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Incidence and Management of Cotton Leafhopper *Amrasca devastans* Dist. Under High Density Planting System (HDPS) Under Rainfed Conditions

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ABSTRACT

The studies on "Incidence and Management of Cotton Leafhopper, *Amrasca devastans* Dist. Under High Density Planting System (HDPS) Under Rainfed Conditions" was conducted at RARS, Lam, Guntur during *kharif,* 2016-17 to observe the incidence of leafhopper under high density planting system (HDPS) and to know the efficacy of insecticides against cotton leafhopper in normal and under HDPS. The population of leafhopper was crossed ETL at 45 and 75 DAS (6.25 and 6.25 per three leaves) in HDPS, while in normal spacing, pest population did not crossed ETL. Among the tested insecticides flonicamid 50% WP @ 0.3g.L^{-1} was found effective in reducing leafhopper population in normal spacing as well as high density planting system.

Key words: *Leafhopper, normal spacing and HDPS*

Cotton (*Gossypium* spp.) popularly known as "White Gold" is a major commercial crop unanimously designated as "King of Fibres" and has a global significance, which is grown for its lint and seed. Cotton is a chief fibre crop of India and contributes significantly to Indian agriculture and Indian economy, the major limiting factor in cotton production is damage due to insect pests [Bennett *et al*. (2004)]. Among the insect pest complex of Bt cotton, the cotton leafhopper, *Amrasca devastans* (Dist.) (Homoptera : Cicadellidae) is an alarming pest causing both quantitative and qualitative losses. After the introduction of Bt cotton, there was a check to the bollworm complex. But, the sucking pest population especially leafhoppers increased gradually reaching economic injury level in many parts of India [Mohan and Nandini (2011)]. Cotton leafhopper is the most important cotton pest and accounts for 11.6 per cent reduction in seed cotton yield in India [Dhawan *et al*. (1988)]. Though, it is an early season pest, it occurs throughout the season serving as one of the major limiting factor for attaining higher crop productivity.

In many countries narrow row planting have been adopted after recording improvement in cotton productivity (Ali *et al.*, 2005). The adoption of HDP along with better genotype with boll worm control is one of option under rainfed situation of Vidharbha and control sucking pests in initial stage of crop is needed (Kalyan *et al*., 2009).

Though the area under cotton is high the research on HDPS in Andhra Pradesh is very scanty. Hence, the present study on "Incidence and Management of Cotton Leafhopper under High Density Planting System (HDPS) Under Rainfed Condition" was undertaken.

MATERIAL AND METHODS

Field trial was conducted during *kharif,* 2016-17, at Regional Agricultural Research Station, Lam, Guntur. The experiment on incidence of leafhopper in cotton under HDPS was laid out in two bulk plots (500 m^2) under normal (15873 plants per ha^{-1}) and high density planting system (133333 plants per ha^{-1}) and the variety used was NDLH-1938, a *Gossypium hirsutum* variety. The population of leafhoppers was recorded per three leaves *i.e* each one from top, middle and bottom canopies of the plant from 20 plants from each bulk plot at 15 days interval starting from three weeks after sowing by random selection.

The field trail on management of the leafhoppers was laid in split plot design with two main plots (to compare efficacy of insecticides in both spacings) *i.e* one with normal spacing (105×60cm) another with HDPS (75×10 cm). Each main plot carries eight sub plots (insecticidal treatments) which replicated thrice with the plot size of 6×5m. The insecticidal treatments include flonicamid 50% WG @ 0.3 $g.L^{-1}$, diafenthiuron 50% WP @ 1.25 $g.L^{-1}$, acephate 75% SP @ 1.5 $g.L^{-1}$, monocrotophos 36% SL @ 1.6 $ml.L^{-1}$, fipronil 5% SC @ 2 $ml.L^{-1}$, buprofezin 25% SC @ 2 $ml.L^{-1}$, imidacloprid 17.8% SL @ 0.4 $ml.L^{-1}$ and control. All treatments were applied at 15 days interval, of which the first spray was initiated when leafhopper population crossed the ETL. The data on leafhoppers population was recorded on three leaves per plant *i.e* top, middle and bottom portion of the plant on five randomly selected and tagged plants per treatment. The data was collected at one day before spraying and 3rd and 7 th day after spray.

The percentage reduction of the pest population over untreated control for each treatment was calculated by using Abbott's formula as given by Flemming and Ratnakaran (1985).

RESULTS AND DISCUSSION

1. Incidence of leafhoppers under high density planting system.

The leafhopper population was observed throughout the cropping season and the incidence was moderate to high up to 120 DAS, thereafter it was declined and reached to a minimum number of 0.45 nos per three leaves at 135 DAS in normal spacing and 0.6 nos per three leaves in HDPS (Table 1.1).

The incidence of leafhopper population was ranged from 0.45 to 5.70 /3 leaves and never crossed ETL in normal spacing. While in HDPS, the population ranged from 0.6 to 6.25/3 leaves and crossed ETL twice at 45 DAS and again at 75 DAS (6.25 and 6.25 per three leaves).

Though the leafhopper incidence was high in HDPS compared to normal spacing there is no significant difference between two spacings. The present findings indicates that plant spacing did not show much difference on leafhopper population between normal and HDPS. The present results are in agreement with Arif *et al.* (2006) who reported that the population of leafhopper did not show significant difference when plant to plant spacing was maintained at 18.5, 23.5, 30 cm with the row to row spacing of 75 cm.

$$\text{Percentage population Reduction} = 1 - \frac{\text{Post treatment population in the treatment}}{\text{Pre treatment population in the treatment}} \times \frac{\text{Pre treatment population in the untreated check}}{\text{Post treatment population in the untreated check}} \times 100$$

Table:1.1 Incidence of leafhoppers at two different spacings in cotton.

DAS	Leafhopper				
	Normal	HDPS		t-test	
45	5.70 (2.38)	6.25 (2.50)		NS	
60	2.35 (1.53)	3.05 (1.74)		NS	
75	4.3 (2.07)	6.25 (2.50)		NS	
90	3.15 (1.77)	4.3 (2.07)		NS	
105	2.8 (1.67)	3.05 (1.74)		NS	
120	3.2 (1.78)	2.15 (1.46)		Sig	
135	0.45 (0.67)	0.6 (0.77)		NS	
150	0.7 (0.83)	0.9 (0.94)		NS	
Mean±SE	2.83±0.61	3.31±0.76	Df = 38	t-cal.value	-0.49

NS: Non significant Sig: Significnt

A total of three sprays were given and pooled data was analysed and presented hereunder.

2.3 Cumulative efficacy of three sprays against Leafhoppers (*A. devastans*).

The mean data of three sprays before application of insecticides against leafhopper population ranged from 5.33 to 6.53 per three leaves in normal and 5.67 to 7.80 leafhoppers per three leaves in high density planting system. In insecticidal treatments against leafhopper the population varied significantly at all the post-treatment counts of normal and HDPS (Table 1.2).

In case of normal spacing at 3 DAT the maximum reduction of the pest over control was recorded with flonicamid 50% WG (97.57 per cent) and it was statistically superior over all the other treatments. The next treatments were diafenthiuron 50% WP, fipronil 5% SC and monocrotophos 36% SL with more than 80 per cent reduction of leafhopper population over control and were statistically on par with one another. The population reduction of the pest was 72.97 and 68.55 per cent from buprofezin 25% SC and imidacloprid 17.8% SL respectively and are statistically on par with each other. The population reduction of leafhopper was 77.19% with acephate 75% SP @ 1.5 $g.L^{-1}$ which was found better over buprofezin 25% SC and imidacloprid 17.8% SL.

At 3 DAT, the maximum reduction of leafhopper over control was 96.79 per cent which was observed in flonicamid 50% WG treated plot and statistically superior from rest of the treatments in HDPS, followed by diafenthiuron 50% WP and fipronil 5% SC which recorded 90.69 and 83.34 per cent reduction over control respectively. The population reduction of 70.65 and 65.21 per cent was observed in buprofezin 25% SC and imidacloprid 17.8% SL treated plots respectively which are statistically on par with one another. The population reduction of leafhopper was 73.67% with acephate 75% SP @ 1.5$g.L^{-1}$ which was found better over buprofezin 25% SC and imidacloprid 17.8% SL.

In case of normal spacing at 7 DAT, flonicamid 50% WG was found to be highly effective in reducing leafhopper population over control with 97.34 per cent reduction and statistically superior than all the other treatments. Diafenthiuron 50% WP, fipronil 5% SC and monocrotophos 36% SL were found to be next effective treatments with 83.74, 79.94 and 77.49 per cent reduction over control, respectively and statistically on par with one another. Lowest reduction of pest was observed in buprofezin 25% SC and imidacloprid 17.8% SL (70.56 and 67.47 per cent) respectively and statistically on par with one another.

At 7 DAT, among the treatments, significantly highest reduction of leafhopper population over control was observed in plots treated with flonicamid 50% WG (92.17%) and diafenthiuron 50% WP (87.05) and on par with one another in HDPS. However, leafhopper population was statistically on par with one another in fipronil 5% SC, monocrotophos 36% SL, acephate 75% SP, buprofezin 25% SC and imidacloprid 17.8% SL treated plots (84.95, 78.58, 73.63, 66.90 and 64.97 leafhoppers per three leaves respectively).

RESULTS AND DISCUSSION

Among the tested insecticides, flonicamid 50% WG @ 0.3$g.L^{-1}$ was found effective against leafhoppers both under normal and HDPS.

The results are in conformity with the findings of Kalyan *et al.* (2017) who reported that per cent reduction of leafhopper population was found higher with flonicamid @ 75 g a.i. ha^{-1}. Fipronil 5% SC also found very effective and it is at par with treatment diafenthiuron 50% WP. Present findings shows that flonicamid 50% WG which is effective against leafhopper, followed by diafenthiuron 50%WP and fipronil 5% SC were on par with one another. The results derive support from findings of Chandi *et al.* (2016) who found that flonicamid @ 100 g a.i. ha-1 gave higher reduction of leafhopper population. Misra (2009) evaluated four insecticides, *Viz.,* flonicamid 50% WG, imidacloprid 17.8 SL, thiamethoxam 25% WG and clothianidin 50 WDG against brown planthopper, *Nilaparvata lugens* (Stal.) and showed that low BPH population (1.40-1.30/hill) was observed with flonicamid 50% WG @ 150 g a.i.ha^{-1} with a population reduction of 90.30% over untreated control.

The present findings are also in conformity with the findings of CICR annual report (2012 - 13), where flonicamid (50% WG @ 50 g a.i .ha^{-1}) and acephate (75% SP @ 562.5g a.i .ha^{-1}) were reported as highly effective in reducing the leafhopper population in high density planting system. Our present results proved that flonicamid 50% WG @ 0.3$g.L^{-1}$ was effective against leafhoppers in cotton but there was no significant

Table: 1.2 Cumulative efficacy of three sprays against leafhopper under HDPS.

Insecticidal Treatment	Pre-treatment count		Population no/3leaves/plant*				Percent population reduction over control**			
			3DAT		7DAT		3DAT		7DAT	
	M1	M2	M1	M2	M1	M2	M1	M2	M1	M2
Flonicamid 50% WG @ 0.3g/L	5.80	6.20	0.20	0.29	0.22	0.82	97.57	96.79	97.34	92.17
	(2.41)	(2.49)	(0.45)	(0.54)	(0.47)	(0.90)	(80.99)^{a}	(79.65)^{a}	(80.58)^{a}	(73.72)^{a}
Diafenthiuron 50% WP @ 1.25G/L	6.27	7.00	0.91	0.93	1.20	1.42	88.85	90.69	83.74	87.05
	(2.50)	(2.65)	(0.95)	(0.97)	(1.10)	(1.19)	(70.46)^{b}	(72.20)^{b}	(66.19)^{b}	(68.87)^{ab}
Acephate 75% SP @ 1.5G/L	5.40	6.33	1.80	2.73	2.04	2.89	77.19	73.67	73.55	73.63
	(2.32)	(2.52)	(1.34)	(1.65)	(1.43)	(1.69)	(61.44)^{cd}	(59.10)^{de}	(59.03)^{cde}	(59.07)^{de}
Monocrotophos 36% SL @ 1.6ml/L	5.93	5.67	1.33	2.47	1.76	2.31	83.13	76.74	77.49	78.58
	(2.44)	(2.38)	(1.15)	(1.57)	(1.32)	(1.52)	(65.72)^{bc}	(61.13)^{cd}	(61.65)^{bcd}	(62.40)^{cd}
Fipronil 5% SC @ 2ml/L	5.40	6.07	1.07	1.89	1.53	1.67	86.47	83.34	79.94	84.95
	(2.32)	(2.46)	(1.03)	(1.37)	(1.24)	(1.29)	(68.39)^{b}	(65.88)^{c}	(63.37)^{bc}	(67.14)^{bc}
Buprofezin 25% SC @ 2ml/L	6.53	6.53	2.16	3.04	2.33	3.73	72.97	70.65	70.56	66.90
	(2.56)	(2.56)	(1.47)	(1.74)	(1.53)	(1.93)	(58.65)^{d}	(57.17)^{de}	(57.12)^{de}	(54.85)^{ef}
Imidacloprid 17.8% SL @ 0.4ml/L	5.33	6.33	2.42	3.62	2.60	3.80	68.55	65.21	67.47	64.97
	(2.31)	(2.52)	(1.56)	(1.90)	(1.61)	(1.94)	(55.86)^{d}	(53.83)^{e}	(55.20)^{e}	(53.68)^{f}
Untreated Control	6.27	7.80	8.18	9.49	8.33	10.78	-	-	-	-
	(2.50)	(2.79)	(2.86)	(3.08)	(2.89)	(3.28)				

	F test	SEM	CD	CV	F test	SEM	CD	CV	F test	SEM	CD	CV	F test	SEM	CD	CV	F test	SEM	CD	CV
Main plot	Sig	0.25	0.09	2.99	NS	0.40	NS	28.80	NS	0.55	NS	2.16	NS	1.95	NS	11.96	NS	1.29	NS	4.72
Sub plot	NS	0.13	NS	6.42	Sig	1.02	0.35	21.15	Sig	1.00	0.30	16.90	Sig	11.87	6.28	7.98	Sig	11.06	5.04	6.60
Interaction	NS	0.07	NS		NS	0.07	NS		NS	0.08	NS		NS	1.08	NS		NS	1.90	NS	

*Figures in parentheses are square root transformed values.
**Figures in parentheses are angular transformed values.
Numbers followed by same superscript are not statistically different.
M1:Normal spacing (105×60cm)
M2:High density planting (75×10cm)

Sig : Significant.
NS : Non significant.
DAT : Days After Treatment.

differences regarding bio-efficacy of insecticides under normal system and HDPS.

CONCLUSION

Though the leafhopper incidence was high in HDPS compared to normal spacing there is no significant difference between two spacings. Bio-efficacy of all insecticides against leafhopper population was similar in both normal as well as HDPS. Our results suggest that flonicamid 50% WG found to be effective against leafhopper population in both the spacings.

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