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Efficacy of Certain Newer Insecticides Against Whitefly, (*Bemisia tabaci* Gennadius) in blackgram (*Vigna mungo* Linnaeus)

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ABSTRACT

A field experiment was conducted to evaluate the efficacy of some newer insecticides against sucking insect pests in blackgram during *rabi* 2013-'14 at Agricultural College Farm, Bapatla, Andhra Pradesh. Among all the insecticides tested, seed treatment with imidacloprid 600 FS along with foliar spray of spirotetramat 150 OD was found to be more efficacious against whiteflies followed by seed treatment of imidacloprid 600 FS along with foliar spray of spiromesifen 240 SC. Seed treatment alone either with imidacloprid 600 FS or with thiamethoxam 70 WS plots were effective against sucking insect pests but their effectiveness lasted upto 25 days of sowing only as thereafter their population was found increased. Yellow mosaic virus (YMV) disease incidence was less in combination treatment of spirotetramat 150 OD followed by combination treatment of spiromesifen 240 SC and the seed yield obtained was also maximum (1096 $kg.ha^{-1}$) from spirotetramat 150 OD combination followed by spiromesifen 240 SC (996 $kg.ha^{-1}$). With regard to the incremental cost benefit ratio, spirotetramat combination recorded the highest cost benefit ratio of 8.69 followed by triazophos combination (7.89).

Key words : Blackgram, Foliar application, Seed treatment, Spiromesifen, Spirotetramat, Whiteflies.

Blackgram (*Vigna mungo* L.) is a short duration, highly remunerative crop grown traditionally as a *kharif* (wet season) crop in most parts of the country, but in Andhra Pradesh it is being cultivated mostly as r*abi* (dry) crop both in uplands and rice fallows. Of late the crop is being ravaged by many sucking insect pests. Among the various insect pests whitefly was the most serious pest. Due to its rapid movement from one plant to another, high reproductive potential and cryptic living habitat (undersides of leaves in colonies) and its vector role in YMV transmission caused the pest to become very difficult for the management. Insect pests, are being generally managed by the use of insecticides, but as vectors, it is utmost important to avoid the incidence whiteflies from the beginning of the crop growth itself. The economic threshold level of many sucking insect pests with respect to viral disease transmission is far below the numbers (equivalent to one) than that suggested for their direct damage. In the light of this fact, seed treatment should be adopted to protect the crop right from the date of sowing and to keep on protecting the crop through the germination and early establishment stages. Hence, it is necessary to evaluate the efficacy of different newer molecules as seed dressers for effective control of them. But seed treatment is effective only upto 20-30 DAS, hence foliar application of insecticides seems to be the only follow-up remedy at later stages of crop growth. Keeping all this in view, the present study was aimed to evaluate the efficacy of different new molecules against whiteflies in blackgram.

MATERIAL AND METHODS

Present investigation was carried out at Agricultural College Farm, Bapatla, Guntur district, A.P. during 2013-14 *rabi* season on blackgram var. LBG-623. The experiment was laid out in RBD with twelve treatments including untreated control with a plot size of 20 m^2. The crop was sown with a spacing of 30 cm x10 cm and all the treatments were replicated thrice. Seed treatment for T_1 and T_2 were done with Imidacloprid 600 FS @ 5$g.kg^{-1}$ and Thiamethoxam 70 WS @ 5$g.kg^{-1}$ respectively before sowing the seed. Seed treatment was carried out in a polythene bag by adding sufficient quantity of gum to the seeds and shaking thoroughly to get a uniform coating over the seed. Later required quantity of seed dressing chemical was added and these two treatments were raised without spraying of insecticides in the field. Remaining treatments are T_3– T_1+ spirotetramat 150 OD; T_4- T_1+ buprofezin 10 EC; T_5- T_1+ spiromesifen 240 SC; T_6- T_1+ triazophos 40 EC; T_7- T_2+ spirotetramat 150 OD; T_8– T_2+ buprofezin 10 EC; T_9- T_2+ spiromesifen 240 SC; T_{10}- T_1+ triazophos 40 EC; T_{11}- scheduled foliar spray of triazophos 40 EC followed by acetamiprid T_{12}- untreated check.

In all foliar treatment plots, three need based sprays were given during the season. The spray was given at 15, 25 and 35 days after sowing with 10 days interval. Pre (one day before spray) and post treatment observations (3^{rd} and 7^{th} day after spray) were recorded in each plot from ten randomly selected plants. The regular observations on sucking insect pest population recorded on three leaves (from lower, middle and upper canopy) of each plant. To evaluate the economics of treatment, current market rate of insecticides were obtained and expenditure on treatment was calculated based on the doses with required quantity for the treatment.

RESULTS AND DISCUSSION

Whitefly

The pooled efficacy of the three sprays (Table 1) showed that seed treatment of imidacloprid along with foliar spray of spirotetramat (84.95 %) was found significantly superior over the rest of treatments. The present findings are in agreement with Sinha and Sharma (2010), Panduranga *et al.* (2011) and Babar *et al.* (2013) who reported that spirotetramat was highly effective against whiteflies. The next best treatment was seed treatment of imidacloprid along with foliar spray of spiromesifen with 79.77 per cent reduction over control and was superior to other treatments, however all the treatments were found significantly superior over the untreated control. Ameta *et al.* (2010) found that spiromesifen was the most effective in control of whitefly population on tomato.

Seed treatment alone plots of imidacloprid and thiamethoxam with 23.32 and 20.82 per cent reduction of whitefly population were on par with each other. These results were in agreement with the findings of Panduranga *et al.* (2011) reported that seed treatment with thiamethoxam, imidacloprid protected the crop from whiteflies upto 25 DAS but later more vector population was observed.

Buprofezin also was effective in reducing the whitefly population with more than 60 per cent reduction over untreated control. The efficacy of buprofezin against mealy bugs in cotton and leaf hoppers in rice was reported earlier by Dhawan *et al.* (2009), Balikai (2002) and Kendappa *et al.* (2005).

Triazophos showed better efficacy against whiteflies and the present results were in conformity with Cheema *et al.* (2006) who reported that triazophos 40 EC proved better in reducing the whitefly population under controlled conditions in blackgram. However, the higher efficacy of triazophos 40 EC against whiteflies was also reported by Sanjeevkumar and Gill (2010).

Yellow mosaic virus (YMV)

The data pertaining to yellow mosaic virus disease (YMV) incidence at 30 days after sowing indicated that the per cent disease incidence was significantly lower in all the seed treated plots than in untreated control (Table 2). Among all the treatments, T_1+ spirotetramat recorded the lowest YMV incidence (2.93 per cent) and it was found to be significantly superior over the other treatments in reducing the disease incidence. The next best treatment in reducing the YMV incidence was T_1+ spiromesifen (4.12 per cent) but it was found on par with T_1+ buprofezin (5.25 %) and both were found significantly superior over the rest of the treatments.

The incidence of YMV recorded at 60 days after sowing indicated that there were no differences in order of reducing the incidence of YMV among different insecticidal plots. However, all the treatments were found significantly superior over untreated control (63.16 per cent) in reducing the YMV incidence at 60 days after sowing in blackgram. The results obtained from the present study showed indicated that the seed treatment was found effective during initial stages of crop growth *i.e.,* upto 25 DAS only, hence, there was increased trend in disease incidence due to the increase in vector population after 30 DAS in seed treated alone plots only. However, control of vector population through seed treatment was effective at early stages of crop growth only and for further control foliar sprays were resoeted for reducing the incidence of YMV and thus caused to increase the

Table 1. Field efficacy of insecticides against whiteflies in blackgram during *rabi*, 2013-'14.

Treatments	Dose	Per cent reduction of population over untreated check		
		Whitefly		
		3 DAS	7 DAS	Mean efficacy
T_1: Imidacloprid (Seed treatment)	5g.kg^{-1}	23.18 (28.77)^{g}	18.47 (25.45)^{h}	20.82 (27.15)^{h}
T_2: Thiamethoxam (seed treatment)	5g.kg^{-1}	25.17 (30.09)^{g}	21.47 (27.60)^{h}	23.32 (28.87)^{h}
T_3: T_1+Spirotetramat	0.4 ml.L^{-1}	83.43 (66.00)^{a}	86.47 (68.60)^{a}	84.95 (67.19)^{a}
T_4: T_1+Buprofezin	1.0 ml L^{-1}	69.68 (56.63)^{bc}	65.67 (54.20)^{c}	67.68 (55.40)^{c}
T_5: T_1+Spiromesifen	0.4 ml.L^{-1}	75.29 (60.23)^{b}	79.77 (63.27)^{b}	77.53 (61.71)^{b}
T_6: T_1+Triazophos	1.0 ml.L^{-1}	65.05 (53.78)^{cd}	58.40 (49.84)^{d}	61.73 (51.80)^{d}
T_7: T_2+Spirotetramat	0.4 ml.L^{-1}	61.79 (51.86)^{de}	59.34 (50.40)^{d}	60.57 (51.13)^{d}
T_8: T_2+Buprofezin	1.0 ml.L^{-1}	55.95 (48.43)^{e}	44.04 (41.57)^{f}	50.00 (45.00)^{f}
T_9: T_2+Spiromesifen	0.4 ml.L^{-1}	61.16 (51.46)^{de}	54.77 (47.74)^{de}	57.97 (49.60)^{de}
T_{10}: T_2+Triazophos	1.0 ml.L^{-1}	42.70 (40.80)^{f}	32.81 (34.93)^{g}	37.76 (37.91)^{g}
T_{11}: Acetamiprid followed by Triazophos	0.2 g.L^{-1} + 1.0 ml.L^{-1}	57.08 (49.08)^{e}	50.68 (45.40)^{ef}	53.88 (47.24)^{ef}
T_{12}: Control		0.00 (0.00)^{h}	0.00 (0.00)^{i}	0.00 (0.00)^{i}
F test		S	S	S
SEm±		1.33	1.29	1.06
CD (P=0.05)		3.91	3.79	3.11
CV%		5.15	5.27	4.22

Figures in parentheses are angular transformed values.
Numbers followed by same superscript are not statistically different at 5%level
S: Significant. DAS: Days After Spraying.

yields in all the seed treatment along with foliar sprayed plots.

The present results were in agreement with Panduranga *et al.* (2011) who reported that seed treatment with thiamethoxam, imidacloprid were protected the crop from whiteflies upto 25 DAS but later stages resulted in more vector population and high MYMV disease incidence.

Yield:

Among all the treatments, (Table 2) highest seed yield of 1096 kg.ha^{-1} was recorded from seed treatment with imidacloprid (T_1) along with foliar spray of spirotetramat treated plots which was on par with T_1+ spiromesifen (996 kg.ha^{-1}) treated plots followed by T_1+ buprofezin (858 kg/ha) and was on par with T_1+ triazophos (806 kg.ha^{-1}). Among

Table 2. Influence of insecticides on YMV incidence and yield in blackgram during *rabi*, 2013-'14.

Treatments	Dose	YMV disease incidence (%)		Yield ($kg.ha^{-1}$)	Incremental Cost benefit ratio
		30DAS	60DAS		
T_1: Imidacloprid (Seed treatment)	$5g.kg^{-1}$	38.95 $(38.61)^{f}$	52.27 $(46.30)^{g}$	442^{fg}	1:5.20
T_2: Thiamethoxam (seed treatment)	$5g.kg^{-1}$	33.43 $(35.32)^{e}$	45.09 $(42.20)^{f}$	491^{f}	1:3.27
T_3: T_1+Spirotetramat	$0.4\ ml.L^{-1}$	2.93 $(9.77)^{a}$	14.59 $(22.45)^{a}$	1096^{a}	1:8.69
T_4: T_1+Buprofezin	$1.0\ ml\ L^{-1}$	5.25 $(13.20)^{abc}$	16.91 $(24.28)^{abc}$	858^{b}	1:4.98
T_5: T_1+Spiromesifen	$0.4\ ml.L^{-1}$	4.12 $(11.34)^{ab}$	15.78 $(23.37)^{ab}$	996^{a}	1:7.00
T_6: T_1+Triazophos	$1.0\ ml.L^{-1}$	10.41 $(18.80)^{b}$	22.07 $(28.01)^{b}$	806^{bc}	1:7.89
T_7: T_2+Spirotetramat	$0.4\ ml.L^{-1}$	15.49 $(23.11)^{c}$	28.16 $(32.02)^{c}$	785^{bcd}	1:3.53
T_8: T_2+Buprofezin	$1.0\ ml.L^{-1}$	20.56 $(26.92)^{d}$	32.22 $(34.58)^{d}$	663^{e}	1:1.98
T_9: T_2+Spiromesifen	$0.4\ ml.L^{-1}$	16.86 $(24.18)^{cd}$	28.52 $(32.26)^{cd}$	720^{cde}	1:2.68
T_{10}: T_2+Triazophos	$1.0\ ml.L^{-1}$	23.19 $(28.71)^{de}$	36.85 $(37.36)^{e}$	542^{f}	1:1.61
T_{11}: Acetamiprid followed by Triazophos	$0.2\ g.L^{-1}$ + $1.0\ ml.L^{-1}$	18.85 $(25.71)^{cde}$	30.51 $(33.52)^{cde}$	697^{de}	1:5.21
T_{12}: Control		48.51 $(44.15)^{g}$	63.16 $(52.64)^{h}$	371^{g}	-
F test		S	S	S	
SEm±		1.22	0.89	37.05	
CD (P=0.05)		3.60	2.61	108.64	
CV%		8.51	4.52	9.10	

Figures in parentheses are angular transformed values.
Numbers followed by same letters are not statistically different at 5% level
S: Significant. DAS: Days After Spraying

all the foliar spray treatments, triazophos recorded as lowest yield with 542 $kg.ha^{-1}$. Seed treatment with imidacloprid and thiamethoxam alone plots were on par with each other with yields of 442 and 491 $kg.ha^{-1}$ respectively. The present findings were in concurrence with the results of Nakat *et al.* (2002) who reported that seed treatment with thiamethoxam gives significant higher yield in grrengram.

The cost benefit ratio was calculated for each treatment and the highest incremental cost benefit ratio was recorded for T_1+ spirotetramat (8.69) followed by T_1+ triazophos (7.89) and T_1+ spiromesifen (7.00). C:B ratio was higher for imidacloprid seed treatment as compared to seed treatment with thiamethoxam and this observation was in conformity with the findings of Kenchareddi and Balikai (2012).

Conclusion:

The results obtained in the present investigation indicate that seed treatment protects the crop upto 25 days only, hence foliar sprays should be given to protect the crop from insect pest incidence after 25 days of sowing. Seed treatment with imidacloprid along with foliar application of spirotetramat or spiromesifen offered complete protection against incidence of whiteflies after 25 DAS. It not only reduced the incidence of YMV but also recorded higher yields which inturn lead to high cost benefit ratio from blackgram.

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