Field performance of newer insecticides against whitefly, *Bimisia tabaci* Genn in tomato

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ABSTRACT

Investigations were conducted in four different villages in Gopalganj district of Bihar to assess the performance of newer insecticides against whitefly in tomato. The experiment consisted of seven treatments laid out in randomized block design replicated three times with plant spacing of 60 x 50 cm. All the alternate sprays of newer insecticides were found significantly superior over the farmers' practice and untreated check in minimizing the whiteflies infestation on the crop. Among the various treatments alternate spray of spiromecifen 240 SC @ 1.0 ml/l and thiomethoxam 25 WSG @ 0.25 ml/l at 15 days interval resulted in minimum number of whiteflies per plant (4.52) as compared to dimethoate 30 EC (farmers' practice) and control with 12.68 and 29.45 whiteflies per plant respectively. The number of curled leaves per plant was also minimum in spiromecifen 240 SC @ 1.0 ml/l and thiomethoxam 25 WSG @ 0.25 ml/l at 15 days interval (24.16%). The yield was recorded maximum in the same treatment (144.96 q/ha). Thus there was an increase of 53.68 q/ha of tomato crop in this treatment over control with maximum net return of Rs 58,161.00. The B-C ratio of 10.65:1 was highest in treatment alternate spray of chlorfenapyr 10 SC @ 0.25 ml/l and acetamiprid 20 SP @ 1.0 g/l water at 15 days interval.

Keywords: Insecticides; tomato; whitefly; farmers' practice; alternate spay

INTODUCTION

Whitefly, *Bemisia tabaci* Genn is an important and major constraint in the higher production of tomato as it is also a vector of virus causing leaf curl disease in tomato and other crops. Considering the heavy loss caused by this pest, a number of insecticides have been recommended for its effective control. The pest attains exponential number within a short time and needs repeated applications of insecticides for successful cultivation of tomato crop. At the same time indiscriminate use, misuse, overuse and injudicious use of insecticides lead to several adverse side effects and also disrupt the agroecosystem.

Unfortunately conventional insecticides do not effectively control this pest due to development of resistance (Perumal et al 2009) and threat to human health and non-target organisms and environment. As an alternative several eco-friendly new chemicals with novel mode of action have been introduced for targeting whitefly. In the present study some new formulations of eco-friendly insecticides were used alternatively under field conditions against whitefly and tomato leaf curl virus. Damage by this pest is caused in three ways viz the vitality of the plants is lowered through the loss of cell sap, normal photosynthesis is interfered due to the growth of a sooty mould on the honeydew excreted by the insect and by transmission of a number of viral diseases including leaf curl virus. It not only sucks the plant sap while feeding but also transmits tomato leaf curl virus (TLCV) which results in curling of leaves (Atwal and Dhaliwal 2005). A single viruliferous whitefly can transmit the disease and requires 30 minutes to acquire and transmit the virus (Nariani and Vasudeva 1963) in tomato plants.

MATERIAL and METHODS

The field experiment was conducted in the farmers' fields in Gopalganj district of Bihar during rabi 2017 on the tomato variety Pusa Gourav. The crop

was raised as per recommended package of practices designed in randomised block design with seven treatments [(T_1: Alternate spray of spiromecifen 240 SC @ 1.0 ml/l and thiomethoxam 25 WSG @ 0.25 ml/l at 15 days interval, T_2: Alternate spray of imidacloprid 17.8 SL @ 0.25 ml/l and difentheuron 50 WP @ 1.0 g/l water at 15 days interval, T_3: Alternate spray of chlorfenapyr 10 SC @ 0.25 ml/l and acetamiprid 20 SP @ 1.0 g/l water at 15 days interval, T_4: Alternate spray of nimbicidine 0.15% @ 4.0 ml/l and imidacloprid 17.8 SL @ 0.25 ml/l water at 15 days interval, T_5: Alternate spray of clothianidine 50 WDG @ 0.25 ml/l and acephate 75 SP @ 1.0 ml/l water at 15 days interval, T_6: Dimethoate 30 EC (farmers' practice), T_7: Control (untreated check) replicated thrice].

The crop was transplanted in the last week of October. Insecticide spraying was done at an interval of 15 days initiating from 30 days after transplanting the seedlings. Five plants were selected randomly from each plot and population of both nymphs and adults was counted during early morning from six leaves (2 each from upper, middle and lower part of the plant canopy) by using cylindrical cage after five and ten days of spraying as post-treatment. The incidence of TLCV was also recorded in each plot at the end of second spray and expressed as severity on leaflet and plant basis. The yield of different plots was recorded after each harvesting of the fruits and the data were analysed statistically.

RESULTS and DISCUSSION

Data given in Table 1 depict that all the alternate insecticide sprays resulted in reduced number of whiteflies as compared to control and farmers' practice. Among the various treatments T_1 (Alternate spray of spiromecifen 240 SC @ 1.0 ml/l and thiomethoxam 25 WSG @ 0.25 ml/l at 15 days interval) resulted in minimum number of whiteflies per plant (4.52) which was at par with T_3 (Alternate spray of chlorfenapyr 10 SC @ 0.25 ml/l and acetamiprid 20 SP @ 1.0 g/l water at 15 days interval), T_2 (Alternate spray of imidacloprid 17.8 SL @ 0.25 ml/l and difentheuron 50 WP @ 1.0 g/l water at 15 days interval) and T_5 (Alternate spray of clothianidine 50 WDG @ 0.25 ml/l and acephate 75 SP @ 1.0 ml/l water at 15 days interval) with 4.86, 5.47 and 5.61 whiteflies per plant respectively as compared to T_6 (Dimethoate 30 EC: farmers' practice) and T_7 (Control) with 12.68 and 29.45 whiteflies per plant respectively. Sinha et al (2007) observed that thiomethoxam followed by fibronil spray significantly controlled whitefly population. Mandal (2017) reported that chlorfenapyr (1.5 g/l) followed by acetamiprid (1.0 g/l) were the most effective against *B tabaci*.

Table 1. Field performance of novel insecticides against whitefly in tomato

Treatment	Mean number of whiteflies/ plant*	Diseases incidence (TLCV) (%)**	Yield (q/ha)	Increase in yield over control (q/ha)	Gross return (Rs/ha)	Cost of treatment (Rs/ha)	Net return (Rs/ha)	B-C ratio
T_1	4.52 (2.24)	24.16 (29.47)	144.96	53.68	64,416.00	6,255.00	58,161.00	9.30:1
T_2	5.47 (2.44)	31.23 (33.96)	134.31	43.03	51,634.00	5,987.00	45,658.00	7.63:1
T_3	4.86 (2.32)	28.37 (32.20)	138.24	46.96	56,352.00	4,836.00	51,516.00	10.65:1
T_4	6.19 (2.58)	38.42 (38.29)	127.85	36.57	43,884.00	4,320.00	39,564.00	9.16:1
T_5	5.61 (2.47)	33.27 (35.18)	131.67	40.39	48,468.00	5,015.00	43,453.00	8.66:1
T_6	12.68 (3.63)	40.51 (39.52)	108.46	17.18	20,616.00	4,750.00	15,866.00	3.34:1
T_7	29.45 (5.47)	62.94 (52.48)	91.28	-	-	-	-	-
SEm±	0.064	0.581	1.948	-	-	-	-	-
$CD_{0.05}$	0.182	1.753	5.847	-	-	-	-	-

*Figures in parentheses are square root x + 0.5 transformed values, **Figures in parentheses are arc sine transformed values, Calculations made on the basis of market price of tomato fruits @ Rs 1,200/q

T_1: Alternate spray of spiromecifen 240 SC @ 1.0 ml/l and thiomethoxam 25 WSG @ 0.25 ml/l at 15 days interval, T_2: Alternate spray of imidacloprid 17.8 SL @ 0.25 ml/l and difentheuron 50 WP @ 1.0 g/l water at 15 days interval, T_3: Alternate spray of chlorfenapyr 10 SC @ 0.25 ml/l and acetamiprid 20 SP @ 1.0 g/l water at 15 days interval, T_4: Alternate spray of nimbicidine 0.15% @ 4.0 ml/l and imidacloprid 17.8 SL @ 0.25 ml/l water at 15 days interval, T_5: Alternate spray of clothianidine 50 WDG @ 0.25 ml/l and acephate 75 SP @ 1.0 ml/l water at 15 days interval, T_6: Dimethoate 30 EC (farmers' practice), T_7: Control (untreated check)

The number of curled leaves was also minimum in the treatment T_1 (24.16%) followed by T_3 (28.37%), T_2 (31.23%) and T_5 (33.27%) the last three being at par. However the incidence in T_6 and T_7 was quite high which was 40.51 and 62.94 per cent respectively.

The present findings are in accordance with the work of Pawar et al (2016) and Mandal (2017). Similar reports were also made by Raj and Parihar (2003) who reported that imidacloprid 17.8 SL, acetamiprid 20 SP and thiomethoxam 25 WSG significantly reduced *Scirtothrips dosalis* incidence in chilli.

The yield was recorded maximum in T_1 (144.96 q/ha) followed by T_3 (138.24 q/ha) and T_2 (134.31 q/ha) the latter two being at par as compared to 108.46 and 91.38 in case of T_6 and T_7 respectively.

The findings are in conformity with those of Raj and Parihar (2003). Kumar et al (2015) found that spiromecifen + imidacloprid resulted in maximum reduction of aphids, whiteflies and jassids and thus enhanced yield.

Thus there was an increase of 53.68 q/ha of tomato crop in T_1 over control followed by 46.96 q/ha in T_3 and 43.03 q/ha in T_2 whereas this increase over control was only 17.18 q/ha in T_6. Among the various treatments T_1 resulted in maximum net return of Rs 58,161.00 with B-C ratio of 9.30:1 followed by T_3 having net return of Rs 51,516.00 and B-C ratio of 10.65:1. On the other hand net return was only Rs 15,866.00 with B-C ratio of 3.34.1 in T_6 (Farmers' practice).

CONCLUSION

The results showed that alternate spray of spiromecifen 240 SC @ 1.0 ml/l water and thiomethoxam 25 WSG @ 0.25 ml/l water at 15 days interval resulted in more effective management of whitefly population with leaf curl disease incidence and giving higher tomato fruit yield. Whereas the alternate spray of chlorfenapyr 10 SC @ 0.25 ml/l water and acetamiprid 20 SP @ 1.0 g/l water at 15 days interval recorded the maximum benefit-cost ratio.

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