitable for management of rose thrips and can be included in IPM program for controlling thrips in rose cultivation areas. This recommendation is based on their demonstrated efficacy, economic viability and their safety towards natural enemies.

5. References

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