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Field efficacy of selected insecticides against aphids infesting tomato (*Lycopersicon esculentum* Mill.)

Athivarman R[1], Ashwani Kumar[2]

[1] Department of Entomology, Naini Agriculture Institute, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj, Uttar Pradesh, India

[2] Associate Professor, Department of Entomology, Naini Agriculture Institute, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj, Uttar Pradesh, India

Abstract
The present investigation entitled, Field efficacy of selected insecticides against aphids infesting tomato (*Lycopersicon esculentum* Mill.) in district Namakkal (Tamil Nadu) was carried out at agricultural land at Mallasamudram, Namakkal district (Tamil nadu) in year 2020-2021 during rabi season. The field laid in RBD with seven treatements and one controlled plot. On the basis of the effectiveness of different treatments against tomato aphids all the insecticidal treatments were significantly effective against aphids over untreated control. The treatment with acetamiprid 20SP recorded lowest (1.79 aphids/3 leaves/plant) aphid population and emerged as superior treatment. Next effective treatment was fipronil 5%SC (1.81 aphids/3 leaves/plant) followed by imidacloprid 17.8%SL @ 125 ml/ha (1.91 aphids/3 leaves/plant), flonicamid 50%WG (1.97 aphids/3 leaves/plant), cypermethrin 25EC (2.44 aphids/3 leaves/plant, spinosad 45%SC@ 125ml/ha (2.61 aphids per 3 leaves per plant). The least effective treatment was thiamethoxam 25WG (2.65 aphids/3 leaves/plant). Cost benefit ratio was worked out, the best and most economical treatment was imidacloprid 17.8SL (1:11.37) followed by acetamiprid 20SP (1:8.41), spinosad 45SC (1:8.30), fipronil 5%SC (1:8.24), thiamethoxam 25WG (1:7.95), flonicamid 50WG (1:7.27), and cypermethrin 25EC (1:6.50), control (1:5.70).

Keywords: *Aphis gosypii*, treatments, cost-benefit ratio

Introduction

In India, Tomato is one of the most important vegetable crops due to its immense commercial and nutritive value and wide range of climatic adaptability. It ranks second to potato. Andhra Pradesh, Bihar, Karnataka, Uttar Pradesh, Orissa, Maharashtra, Madhya Pradesh and Assam, are the largest producer of tomato in our country. The highest productivity of tomato is incurred by Spain having 66.8 t /ha while India has only 17.50 t ha-1. When we focus, on national scenario we get that, Madhya Pradesh contributed maximum production 2177 thousand million tonnes but the highest productivity was occupied by Himachal Pradesh (41.663 t ha-1) (Anonymous, 2014-15) [2]. He estimated area under tomato in India is 6.33 lakh hectares with 124.25 lakh tonnes of fruit production. In India tomato is cultivated in an area of 8.79 lakh hectares with production of about 182.26 lakh tonnes and productivity of 20.7 tonnes/ha. In Gujarat, this crop occupied 44000 ha area with production of 11.57 lakh tonnes and productivity is 26.3 tonnes/ha (Anonymous, 2014) [1].

Tomato crop is infested by different insect pests and diseases at nursery as well as field stages. Spider mites, tomato pinworms, leaf minors, whitefly, tomato bugs, thrips and fruit worms are considered as major insect pests of tomato crop out of them whitefly *Bemisia tabaci* is considered as major insect pest of tomato crop which infest at all stages throughout cropping season (Schuster *et al.,* 2009*)* [8].

The tomato crop is attacked by several sucking pests causing appreciable damage to crop the major sucking pest infesting the tomato crop are as under (Butani *et al.,* 1984) [5]. Aphid is also phytophagous pest. Though cotton and okra are its main hosts, it also cause severe damage to tomato, brinjal, beans and potato. Both nymph and adult suck the cell sap and secret honey dew. Which not only attract the black ants but also favours the growth of sooty mould, giving the plants a sticky appearance (Butani and Jotwani, 1984) [5]. The aphid transmitted yellowing virus reduced yield and quality of tomato. Early infection (2-3 week after transplanting) caused the greater plant stunting 8-15 per cent and reduction in yields 60-83 per cent (Zitter and Everett, 1982) [14].

In view of this indiscriminate use of chemical pesticides and public concerns, the rise of new generation insecticides provides an alternative to reduce the ill effects of conventional insecticides. The new insecticides are more tissue-specific, activated in unique ways inside the target cells of insects resulting in reduced threat to other organism. Selective toxicity to insects and safety to natural enemies have made the new class of insecticides more user and eco-friendly. (Samota *et al.,* 2017)

Method of observation

First spray was given at 25 days after transplanting of tomato when the damage by pest population reached above ETL and 2nd spray was given 15 days after 1st spray. The control plot was maintained without any spraying. The observations on population of sucking pest should be recorded visually using

magnifying lens early on three leaves at top, middle and bottom canopy from five randomly selected and tagged plants in each plot. The populations were recorded at 3, 7

and 14 days after the spray and the percent reduction was worked out using the formula.

$$\text{Percent reduction (\%)} = \frac{\text{Population in control} - \text{Population in treatment}}{\text{Population in control}} \times 100$$

Bhambhaniya *et al*, (2018) [3]

Results and Discussion

First spray

Pre-treatment

The aphid population in the pre-treatment observation ranged from 3.44 to 4.84 aphids per 3 leaves per plant showing statistically non-significant difference among different treatment denoting uniform population. (Table 1)

At 3 days after spraying

The result revealed that all the insecticidal treatments differed significantly from untreated control and recorded the aphid population in the range of 2.02 to 3.19 aphids per 3 leaves per plant as against 3.55 aphids per 3 leaves in untreated control. The treatment with T4-fipronil 5%SC recorded the lowest (2.02 aphids/ 3 leaves/ plant) aphid population. T5- Imidacloprid 17.8SL (2.33 aphids/ 3 leaves/ plant) is the next best treatment followed by T1- flonicamid 50WG (2.44 aphids/3leaves/plant), T2-acetamiprid 20SP (2.68 aphids /3 leaves/plant), T3-cypermethrin 25 EC (2.93 aphids/3 leaves/plant), T7-spinosad 45SC (3.08 aphids /3 leaves/plant). The least effective treatment was T6-thiamethoxam 25WG which recorded 3.19 aphids per 3 leaves per plant.

At 7 days after spraying

The data revealed that all the insecticidal treatments were significantly superior in reducing the aphid incidence (1.64 to 2.82 aphids/3 leaves/ plant) over untreated control (4.11 aphids/3 leaves/ plant). The lowest aphid population was observed in the treatment with T5- imidacloprid 17.8SL (1.64 aphids/ 3 leaves/ plant) and proved to be best among all the treatments. T6-Thiamethoxam 25WG is the next effective treatment which recorded which recorded 1.90 aphids/3 leaves/ plant, followed by T1-flonicamid 50WG (2.04 aphids/3leaves/plant), T4-fipronil 5%SC (2.30 aphids /3 leaves/plant), T2-acetamiprid 20SP (2.53 aphids/3 leaves/plant), T3-cypermethrin 25EC (2.68 aphids /3 leaves/plant). The least effective treatment was T7-spinosad 45SC which recorded 2.82 aphids per 3 leaves per plant.

At 14 days after spraying

Aphid population recorded in different treatment was in between 2.17 to 3.41 aphids per 3 leaves per plant as against 4.88 aphids per 3 leaves per plant in untreated control. T4-fipronil 5%SC proved to be the significantly superior with minimum population (2.17 aphids/3 leaves/ plant). T2-Acetamiprid 20SP showed (2.42 thrips per 3 leaves per plant) followed by T5- imidacloprid 17.8SL (2.48 aphids/3leaves/plant), T1-flonicamid 50WG (2.82 aphids /3 leaves/plant), T3-cypermethrin 25EC (3.17 aphids /3 leaves/plant), T7-spinosad 45SC (3.35 aphids/3leaves/plant). T6-Thiamethoxam 25WG was least effective compared to other treatments recorded 3.41 thrips per 3 leaves per plant.

Second spray

At 3 days after spraying

After 3 days of second spray, amongst all the treatments, T2-acetamiprid 20SP found to be most effective with minimum population of 1.17 aphids which was at par with T5- imidacloprid 17.8SL (1.42 aphids/3 leaves/plant) and T1- flonicamid 50WG (1.64 aphids/3 leaves/plant) followed by T4- fipronil 5%SC (1.91 aphids/3leaves/plant), T7-spinosad 45SC (2.04 aphids/3leaves/plant), T3-cypermethrin 25EC (2.35 aphids /3 leaves/plant). T6-Thiamethoxam 25WG was found to be least effective treatment with population of 2.55 aphids per 3 leaves per plant (Table 2).

At 7 days after spraying

All the insecticidal treatments were significantly effective over untreated control in re.ducing aphid population after 2nd spraying. The less number of aphids 0.62 per 3 leaves per plant was recorded in treatment T2-acetamiprid 20SP. T4-fipronil 5%SC observed 0.95 aphids per 3 leaves per plant. It was at par with T1- flonicamid 50WG and T5-imidacloprid 17.8SL which recorded population of 1.08 and 1.26 aphids per 3 leaves per plant) followed by T3-cypermethrin 25EC (1.37 aphids/3leaves/plant), T7-spinosad 45SC (1.95 aphids/3leaves/plant), T6-thiamethoxam 25WG (2.15 aphids /3 leaves/plant).

At 14 days after spraying

Fourteen days after spray, the result revealed that all the insecticidal treatment were significantly differ from the untreated plot and recorded the population in range of 1.33 to2.71 aphids/3 leaves/plant as against 7.06 in control plot. T2-acetamiprid 20SP proved to be best with minimum population (1.33 aphids/3 leaves/plant). Next effective treatment was T4- fipronil 5%SC which recorded aphid population of (1.55 aphid/3 leaves/plant) followed by T1-flonicamid 50WG (1.82 aphids/3leaves/plant), T5-imidacloprid 17.8SL (2.06 aphids/3leaves/plant), T3-cypermethrin 25EC (2.21 aphids /3 leaves/plant, T7-spinosad 45SC (2.48 aphids/3leaves/plant). T6-Thiamethoxam 25WG was least effective with population of 2.71 aphids/3 leaves/plant.

Table 1: Comparative performance of foliar application of chemicals for the management of population of aphids 1st spray

Treatment symbols	Treatment	Pre-treatment	Aphid population/3 leaves/plant			Mean	% Reduction Over Control
			Days after spraying				
			3 DAS	7 DAS	14 DAS		
T1	Flonicamid 50% WG	4.06	2.44	2.04	2.82	2.43	41.86
T2	Acetamiprid 20SP	4.27	2.68	2.53	2.42	2.54	39.23
T3	Cypermethrin 25EC	4.22	2.93	2.68	3.17	2.92	30.14
T4	Fipronil 5%SC	4.53	2.02	2.30	2.17	2.16	48.32
T5	Imidacloprid 17.8%SL	4.84	2.33	1.64	2.48	2.15	48.56

T6	Thiamethoxam 25WG	4.37	3.19	1.90	3.41	2.83	32.29
T7	Spinosad 45% SC	4.82	3.08	2.82	3.35	3.08	26.31
T0	Control	3.44	3.55	4.11	4.88	4.18	----------
	F-Test	S	S	S	S	S	----------
	C.D at 5%	0.44	0.49	0.74	0.83	0.64	----------
	S. Ed. (±)	0.21	0.24	0.36	0.40	0.31	----------

Table 2: Comparative performance of foliar application of chemicals for the management of population of aphids 2nd spray

Treatment symbols	Treatment	Aphid population/3 leaves/plant			Mean	% Reduction Over Control
		Days after spraying				
		3 DAS	7 DAS	14 DAS		
T1	Flonicamid 50% WG	1.64	1.08	1.82	1.51	78.11
T2	Acetamiprid 20SP	1.17	0.62	1.33	1.04	84.92
T3	Cypermethrin 25EC	2.35	1.37	2.21	1.97	71.44
T4	Fipronil 5% SC	1.91	0.95	1.55	1.47	78.69
T5	Imidacloprid 17.8%SL	1.42	1.26	2.06	1.58	77.10
T6	Thiamethoxam 25WG	2.55	2.15	2.71	2.47	64.20
T7	Spinosad 45% SC	2.04	1.95	2.48	2.15	68.84
T0	Control	6.77	6.88	7.06	6.90	----------
	F-Test	S	S	S	S	---------
	C.D at 5%	1.75	1.97	1.79	1.83	----------
	S.Ed.(±)	0.84	0.95	0.87	0.89	---------

Overall mean value of first and second spray

Cumulative effect of the treatments at second spraying revealed that all the insecticidal treatments were significantly effective against aphids over untreated control. The treatment with T2-acetamiprid 20SP recorded lowest aphid population (1.79 aphids/3 leaves/plant) and emerged as superior treatment, these findings are agreement with Bambhaniya *et al*., (2017). Next effective treatment was T4-fipronil 5%SC (1.81 aphids/3 leaves/plant), these findings are agreement with Indhumathi *et al*.,(2017) [6] followed by T5- imidacloprid 17.8%SL @ 125 ml/ha (1.91 aphids/3 leaves/plant), these findings are agreement with Borad *et al*., (2016) [12] T1-flonicamid 50%WG (1.97 aphids/3 leaves/plant), these findings are agreement with Pavan *et al*., (2019) [7] T3-cypermethrin 25EC(2.44 aphids/3 leaves/plant),these findings are agreement with Sathish and Ashwani (2017) T7-spinosad 45%SC@ 125ml/ha (2.61 aphids/3 leaves/plant), these findings are agreement with Wagh *et al*., (2017) [11]. The least effective treatment was T6-thiamethoxam 25WG with 2.65 aphids per 3 leaves per plant, these findings are agreement with Sharma and Kumar (2020) [9]. (Table 3).

Table 3: Overall mean of 1st and 2nd spray aphids

S.No	Treatments	Mean of 1st spray	Mean of 2nd spray	Overall Mean	% Reduction Over Control
T1	Flonicamid 50% WG	2.43	1.51	1.97	64.44
T2	Acetamiprid 20SP	2.54	1.04	1.79	67.68
T3	Cypermethrin 25EC	2.92	1.97	2.44	55.95
T4	Fipronil 5%SC	2.16	1.47	1.81	67.32
T5	Imidacloprid 17.8%SL	2.15	1.58	1.91	65.52
T6	Thiamethoxam 25WG	2.83	2.47	2.65	52.16
T7	Spinosad 45% SC	3.08	2.15	2.61	52.88
T0	Control	4.18	6.90	5.54	--------
F-Test		S	S	S	---------
S. Ed. (±)		0.31	0.89	0.59	----------
C.D at 5%		0.64	1.83	1.21	----------

Conclusion

All the chemicals proved their superiority over the control in reducing the damage and increasing the marketable fruit yield. On the basis of the effectiveness different chemicals on aphids acetamiprid 20SP, fipronil 5%SC, Imidacloprid 17.8SL, and flonicamid 50WG proved to be the most effective treatments.

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