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ECO-FRIENDLY APPROACHES FOR MANAGEMENT OF LEAFHOPPERS AND APHIDS IN TOMATO

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ABSTRACT

Tomato (*Solanum lycopersicum* L.) is one of the most popular and widely grown vegetable crop of both tropics and subtropics of the world. It is a member of the family Solanaceae. Low tomato yields have been ascribed to a variety of issues, including poor seed quality, pest infestations and severe weather conditions. Insect pests are the most important of all known causes, causing significant losses at any stage of crop development. Many tomato producers are complaining about losses owing to sucking pests. Therefore, the study was carried out to compare the efficiency of different chemical insecticides against leafhoppers and aphids of tomato at Main Agriculture Research Station, Dharwad, Karnataka, during *rabi*, 2021-22. The experiment involves the treatments such as, T_1- VC (2.5t/ha) + NC (2.5q/ha) followed by foliar spray of Azardirachtin 10000 ppm @ 2ml/L, T_2- VC (2.5t/ha) + PC (2.5q/ha) followed by foliar spray of Azardirachtin 10000 ppm @ 2ml/L, T_3- VC (2.5t/ha) + NC (1.25q/ha) + PC (1.25q/ha) followed by foliar spray of Azardirachtin 10000 ppm @ 2ml/L, T_4- VC (2.5t/ha) + NC (2.5q/ha) followed by foliar spray of Pongamia oil @ 5ml/L, T_5- VC (2.5t/ha) + PC (2.5q/ha) followed by foliar spray of Pongamia oil @ 5ml/L, T_6 - VC (2.5t/ha) + NC (1.25q/ha) + PC (1.25q/ha) followed by foliar spray of Pongamia oil @ 5ml/L, T_7 - VC (2.5t/ha) + NC (1.25q/ha) + PC (1.25q/ha), T_8 - Azardirachtin 10000 ppm @ 2ml/l + Pongamia oil @ 5ml/l, T_9- RPP (Imidacloprid17.8 SL @ 0.25ml/l), T_{10}- Untreated check. Among the various treatments imposed, the VC (2.5t/ha) + NC (1.25q/ha) + PC (1.25q/ha) - Azardirachtin 10000 ppm @ 2ml/l was found effective in reducing the leafhoppers and aphids population. Highest fruit yield (35.25 t/ha) was recorded in VC (2.5t/ha) + NC (1.25q/ha) + PC (1.25q/ha) - Azardirachtin 10000 ppm @ 2ml/l. Similarly highest net return was registered in VC (2.5t/ha) + NC (1.25q/ha) + PC (1.25q/ha) - Azardirachtin 10000 ppm @ 2ml/l (1.18 lakh/ha).
***Keywords* :** Tomato, Vermicompost, Azardirachtin, Pongamia oil.

Introduction

Tomato, *Lycopersicon esculentum* (Miller), is one of the most popular and nutritive vegetable crops grown all over the world. Tomato belongs to family Solanaceae and is native of Peru and México. It is a warm season crop. It is grown as an off-season vegetable in the hills of India and farmers fetch good income. The fruit can be eaten raw or cooked. Tomato in large quantities is used to produce soup, juice, ketchup, puree, paste and powder. Tomato fruit contain water 93%, protein 1.9%, fat 0.3 g, fibre 0.7%, carbohydrates 3.6%, calorie 23, vitamin 'A' 320 I.U., vitamin 'B1' 0.07 mg, vitamin 'B2' 0.01mg, vitamin 'C' 31 mg, nicotinic acid 0.4 mg, calcium 20 mg, phosphorus 36 mg and iron 0.8 mg. Globally, India ranks second in tomato production after China. The area under cultivation of vegetables was 10383 thousand hectares with production of 179692 thousand metric tons during 2017-18. In India, tomato was grown in an area of 786 thousand hectare with production of 19377 metric tons during 2017-18. The area of tomato in Maharashtra was 50 thousand hectares with production of 1200 thousands metric ton and productivity 24 metric tons per hectare. In India, productivity of tomato is very low as compare to its production potential of the developed countries. There are many factors for low production potential, among them insect pests' infestation is one of the major factors that is responsible for reduction in productivity.

The production and quality of tomato fruits are considerably affected by array of insect pests infesting at different stages of crop growth. Though there are number of pests on tomato, some of them causes great to economic damage, some important insect pests include, Fruit borer, *Helicoverpa armigera* (Hubner), *Spodoptera litura* (Fabricus), sucking pests like whitefly, *Bemisia tabaci* (Gennadius), aphid, *Aphis gossypii* (Glover) and thrips *Frankliniella schultzei* (Trybom). *Ferrisisa virgate* (Cockerell), serpentine leaf miner, *Liriomyza trifoli* (Burgess) and Tomato Leaf miner, *Tuta obsoluta* (Meyrick). The sucking pests viz., aphid, whiteflies and thrips cause severe damage to crop by transmitting virus disease rather than direct feeding. In sucking pest complex, whitefly is important as it imparts direct damage to the crop by desaping and also acts as vector for transmission of leaf curl virus disease in tomato. Yield losses due to direct and indirect damage caused by whiteflies were reported to the extent of 20 to 100%. Considerable economic losses due to *H. armigera* reported by many workers to the extent about 50-80%. And Tomato leaf miner, *Liriomyza trifoli* (Burgess) can cause damage up to 90% under greenhouse and field conditions. As the meteorological parameters play a vital role in the biology of any pest, the interaction between pest activity and abiotic factors will help in deriving at predictive models that aids in forecast of pest incidence. Any pest management programme will require the use of monitoring practices to be effective. It is, therefore, imperative to study the population fluctuation of the crop pest in relation to weather parameters that largely direct the activity of a given species of insect pest. The seasonal and long-term changes would affect the fauna, flora and population dynamics of pests. The abiotic parameters are known to have direct impact on insect population dynamics. Therefore, keeping in view the economic importance of the crop and the magnitude of the damage caused by various insect pests, the present study was carried out to study the population buildup of major insect pests on tomato in relation to the abiotic factors.

Material and Methods

The experiment was laid out in randomized block design (RBD) at Main Agriculture Research Station, University of Agricultural Sciences, Dharwad during *rabi* 2021-22 and the crop was grown as per package of practices. The experiment consisted of ten treatments which were replicated thrice. The Durga variety of tomato seedlings were transplanted during 2nd fortnight of October, in a plot of size 3 × 3 m with 60 × 45 cm spacing. The treatments are *viz.,* T_1- VC (2.5t/ha) + NC (2.5q/ha) followed by foliar spray of Azardirachtin 10000 ppm @ 2ml/L, T_2- VC (2.5t/ha) + PC (2.5q/ha) followed by foliar spray of Azardirachtin 10000 ppm @ 2ml/L, T_3- VC (2.5t/ha) + NC (1.25q/ha) + PC (1.25q/ha) followed by foliar spray of Azardirachtin 10000 ppm @ 2ml/L, T_4- VC (2.5t/ha) + NC (2.5q/ha) followed by foliar spray of Pongamia oil @ 5ml/L, T_5- VC (2.5t/ha) + PC (2.5q/ha) followed by foliar spray of Pongamia oil @ 5ml/L, T_6 - VC (2.5t/ha) + NC (1.25q/ha) + PC (1.25q/ha) followed by foliar spray of Pongamia oil @ 5ml/L, T_7 - VC (2.5t/ha) + NC (1.25q/ha) + PC (1.25q/ha), T_8 - Azardirachtin 10000 ppm @ 2ml/l + Pongamia oil @ 5ml/l, T_9- RPP (Imidacloprid17.8 SL @ 0.25ml/l), T_{10}- Untreated check. Three sprays were given at 30, 45 and 60 days after transplanting. In each plot five plants were selected for recording observation. Plants were randomly observed for infestation of leafhopper and aphids by counting total number of insects in three leaves from top, middle and bottom canopy of each plant. These observations were recorded at 45, 60 and 75 days after transplanting. The data obtained was subjected to statistical analysis. Further the efficacy of treatments was compared by following DMRT (Duncan's Multiple Range Test) in Wasp 2.0.

Results and Discussion

Leafhopper

At 45 DAT, significantly low number of leafhoppers (4.90/ 3 leaves) was registered by VC (2.5t/ha) + NC (1.25q/ha) + PC (1.25q/ha) - Azadirachtin 10000 ppm @ 2ml/l and was on par with T_2 and T_1 with a leafhopper population of 4.88 and 4.99 leafhoppers per three leaves. Significantly higher leafhopper population (16.30 leafhoppers/ three leaves) was registered in untreated check. However, all the treatments were performed better over untreated check (Table-1).

At 60 DAT, treatments T_1, T_2 and T_3 were found equally effective by recording significantly least leafhopper population of 3.65, 3.60 and 3.20 leafhoppers per three leaves, respectively. However, T_6 (4.50/ 3 leaves) and T_8 (5.10/ 3 leaves) were found next best treatments against leafhoppers. Significantly higher leafhopper population (16.53/ 3 leaves) was recorded in untreated check.

At 75 DAT, among different treatments T3 was found significantly superior by recording less leafhopper population (5.55 leafhoppers/3 leaves) and was on par with T_1, T_2, T_5, T_6 and T_8. Significantly higher leafhopper population (8.56 leafhoppers/3 leaves) was registered in T_7 and was on par with untreated check.

Table 1 : Efficacy of different eco-friendly approaches against leafhoppers in tomato during *rabi* 2021-22

Tr. No.	Treatments	Mean no. of leafhoppers / 3 leaves				ROC (%)
		45 DAT	60 DAT	75 DAT	Mean	
T_1	VC (2.5t/ha) + NC (2.5q/ha) followed by foliar spray of Azardirachtin 10000 ppm @ 2ml/l	4.99 (2.34)^{b}	3.65 (2.04)^{bc}	5.60 (2.47)^{b}	5.06	59.11
T_2	VC (2.5t/ha) + PC (2.5q/ha) followed by foliar spray of Azardirachtin 10000 ppm @ 2ml/l	4.88 (2.32)^{b}	3.60 (2.02)^{bc}	6.00 (2.55)^{bc}	5.12	58.61
T_3	VC (2.5t/ha) + NC (1.25q/ha) + PC (1.25q/ha) followed by foliar spray of Azardirachtin 10000 ppm @ 2ml/l	4.90 (2.32)^{b}	3.20 (1.92)^{ab}	5.55 (2.46)^{b}	4.79	61.30
T_4	VC (2.5t/ha) + NC (2.5q/ha) followed by foliar spray of Pongamia oil @ 5ml/l	8.65 (3.02)^{d}	4.99 (2.34)^{d}	6.96 (2.73)^{c}	6.86	44.52
T_5	VC (2.5t/ha) + PC (2.5q/ha) followed by foliar spray of Pongamia oil @ 5ml/l	7.99 (2.91)^{d}	4.80 (2.30)^{d}	6.50 (2.65)^{bc}	6.45	47.88
T_6	VC (2.5t/ha) + NC (1.25q/ha) + PC (1.25q/ha) followed by foliar spray of Pongamia oil @ 5ml/l	6.50 (2.65)^{c}	4.50 (2.24)^{cd}	6.21 (2.59)^{bc}	5.85	52.69
T_7	VC (2.5t/ha) + NC (1.25q/ha) + PC (1.25q/ha)	6.25 (2.60)^{c}	7.99 (2.91)^{e}	8.56 (3.01)^{d}	7.01	43.31
T_8	Foliar spray of Azardirachtin 10000 ppm @ 2ml/l + Pongamia oil @ 5ml/l	6.20 (2.59)^{c}	5.10 (2.37)^{d}	5.99 (2.55)^{bc}	6.07	50.91
T_9	RPP(Imidacloprid 17.8 SL @ 0.25ml/l)	2.55 (1.75)^{a}	2.30 (1.67)^{a}	1.32 (1.35)^{a}	3.42	72.37
T_{10}	Untreated check	16.30 (4.10)^{e}	16.53 (4.13)^{f}	8.81 (3.05)^{d}	12.37	-
	SEM±	0.31	0.28	0.31	-	-
	CD (P=0.05)	0.93	0.84	0.93	-	-
	CV (%)	9.07	9.02	9.26	-	-

VC- Vermicompost, NC- Neem cake, PC- Pongamia cake, ROC- Reduction over control, DAT-Days after treatment.

Further the maximum reduction of leafhopper population over control was registered in T_3 (61.30%) followed by T_1 (59.11%) and T_2 (58.61%). However, other treatments recorded moderate reduction in leafhopper population over control which ranged from 43.31 to 52.69 per cent (Table 1).

Aphids

At 45 DAT, significantly a smaller number of aphids (4.85/ 3 leaves) was registered by VC (2.5t/ha) + NC (1.25q/ha) + PC (1.25q/ha) - Azadirachtin 10000 ppm @ 2ml/l and was on par with T_2 and T_1 with a aphid population of 5.00 and 5.20 aphids per three leaves. Significantly higher aphid population (20.44 aphids/ three leaves) was registered in untreated check. However, all the treatments performed better over untreated check (Table-2).

At 60 DAT, treatments T_1, T_2 and T_3 were found equally effective by recording significantly less aphid population of 6.22, 6.59 and 5.95 aphids per three leaves, respectively. However other treatments T_6 (7.50/ 3 leaves) and T_8 (8.50/ 3 leaves) were found as next best treatments against aphids. Significantly higher aphid population (23.39/ 3 leaves) was recorded in untreated check.

At 75 DAT, pattern of treatment significance was similar as that of 60 DAT, with same organics and botanical sprays excelling over others.

Further, the maximum reduction of aphid population over control (66.81%) was registered in T_3 followed by T_2 (63.81%) and T_1 (62.71%). However, other treatments recorded moderate reduction in aphid population over control which ranged from 42.37 to 57.75 per cent (Table 2).

Effect on yield and economics

Among different treatments VC (2.5t/ha) + NC (1.25q/ha) + PC (1.25q/ha) - Azardirachtin 10000 ppm @ 2ml/l was found significantly superior by recording highest fruit yield (35.25 t/ha) and was on par with VC (2.5t/ha) + NC (2.5q/ha) - Azardirachtin 10000 ppm @ 2ml/l (34.10 t/ha) and VC (2.5t/ha) + PC (2.5q/ha) - Azardirachtin 10000 ppm @ 2ml/l (34.00 t/ha). While the significantly lower yield was recorded in VC (2.5t/ha) + NC (1.25q/ha) + PC (1.25q/ha) (30.00 t/ha) followed by untreated check (27.50 t/ha). However, RPP (T_9) recorded significantly higher yield (38t/ha) compared to other treatments.

Table 2 : Efficacy of different eco-friendly approaches against aphids in tomato during *rabi* 2021-22

Tr. No.	Treatments	Mean no. of aphids / 3 leaves				ROC (%)
		45 DAT	60 DAT	75 DAT	Mean	
T_1	VC (2.5t/ha) + NC (2.5q/ha) followed by foliar spray of Azardirachtin 10000 ppm @ 2ml/l	5.20 $(2.39)^{bc}$	6.22 $(2.59)^{b}$	9.80 $(3.21)^{cd}$	6.31	62.71
T_2	VC (2.5t/ha) + PC (2.5q/ha) followed by foliar spray of Azardirachtin 10000 ppm @ 2ml/l	5.00 $(2.35)^{b}$	6.59 $(2.66)^{bc}$	8.90 $(3.07)^{c}$	6.12	63.81
T_3	VC (2.5t/ha) + NC (1.25q/ha) + PC (1.25q/ha) followed foliar spray of by Azardirachtin 10000 ppm @ 2 ml/l	4.85 $(2.31)^{b}$	5.95 $(2.54)^{b}$	8.50 $(3.00)^{bc}$	5.61	66.81
T_4	VC (2.5t/ha) +NC (2.5q/ha) followed by foliar spray of Pongamia oil @ 5ml/l	6.50 $(2.65)^{d}$	9.50 $(3.16)^{e}$	11.50 $(3.46)^{e}$	8.16	51.73
T_5	VC (2.5t/ha) + PC (2.5q/ha) followed by foliar spray of Pongamia oil @ 5ml/l	6.25 $(2.60)^{cd}$	9.22 $(3.12)^{e}$	11.05 $(3.40)^{de}$	7.83	53.70
T_6	VC (2.5t/ha) + NC (1.25q/ha) + PC(1.25q/ha) followed by foliar spray of Pongamia oil @ 5ml/l	6.15 $(2.58)^{cd}$	7.50 $(2.83)^{cd}$	11.00 $(3.39)^{de}$	7.29	56.90
T_7	VC (2.5t/ha) + NC (1.25q/ha) + PC(1.25q/ha)	9.99 $(3.24)^{e}$	11.00 $(3.39)^{f}$	13.99 $(3.81)^{f}$	9.75	42.37
T_8	Foliar spray of Azardirachtin 10000 ppm @ 2ml/l + Pongamia oil @ 5ml/l	6.58 $(2.66)^{d}$	8.50 $(3.00)^{de}$	7.25 $(2.78)^{b}$	7.15	57.75
T_9	RPP (Imidacloprid 17.8 SL @ 0.25ml/l)	2.59 $(1.76)^{a}$	3.52 $(2.00)^{a}$	3.99 $(2.12)^{a}$	4.03	76.20
T_{10}	Untreated check	20.44 $(4.58)^{f}$	23.39 $(4.89)^{g}$	17.30 $(4.22)^{g}$	16.91	-
	SEM±	0.31	0.38	0.46	-	-
	CD (P=0.05)	0.93	1.14	1.36	-	-
	CV (%)	8.23	8.33	8.80	-	-

VC- Vermicompost, NC- Neem cake, PC- Pongamia cake, ROC- Reduction over control, DAT-Days after treatment.

The cost benefit ratio varied from 1.18 in untreated check to maximum of 1.62 in RPP. VC (2.5t/ha) + NC (1.25q/ha) + PC (1.25q/ha)-Azardirachtin 10000 ppm @ 2ml/l (1.39), VC (2.5t/ha) + PC (2.5q/ha)-Azardirachtin 10000 ppm @ 2ml/l (1.35) and VC (2.5t/ha) + NC (2.5q/ha)-Azardirachtin 10000 ppm @ 2ml/l (1.34) were the next best treatments. The lowest cost benefit ratio recorded in VC (2.5t/ha) + NC (1.25q/ha) + PC (1.25q/ha) as well as untreated check (1.18). Cost benefit ratio reveals benefit out of every rupee investment (Table 3).

The results of the present findings are in close relation with Gundannavar *et al.* (2007) reported that soil application of organic amendments (neem cake, vermicompost and FYM) along with spray of Nimbecidine and NSKE was found to be most effective to control chilli sucking pests. Veena *et al.* (2017) who revealed that application of vermicompost (1t/ha) and neem cake (250 kg/ha) kept the mite and thrips population at lowest level. Identical results were also obtained by Giraddi and Smitha (2004) who reported that neem cake at 200 kg per ha with 50 per cent RDF showed significantly lower mite population in chilli. And they also revealed that pongamia cake was also played an important role in reducing the thrips and mite population. Manu (2005) found that the neem cake application at 500 kg per ha recorded the least population of whiteflies, aphids and thrips on cotton.

The present results are in accordance with Thorat *et al.* (2020) reported that the azadirachtin 3000 ppm at 3 ml/litre of water was also found effective in reducing the whitefly population in tomato and lowest population was recorded in imidacloprid 17.8 SC at 0.005%. Khaire *et al.* (2017) in their findings revealed that the treatments with yellow sticky trap, castor oil along the crop canopy followed by azadirachtin 10000 ppm @2 ml/L were found to be more superior in controlling cotton aphid, leafhopper and whitefly.

The present results on the effectiveness of pongamia oil are in agreement with the work of Kumar *et al.* (2019) in their study against cotton whitefly revealed that pongamia oil @ 1% showed 44.9 per cent reduction of population at seven days after spray. Sajay *et al.* (2020) who observed that the pongamia oil soap @ 2% was effective in reducing the maximum aphid population in cowpea.

Table 3 : Cost benefit ratio of different eco-friendly approaches against important sucking pests of tomato during *rabi* 2021-22

Tr. No.	Treatments	Yield (t/ha)	Cost of protection (Rs/ha)	Total cost of production (Rs/ha)	Gross returns (Rs/ha)	Net returns (Rs/ha)	B:C ratio
T_1	VC (2.5t/ha) + NC (2.5q/ha) followed by foliar spray of Azardirachtin 10000 ppm @ 2ml/l	34.10^{bc}	26100	306100	409200	103100	1.34
T_2	VC (2.5t/ha) + PC (2.5q/ha) followed by foliar spray of Azardirachtin 10000 ppm @ 2ml/l	34.00^{bc}	22000	302000	408000	106000	1.35
T_3	VC (2.5t/ha) + NC (1.25q/ha) + PC (1.25q/ha) followed by foliar spray of Azardirachtin 10000 ppm @ 2ml/l	35.25^{b}	24850	304850	423000	118150	1.39
T_4	VC (2.5t/ha) + NC (2.5q/ha) followed by foliar spray of Pongamia oil @ 5ml/l	31.50^{def}	24850	304850	378000	73150	1.24
T_5	VC (2.5t/ha) + PC (2.5q/ha) followed by foliar spray of Pongamia oil @ 5ml/l	32.25^{cde}	22350	302350	387000	84650	1.28
T_6	VC (2.5t/ha) + NC (1.25q/ha) + PC (1.25q/ha) followed by foliar spray of Pongamia oil @ 5ml/l	33.00^{cd}	23600	303600	396000	92400	1.30
T_7	VC (2.5t/ha) + NC (1.25q/ha) + PC (1.25q/ha)	30.00^{fg}	26000	306000	360000	54000	1.18
T_8	Foliar spray of Azardirachtin 10000 ppm @ 2ml/l + Pongamia oil @ 5ml/l	30.50^{efg}	4350	284350	366000	81650	1.29
T_9	RPP(Imidacloprid 17.8 SL @ 0.25ml/l)	38.00^{a}	1950	281950	456000	174050	1.62
T_{10}	Untreated check	27.50^{g}	-	280000	330000	50000	1.18
	SEM±	1.23	-	-	-	-	-
	CD (P=0.05)	3.65	-	-	-	-	-
	CV (%)	8.27	-	-	-	-	-

VC- Vermicompost, NC- Neem cake, PC- Pongamia cake. Tomato price- 12 Rs/kg , Cost: VC- 5 Rs/kg, NC- 40 Rs/kg, PC- 30 Rs/kg, Azadirachtin- 1000 Rs/L, Pongamia oil- 150 Rs/L

Conclusion

From the foregoing discussion it can be concluded that Among different eco-friendly approaches, VC (2.5t/ha) + NC (1.25q/ha) +PC (1.25q/ha) - Azardirachtin 10000 ppm @ 2ml/l was significantly superior in recording lowest sucking pests of tomato under field condition and witnessed the highest fruit yield of 35.25 t/ha.

References

Giraddi, R.S. and Smitha, M.S. (2004). Organic way of controlling yellow mite in chillies. *Spice India*, **17**: 51-55.

Gundannavar, K.P., Giraddi, R.S., Kulkami, K.A. and Awaknavar, J.S. (2007). Development of Integrated pest Management module for chilli pest. *Karnataka Journal of Agricultural Science*s, **20**: 757-760.

Khaire, A. C., Thakare, A. Y. and Bisen, V. M. (2017). Evaluation of yellow sticky trap with different sticky materials and azadirachtin against major sucking pest of cotton. *Environment and Ecology*, **35**: 48-53.

Kumar, R., Kranthi, S., Nagrare, V. S., Monga, D., Kranthi, K. R., Rao, N. and Singh, A. (2019). Insecticidal activity of botanical oils and other neem-based derivatives against whitefly, *Bemisia tabaci* (Gennadius) (Homoptera: Aleyrodidae) on cotton. *International Journal of Tropical Insect Science,* **39**: 203-210.

Manu, R. (2005). Role of biorationals for the management of cotton sucking pests. *M.Sc. (Agri.) Thesis,* University of Agricultural Sciences, Dharwad, Karnataka, India.

Sajay, S., Sreekumar, K. M., Varma, C. Y. and Ramesha, B. (2020). Pongamia oil soap for managing the cowpea aphid, *Aphis craccivora* koch. *Entomon*, **45**: 219-224.

Thorat, S, S,, Kumar, S. and Patel, J. D. (2020). Bio efficacy of different pesticides against whitefly (*Bemisia tabaci* Gennadius) in tomato. *Journal of Entomology and Zoology Studies*, **8**: 1428-1431.

Veena, S. K., Giraddi, R. S., Bhemmanna, M. and Kandpal, K. (2017). Effect of pongamia cake, neem cake and vermicompost on sucking insect pests of chilli. *Journal of Entomology and Zoology Studies*, **5**: 131-136.