J. Cotton Res. Dev. **35**(1), 117-122 (January, 2021) **ISSN No. 0972-8619**

Cotton leafhopper (*Amrasca* spp) management with new insecticides

M. LAKSHMANNA*, A. SITHA RAMA SARMA, K.V. HARIPRASAD AND K. VISWANATH

Acharya N.G. Ranga Agricultural University, Regional Agricultural Research Station, Nandyal-51802

**Email: luckygopi25@gmail.com*

ABSTRACT : A field experiment was conducted at Regional Agriculture Research Station, Nandyal, Andhra Pradesh during *kharif* 2017-2018 on vertisols to evaluate the efficacy of new insecticides against cotton leafhopper, *Amrasca* spp. under rainfed condition. The experiment was laid out in randomized block design with seven treatments including untreated check and was replicated thrice. Treatments included sulfoxaflor (75% WG) @ 1.5 ml/L, flonicamid (50% WDG) @ 0.3 g/L, monocrotophos (36% SL) @ 1.6 ml/L, thiacloprid (240 SC) @ 0.4 ml/L, dinotefuran (20% SG) @ 0.3 g/l and pymetrozine (50 % WG) @ 0.4 g/L along with untreated check. Treatments were imposed twice based on the ETL and among the treatments evaluated, monocrotophos, flonicamid and sulfoxaflor were effective in controlling the leafhoppers. The higher seed cotton yield of 1376 kg/ha was obtained with monocrotophos (36% SL) @ 1.6 ml/L which was *at par* with flonicamid (50% WDG) @ 0.3 g/L (1248 kg/ha) and sulfoxaflor (75 % WG) @ 1.5 ml/L (1235 kg/ha).

Key words: *Bt* cotton, insecticides, leafhopper, seed cotton yield

Cotton (*Gossypium hirsutum* L.) is the most important cash crop in India, Due to assured protection of bollworms in *Bt* cotton hybrids the area under *Bt* cotton is increasing day by day but at the time sucking pests has emerged as major threat for cotton growers causing heavy yield loss. Cotton crop was known to attacked by 162 species of insect pests which can be primarily divided into bollworms and sucking pests from sowing to harvesting amounting loss up to 50-60 per cent in India. Leafhopper, *Amrasca biguttula biguttula* (Ishida), aphid, *Aphis gossypii* (Glover), thrips, *Thrips tabaci* (Lind.) and whitefly, *Bemisia tabaci* (Genn.) are of major importance among sucking pests which occur at all the stages of crop growth and responsible for indirect yield losses (Ambarish *et al.*, 2017). *Bt* cotton succumb to yield loss due to the sap feeders spread throughout the growing season, right from seedling emergence to harvest, as the biotic potential of sucking pests being high, they are potential threat to *Bt* cotton. Farmers depend generally on the chemicals to protect the crop from the attack of sucking pests which are environmentally dangerous. In this view there is a scope for utilizing the newer chemistry molecules which are required in small quantity to control the insect pests and are comparatively environmental safe and economically effective for control of sucking pests in cotton ecosystem. The present study was carried out with insecticides for the management of leafhopper on *Bt* cotton duly considering the above points.

Field trial was conducted at ANGRAU Regional Agricultural Research Station, Nandyal, Kurnool district during *kharif* 2017-2018. The experiment was laid in randomised block design in three replications and 7 treatments including untreated check with a view to evaluate the efficacy of insecticides against major sucking pests, especially leafhopper *i.e.*, *Amrasca* spp. on *Bt* transgenic cotton (RCH 2 *Bt* BG II). The insecticides, sulfoxaflor (75% WG) @ 1.5 ml/L, flonicamid (50% WDG) @ 0.3 g/L, monocrotophos (36% SL) @ 1.6 ml/L, thiacloprid (240 SC) @ 0.4 ml/L, dinotefuran (20% SG) @ 0.3 g/l and pymetrozine (50 % WG) @ 0.4 g/L were tested along with untreated check against major sucking pests in cotton. The treatments were imposed for two times after the leafhoppers crossed economic threshold level. For collection

of data, five plants were selected at random and were tagged and on each plant three leave each from the top, middle and bottom leaves on the pest population a day before and at 3, 5, 7 and 9 days after treatment imposition duly following the approved standard protocols. Finally, seed cotton yield was recorded in each of the net plots, so as to compare the effect of different treatments. The data was suitably transformed and statistically analyzed.

First spray : A day before the treatment imposition, there was no significant difference between the treatments with respect to leafhopper population. At 3 day after first spray, the lower leafhopper population was recorded in monocrotophos (36% SL) @ 1.6 ml/l which recorded 2.87 leafhoppers/3 leaves which was *on par* with flonicamid (50% WDG) @ 0.3 g/L, sulfoxaflor (75 % WG) @ 1.5 ml/L, pymetrozine (50 % WG) @ 0.4 g/L and dinotefuran (20% SG) @ 0.3 g/Lwhich recorded 2.93, 3.00, 3.67 and 4.07 leafhoppers/3 leaves, respectively. Thiacloprid (240 SC) @ 0.4 ml/L followed the monocrotophos by recording 5.20 leafhoppers/ 3 leaves and was *at par* with untreated check which recorded 6.27 leafhoppers/3 leaves (Table1). The highest reduction of leafhoppers (54.28%) was recorded in monocrotophos (36% SL) @ 1.6 ml/L followed by flonicamid (50% WDG) @ 0.3 g/L and sulfoxaflor (75% WG) @ 1.5 ml/L which gave 53.22 and 52.15 per cent reduction of leafhoppers over untreated check, respectively at 3 DAS. Pymetrozine (50% WG) @ 0.4 g/L and dinotefuran (20% SG) @ 0.3 g/L gave 41.52 and 35.14 per cent reduction of leafhoppers over untreated check, respectively. However, the lowest per cent reduction of leafhoppers (17.07%) over untreated check at 3 DAS was recorded in thiacloprid (240 SC) @ 0.4 ml/L.

At 5 days after spraying (5DAS), monocrotophos (36% SL) @ 1.6 ml/L emerged as best treatment by recording the lowest leafhopper population of 3.13 leafhoppers/3 leaves and was *on par* with flonicamid (50% WDG) @ 0.3 g/L, sulfoxaflor (75% WG) @ 1.5 ml/L and pymetrozine (50% WG) @ 0.4 g/L which recorded 3.47, 3.60 and 4.27 leafhoppers/3 leaves, respectively. Dinotefuran (20% SG) @ 0.3 g/L followed the best treatment by recording 5 leafhoppers/3 leaves and was *on par* with thiacloprid (240 SC) @ 0.4 ml/L and untreated check which recorded 5.33 and 6.40 leafhoppers/3 leaves, respectively at 5DAS. Monocrotophos (36% SL) @ 1.6 ml/L continued to show its efficacy even after 5 days after spraying by giving 51.04 per cent reduction of leafhoppers over untreated check. Flonicamid (50% WDG) @ 0.3 g/L, sulfoxaflor (75% WG) @ 1.5 ml/L and pymetrozine (50% WG) @ 0.4 g/L followed monocrotophos (36% SL) @ 1.6 ml/L by registering 45.83, 43.75 and 33.33 per cent reduction of leafhoppers over untreated check, respectively. However, the lowest per cent reduction (16.67%) was registered with thiacloprid (240 SC) @ 0.4 ml/l at 5 DAS.

The treatments differ significantly from each other with respect to leafhoppers population at seven days after spraying (7DAS) and the leafhoppers population ranged from 3.20 to 6.67 leafhoppers/3 leaves. The lowest leafhopper population of 3.20 leafhoppers/3 leaves was recorded in monocrotophos (36% SL) @ 1.6 ml/L which was *on par* with flonicamid (50% WDG) @ 0.3 g/L, sulfoxaflor (75 % WG) @ 1.5 ml/L and pymetrozine (50 % WG) @ 0.4 g/L which recorded 3.53, 4.13, and 4.47 leafhoppers/3 leaves, respectively. Thiacloprid (240 SC) @ 0.4 ml/L followed the best treatment by recording 5.27 leafhoppers/3 leaves and was *on par* with dinotefuran (20% SG) @ 0.3 g/L and untreated check which recorded and 5.73 and 6.67 leafhoppers/3 leaves, respectively at 7 DAS. The highest reduction of leafhoppers (52.00%) was recorded in monocrotophos (36% SL) @ 1.6 ml/L followed by flonicamid (50% WDG) @ 0.3 g/L and sulfoxaflor (75 % WG) @ 1.5 ml/L which gave 47 and 38 per cent reduction of leafhoppers

Table 1. Efficacy of different chemicals on leafhoppers of cotton (first spray)

Treatments	Dose(g or ml L^{-1})	1 DBS	3 DAS	ROC (%)	5DAS	ROC (%)	7 DAS	ROC (%)	9 DAS	ROC (%)	Mean	Mean ROC (%)
Sulfoxaflor (75% WG)	1.5	6.40(2.60)	3.00(1.87)	52.15	3.60(2.01)	43.75	4.13(2.14)	38.00	4.73(2.29)	45.38	3.86	44.82
Flonicamid (50% WDG)	0.3	8.07(2.86)	2.93(1.85)	53.22	3.47(1.97)	45.83	3.53(2.01)	47.00	3.07(1.89)	64.62	3.25	52.67
Monocrotophos (36% SL)	1.6	10.13(3.26)	2.87(1.83)	54.28	3.13(1.89)	51.04	3.20(1.91)	52.00	4.67(2.25)	46.15	3.47	50.87
Thiacloprid (240 SC)	0.4	7.40(2.75)	5.20(2.36)	17.07	5.33(2.41)	16.67	5.27(2.40)	21.00	5.87(2.51)	32.31	5.42	21.76
Dinotefuran (20% SG)	0.3	12.93(3.63)	4.07(2.13)	35.14	5.00(2.34)	21.88	5.73(2.49)	14.00	5.60(2.46)	35.38	5.10	26.66
Pymetrozine (50% WG)	0.4	11.80(3.49)	3.67(2.03)	41.52	4.27(2.16)	33.33	4.47(2.22)	33.00	4.67(2.26)	46.15	4.27	38.58
Untreated check		8.80(3.03)	6.27(2.59)	0.00	6.40(2.63)	0.00	6.67(2.66)	0.00	8.67(3.20)	0.00	7.00	0.00
F-Test		NS	S		S		S		S			
SEm		0.32	0.14		0.13		0.14		0.19			
CD(p = 0.05)		NS	0.43		0.40		0.44		0.59			
CV(%)		18.21	11.64		10.13		10.89		13.99			

***Figures in parentheses are Square root (x+0.5) transformed values DBS: Day before spray; DAS: Days after spray**

Table 2. Efficacy of different chemicals on leafhoppers (second spray) and yield of cotton

Treatment name	Dose (g or ml L^{-1})	1 DBS	3 DAS	ROC (%)	5DAS	ROC (%)	7 DAS	ROC (%)	9 DAS	ROC (%)	Mean	Mean ROC (%)	Yield (Kg ha^{-1})
Sulfoxaflor (75% WG)	1.5	6.47(2.64)	1.87(1.53)	72.82	2.27(1.64)	67.62	2.73(1.78)	62.73	3.07(1.88)	61.67	2.49	66.21	1253
Flonicamid (50% WDG)	0.3	7.00(2.73)	1.67(1.46)	75.73	1.87(1.52)	73.33	2.27(1.65)	69.09	2.13(1.59)	73.33	1.99	72.87	1248
Monocrotophos (36% SL)	1.6	6.53(2.65)	1.40(1.36)	79.61	1.60(1.44)	77.14	1.73(1.49)	76.36	2.07(1.59)	74.17	1.70	76.82	1376
Thiacloprid (240 SC)	0.4	8.67(2.98)	5.33(2.41)	22.33	5.53(2.44)	20.95	5.87(2.51)	20.00	7.47(2.80)	6.67	6.05	17.49	997
Dinotefuran (20% SG)	0.3	6.73(2.65)	4.73(2.28)	31.07	5.33(2.40)	23.81	4.40(2.20)	40.00	3.20(1.92)	60.00	4.42	38.72	1010
Pymetrozine (50% WG)	0.4	12.87(3.65)	2.47(1.72)	64.08	2.87(1.82)	59.05	3.33(1.95)	54.55	5.87(2.52)	26.67	3.64	51.09	1054
Untreated check		8.93(3.06)	6.87(2.71)	0.00	7.00(2.74)	0.00	7.33(2.80)	0.00	8.00(2.91)	0.00	7.30	0.00	878
F-Test		NS	S		S		S		S				
SEm		0.23	0.13		0.17		0.16		0.16				
CD(p = 0.05)		NS	0.40		0.51		0.49		0.49				
CV(%)		13.98	11.60		14.36		13.48		12.79				

***Figures in parentheses are Square root (x+0.5) transformed values DBS: Day before spray; DAS: Days after spray**

over untreated check, respectively at 7 DAS. Pymetrozine (50% WG) @ 0.4 g/L and thiacloprid (240 SC) @ 0.4 ml/L gave 33 and 21 per cent reduction of leafhoppers over untreated check, respectively. However, the lowest per cent reduction of leafhoppers (14 %) over untreated check was recorded in dinotefuran (20% SG) @ 0.3 g/L at 7 DAS.

Flonicamid (50% WDG) @ 0.3 g/L emerged as best treatment by recording the lowest leafhopper population of 3.07 leafhoppers/3 leaves at 9 days after spraying (9DAS) and was *on par* with monocrotophos (36% SL) @ 1.6 ml/L, pymetrozine (50% WG) @ 0.4 g/L, sulfoxaflor (75% WG) @ 1.5 ml/L and dinotefuran (20% SG) @ 0.3 g/L which recorded 4.67, 4.67, 4.73 and 5.60 leafhoppers/3 leaves, respectively. Thiacloprid (240 SC) @ 0.4 ml/L followed the best treatment by recording 5.87 leafhoppers/3 leaves. However, the highest leafhopper population of 8.67 leafhoppers/3 leaves was recorded in untreated check. Flonicamid (50% WDG) @ 0.3 g/L continued its efficacy even after 9 days by reducing leafhopper population by 64.62 per cent over untreated check. Monocrotophos (36% SL) @ 1.6 ml/L, pymetrozine (50 % WG) @ 0.4 g/L, sulfoxaflor (75 % WG) @ 1.5 ml and dinotefuran (20% SG) @ 0.3 g/L registered 46.15, 46.15, 45.38 and 35.38 per cent reduction of leafhoppers over untreated check, respectively. However, the lowest per cent reduction (32.31%) was registered with thiacloprid (240 SC) @ 0.4 ml/L at 9 DAS.

After all the days of observations the lowest mean leafhopper population of 3.25 leafhoppers/ 3 leaves was observed in flonicamid 50% WDG @ 0.3 g/L followed by monocrotophos 36% SL @ 1.6 ml/L, sulfoxaflor 75% WG @ 1.5 ml/L, pymetrozine 50% WG @ 0.4 g/L, dinotefuran 20% SG @ 0.3 g/L and thiacloprid 240 SC @ 0.4 ml/L which recorded 3.47, 3.86, 4.27, 5.10 and 5.42 leafhoppers/3 leaves, respectively. The highest mean leafhopper population of 7 leafhoppers/3 leaves was recorded in untreated check.

The highest mean reduction of leafhoppers (52.67%) was recorded in flonicamid (50% WDG) @ 0.3 g/L over untreated check at after all the days of observations. Monocrotophos (36% SL) @ 1.6 ml/L, sulfoxaflor (75% WG) @ 1.5 ml/L, pymetrozine (50% WG) @ 0.4 g/L, dinotefuran (20% SG) @ 0.3 g/L which recorded 50.87, 44.82, 38.58 and 26.60 per cent mean reduction of leafhoppers over untreated check, respectively. However, lowest mean per cent reduction of leafhoppers (21.76%) was observed in thiacloprid (240 SC) @ 0.4 ml/L.

Second spray : At a day before the treatment imposition, there was no significant difference between the treatments with respect to leafhopper population and the leafhopper population ranged from 6.47 to 12.87 leafhoppers/3 leaves (Table 2). A significant difference was observed between the treatments at three days after spraying (3DAS) with respect to leafhoppers population and the leafhoppers population ranged from 1.40 to 6.87 leafhoppers/3 leaves. The lowest leafhopper population of 1.40 leafhoppers/3 leaves was recorded in monocrotophos (36% SL) @ 1.6 ml/L which was *on par* with flonicamid (50% WDG) @ 0.3 g/L, sulfoxaflor (75% WG) @ 1.5 ml/L and pymetrozine (50% WG) @ 0.4 g/L which recorded 1.67, 1.87 and 2.47 leafhoppers/3 leaves, respectively. Dinotefuran (20% SG) @ 0.3 g/L followed the best treatment by recording 4.73 leafhoppers/3 leaves and was *on par* with thiacloprid (240 SC) @ 0.4 ml/l which recorded 5.33 leafhoppers/ 3 leaves whereas untreated check recorded the highest population of 6.87 leafhoppers/ 3 leaves.

The highest reduction of leafhoppers (79.61%) was recorded in monocrotophos (36% SL) @ 1.6 ml/L followed by flonicamid (50% WDG) @ 0.3 g/L and sulfoxaflor (75% WG) @ 1.5 ml/L which gave 75.73 and 72.82 per cent reduction of leafhoppers over untreated check, respectively at 3 DAS. Pymetrozine (50% WG) @ 0.4 g/L and

dinotefuran (20% SG) @ 0.3 g/L gave 64.08 and 31.07 per cent reduction of leafhoppers over untreated check, respectively. However, the lowest per cent reduction of leafhoppers (22.33%) over untreated check was recorded in thiacloprid (240 SC) @ 0.4 ml/L at 3 days after spraying.

The same trend has been observed at 5DAS as that at 3 DAS. At seven days after spraying (7 DAS) and the leafhoppers population ranged from 1.73 to 7.33 leafhoppers/3 leaves. The lowest leafhopper population of 1.73 leafhoppers/3 leaves was recorded in monocrotophos (36% SL) @ 1.6 ml/L which was *on par* with flonicamid (50% WDG) @ 0.3 g/L, sulfoxaflor (75 % WG) @ 1.5 ml/L and pymetrozine (50 % WG) @ 0.4 g/L which recorded 2.27, 2.73 and 3.33 leafhoppers/3 leaves, respectively. Dinotefuran (20% SG) @ 0.3 g/L followed the best treatment by recording 4.40 leafhoppers/3 leaves and was *on par* with thiacloprid (240 SC) @ 0.4 ml/L which recorded 5.87 leafhoppers/3 leaves. However, highest leafhopper population 7.33 leafhoppers/3 leaves recorded in untreated check. The highest reduction of leafhoppers (76.36%) was recorded in monocrotophos (36% SL) @ 1.6 ml/L followed by flonicamid (50% WDG) @ 0.3 g/L, sulfoxaflor (75 % WG) @ 1.5 ml/L and pymetrozine (50% WG) @ 0.4 g/L which gave 69.09, 62.73and 54.55 per cent reduction of leafhoppers over untreated check, respectively. Dinotefuran (20% SG) @ (0.3 g/L gave 40.00 per cent reduction of leafhoppers over untreated check. However, the lowest per cent reduction of leafhoppers (20%) over untreated check was recorded in thiacloprid (240 SC) @ 0.4 ml/L. Almost the treatments followed the same trend during 9th day after spray as was observed at 7th day after spray.

Efficacy different treatments on seed cotton yield : Monocrotophos (36% SL) @ 1.6 ml/L recorded highest yield (1376 kg ha^{-1}) which was *on par* with flonicamid (50% WDG) @ 0.3 g/L and sulfoxaflor (75% WG) @ 1.5 ml/L which recorded 1248 and 1235 kg/ha, respectively. Pymetrozine (50% WG) @ 0.4 g/L followed the best treatment by recording 1054 kg/ha and was *on par* with dinotefuran (20% SG) @ 0.3 g/L, and thiacloprid (240 SC) @ 0.4 ml/L which recorded 1010 and 997 kg/ha of yield, respectively.

Mohan and Katiyar (2000) reported monocrotophos was effective against leafhopper which is in agreement with the present results obtained. Similar findings were also reported by Asi *et al.,* (2008) and Sarwar and Sattar (2016) wherein monocrotophos was reported as very effective chemical against sucking pests especially leafhopper. The efficacy of flonicamid as reported by Gaurkhede *et al.*, (2015), Sarma *et al.*, (2016) and Sarma *et al.*, (2016) are in accordance with the results obtained during present investigation.

The efficacy of sulfoxaflor is comparable with that of monocrotophos in the present findings which are in line with the reports of Ambarish *et al.*, (2017) who reported that sulfoxaflor alone and combination with spinetoram was effective in leafhopper management in cotton.

CONCLUSION

Based on the above experimentation, it can be concluded that the insecticides monocrotophos, flonicamid and sulfoxaflor were effective in controlling the leafhopper *Amrasca* spp. in *Bt* cotton.

Acknowledgement : The authors are grateful to Regional Agricultural Research Station, Nandyal (ANGRAU), Andhra Pradesh for providing the facilities for smooth conduct of the experiment.

LITERATURE CITED

Ambarish, S., Kumar, S.C., Somu, G and Navi, S. 2017. Studies on the bioefficacy of new insecticide molecules against insect pests in cotton. *J. Ent. Zool. Stu.* **5**: 544-48.

Asi, M.R., Afzal, M., Anwar, S.A and Bashir, M.H. 2008. Comparative efficacy of insecticides against sucking insect pests of cotton. *Pakistan J. Life Soc. Sci.* **6**: 140-42.

Gaurkhede, A.S., Bhalkare, S.K., Sadawarte A.K and Undirwade, D.B. 2015. Bioefficacy of new chemistry molecules against sucking pests of *Bt* transgenic cotton. *Internat. J. Plant Prot.* **8**: 7-12.

Mohan, M and Katiyar, K.N. 2000. Impact of different insecticides used for bollworm control on the population of jassid and whitefly in cotton. *Pesticide Res.* **12**: 99-102.

Sarma, A.S.R., Basha, S.J., Reddy, Y.R and Reddy, B.G. 2016. Efficacy of new insecticides and biocontrol agents in *Bt* cotton against leafhopper, *Amrasca* spp. *Prog. Res.* **11**: 5732-35.

Sarma, A.S.R., Basha, S.J., Reddy, Y.R and Reddy, B.G. 2016. Efficacy of new insecticides against leafhopper, *Amrasca* spp. In *Bt* cotton. *Adv. life sci.* **5**: 9671-74.

Sarwar, M and Sattar, M. 2016. An analysis of comparative efficacies of various insecticides on the densities of important insect pests and the natural enemies of cotton, *Gossypium hirsutum* L. *Pakistan J. Zool.* **48**: 131-36.

Received for publication : April 4, 2020
Accepted for publication : July 17, 2020