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Efficacy of insecticides against sucking pest complex in blackgram

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Abstract
Efficacy of novel group of insecticides imidacloprid 70 WS (5 g kg^{-1}), thiamethoxam 25 WG (3 g kg^{-1}) seeds, imidacloprid 17.8 SL (10 ml kg^{-1}), acetamiprid 20 SP (15 g kg^{-1}) along with two other insecticides dimethoate 20 EC (5 ml kg^{-1}), carbosulfan 25 EC (30 ml kg^{-1}) as seed treatment along with untreated control was tested against sucking pest complex in blackgram by raising experiment in Randomized Block Design with seven treatments and replicated thrice during *rabi* 2017-18 and results revealed that among all the insecticides tested imidacloprid WS 70 at 5 g kg^{-1} was found to be the most effective treatment which was followed by thiamethoxam 25 WG at 3 g kg^{-1}, imidacloprid 17.8 SL at 10 ml kg^{-1}, acetamiprid 20 SP at 15 g kg^{-1}, carbosulfan 25 EC at 30 ml kg^{-1} and dimethoate 20 EC at 5 ml kg^{-1} against leafhopper and thrips population in *rabi* blackgram**.** Thiamethoxam 25 WG at 3 g kg^{-1} was found to be the most effective against whiteflies which was followed by imidacloprid 70 WS at 10 ml kg^{-1}, acetamiprid 20 SP at 15 g kg^{-1} and imidacloprid 17.8 SL. The least effective insecticides were carbosulfan 25 EC at 30 ml kg^{-1} and dimethoate 20 EC at 5 ml kg^{-1} but were found to be superior over the untreated control against whiteflies.

Keywords: novel group of insecticides, seed treatment, sucking pests, blackgram

Introduction
Pulses are the important sources of protein, vitamins and minerals and play a vital role in the diet of vegetarians and are popularly known as “Poor man’s meat” and “rich man’s vegetable”, which contribute significantly to the nutritional security of the country. Damage by insect pests was a serious limiting factor in pulse cultivation leading to reduced production and productivity. Black gram is attacked by an array of insect pests from sowing to harvest in the field as well as in storage (Lal and Sachan, 1987) [5]. Among them, sucking pests were the important pests in early stages of crop growth which not only reduces the plant vigour but also acts as vectors for deadly viral diseases. As pests, these are being managed through insecticides, but as vectors, it is most important to avoid the incidence of sucking pests from the beginning of crop growth itself. Hence, seed treatment should be adopted to protect the crop from the moment of sowing and to keep on protecting the crop through the germination and early establishment stages. Seed treatment is the most targeted, effective and ecofriendly method for controlling the sucking pests. Recommendation of broad spectrum insecticides as blanket sprays against sucking pests leads to resistance problems in some cases. Hence, it is necessary to evaluate the efficacy of different new molecules as seed dressers for effective control of sucking pests.

Materials and Methods
The experiment was laid out in a Randomized Block Design (RBD) with seven treatments including untreated check in three replications with a plot area of 20 m^2 each with a spacing of 30 X 10 cm for studying the efficacy of selected insecticides as seed treatment for the control of sucking pest complex incidence in black gram.

Seed Treatment
Seed treatment was done by taking one kilogram of seeds in a polythene bag and measured quantity of insecticide (Table: 1.1.) was added to the seed and shaking was done vigorously for uniform mixing up of the insecticide with the seed. Later, the seed was shade dried for 24 hours and were used for sowing.

Table 1.1: Details of different insecticides used as seed treatments

Treatment	Insecticide	Dosage	Trade name
T_1	Imidacloprid 70 WS	5 g kg^{-1}	Goucho
T_2	Thiamethoxam 25 WG	3 g kg^{-1}	Actara
T_3	Imidacloprid 17.8 SL	10 ml kg^{-1}	Confidor
T_4	Acetamiprid 20 SP	15 g kg^{-1}	Pride
T_5	Dimethoate 20 EC	5 ml kg^{-1}	Rogor
T_6	Carbosulfan 25 EC	30 ml kg^{-1}	Marshall
T_7	Untreated Control	--	--

The population of sap feeders i.e., whiteflies, leafhoppers and thrips were recorded early in the morning. Five plants were selected randomly in each treatment and number of sap feeders were counted by tapping the top two, middle two and bottom two leaves on a white paper at five days interval from 10 DAS to 30 DAS as suggested by Mahto (1990) [6] for leaf hoppers, Men and Sarode (1999) [8] for whiteflies and Rathore and Tiwari (1999) [15] for thrips during morning hours The mean data on thrips, whiteflies, leafhoppers and plant growth characters were subjected to statistical analysis after using relevant transformations (Square root transformations).

Results and Discussions

Whiteflies

The efficacy of insecticides at 30 days after sowing was considered as overall efficacy of insecticides as seed treatment against whiteflies in blackgram. Among all the treatments, lowest population of whiteflies were recorded in thiamethoxam 25 WG at 3 g kg^{-1} seed with 2.40 whiteflies per six leaves (Tab 1.2 and Fig 1.1) this treatment was on par with and imidacloprid 70 WS at 5 g kg^{-1} seed with 2.60 whiteflies per six leaves and acetamiprid 20 SP at 15 g kg^{-1} seed with 2.87 whiteflies per six leaves. The next best treatment imidacloprid 17.8 SL at 10 ml kg^{-1} seed with 3.20 whiteflies per six leaves and was not significantly different with imidacloprid 70 WS at 5 g kg^{-1} and acetamiprid 20 SP at 15 g kg^{-1}. The least effective treatments were carbosulfan 25 EC at 30 ml kg^{-1} seed and dimethoate 20 EC at 5 ml kg^{-1} with 5.47 and 5.73 whiteflies per six leaves respectively and were on par with each other. The highest population of 6.93 leafhoppers per six leaves was recorded in untreated control.

These results are in conformity with Ganapathy and Karuppaiah (2004) [3] who revealed that seed treatment with thiamethoxam at 5 g kg^{-1} seed recorded minimum whitefly population in blackgram. Dubey and Singh (2010) [1] found thimethoxam at 4 and 6 g kg^{-1} was found to be superior to imidacloprid at 4 and 6 g kg^{-1} in controlling whitefly population. Naveed *et al*. (2010) [12] used imidacloprid 70 WS at 8 gm kg^{-1} and thiamethoxam 25 WG at 3 gm kg^{-1} as seed treatment in cotton against whitefly. The population of whitefly was significantly lower in the imidacloprid and thiamethoxam seed treated plots compared to untreated check plots.

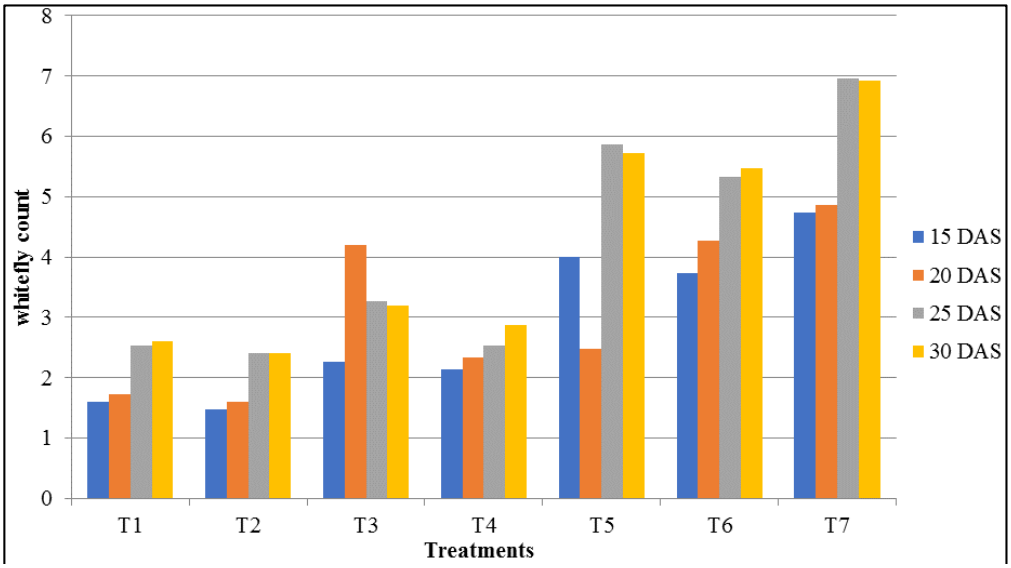

Fig 1.1: Efficacy of insecticides as seed treatment against Whiteflies in blackgram

Thakor *et al*. (2009) [19] illustrated that among the various insecticidal treatments tested, seed treatment with thiamethoxam 25 WG (3 g kg^{-1} seed), imidacloprid 70 WS (7.5 g kg^{-1} seed) and acetamiprid 20 SP (7 g kg^{-1} seed) recorded significantly lower population of whitefly in greengram. Rana *et al*. (2006) [14] found seed treatment with imidacloprid at 2 ml, thiamethoxam 2 g and carbosulfan at 2 g kg^{-1} were effective in controlling the whitefly in okra. Roshan and Lal (2015) [16] revealed that minimum population of whitefly was recorded at 30 days after sowing when the seeds were treated with dimethoate 30 EC at 5 ml kg^{-1} seed.

Leafhoppers

The efficacy of insecticides at 30 days after sowing was considered as overall efficacy of insecticides as seed treatment against leafhoppers (Tab 1.3 and Fig 1.2) in blackgram. Observations at 30 DAS revealed that imidacloprid 70 WS at 5 g kg^{-1} seed, thiamethoxam 25 WG at 3 g kg^{-1} seed and imidacloprid 17.8 SL at 10 ml kg^{-1} seed with 2.27, 2.40 and 2.67 leafhoppers per six leaves respectively were found to be statistically on par with each other followed by acetamiprid 20 SP at 15 g kg^{-1} with 3.07 leafhoppers per six leaves which was on par with the thiamethoxam 25 WG at 3 g kg^{-1} seed and imidacloprid 17.8 SL at 10 ml kg^{-1} seed. Both the treatments carbosulfan 25 EC at 30 ml kg^{-1} and dimethoate 20 EC at 5 ml kg^{-1} were least effective but were on par with each other with 5.27 and 5.53 leafhoppers per six leaves but were significantly different from control. The highest population of leafhoppers were recorded in untreated plot with a mean population of 6.73 leafhoppers per six leaves.

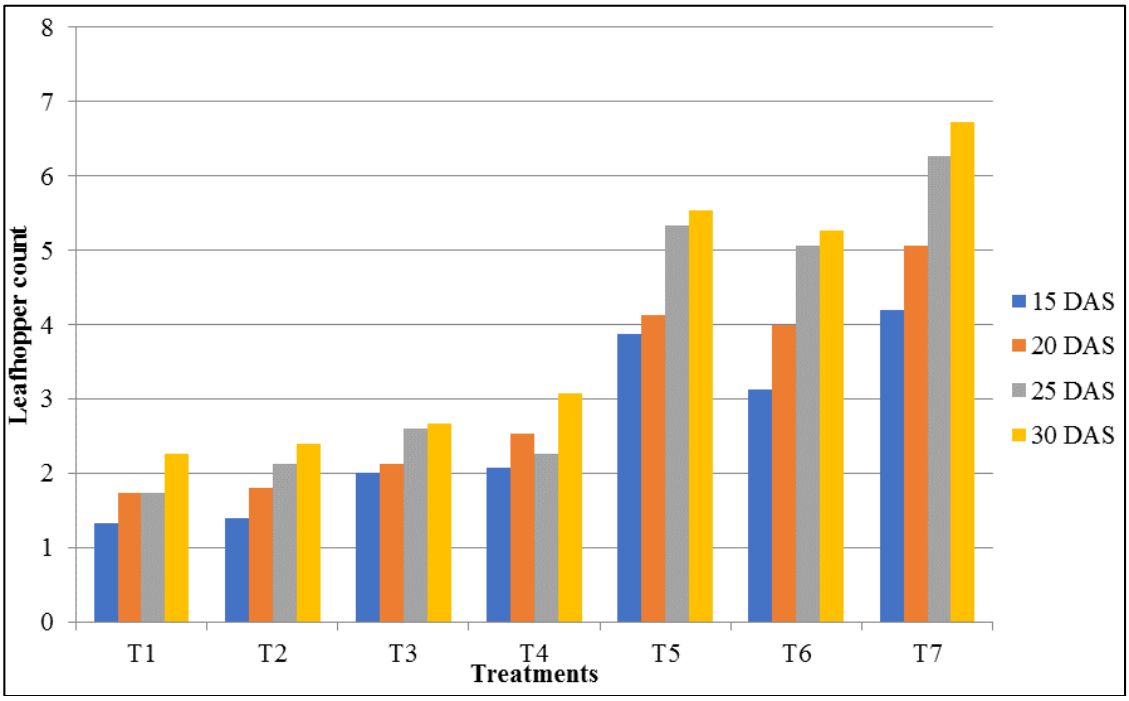

Fig 1.2: Efficacy of insecticides as seed treatment against Leafhoppers in blackgram

The results were supported by Nakat *et al*. (2002) [11] who revealed that imidacloprid 70 WS at 0.5% and thiamethoxam 25 WG at 0.2, 0.3 and 0.5 per cent a.i. per kg were found effective against leafhoppers in greengram. The same results were proved by Karabhantanal *et al*. (2007) [4] and found that the effectiveness of imidacloprid 70 WS as seed treatment at 10 g kg^{-1} seeds registered significantly lowest number of leafhopper in cotton. Mohapatra and Sahu (2005) [9] reported that the seed treatment with imidacloprid 70 WS at 7.5 g kg^{-1} seed proved most effective in protecting the crop from sucking pest complex upto 45 days after emergence in cotton and further confirmed that among all the treatments, carbosulfan 25 EC at 30 ml kg^{-1} was found least effective with more population of sucking pests.

Sathyan *et al*. (2016) [17] reported that imidacloprid 17.8 SL as seed treatment recorded minimum leafhopper injury grade of 2.5 and thiamethoxam recorded a grade of 3.0. Murugesan and Kavitha (2009) [10] found imidacloprid 17.8 SL was effective in controlling leafhopper population. Patil *et al*. (2001) [13] revealed that seed treatment with acetamiprid 20 SP at 26.25 g kg^{-1} recorded lower leafhopper population up to 39 days after sowing.

Thrips

The efficacy of insecticides at 30 days after sowing was considered as overall efficacy of insecticides as seed treatment against thrips in blackgram. The data recorded at 30 DAS revealed that the treatments imidacloprid 70 WS at 5 g kg^{-1} with 2.67 thrips per six leaves and thiamethoxam 25 WG at 3 g kg^{-1} with 2.80 thrips per six leaves (Tab 1.4 and Fig 1.3) were found on par with each other. The next best treatments were imidacloprid 17.8 SL at 10 ml kg^{-1} and acetamiprid 20 SP at 15 g kg^{-1} with 3.80 and 3.87 thrips per six leaves respectively, were on par to each other and were not significantly different with the thiamethoxam 25 WG at 3 g kg^{-1}. The least effective insecticidal treatments were carbosulfan 25 EC at 30 ml kg^{-1} and dimethoate 20 EC at 10 ml kg^{-1} which recorded 6.67 and 7.00 thrips per six leaves respectively. The highest population of thrips were recorded in the untreated control plot with 8.80 thrips per six leaves.

These results are in accordance with Nakat *et al*. (2002) [11] who revealed that imidacloprid 70 WS at 0.5% and thiamethoxam @ 0.2, 0.3 and 0.5 per cent a.i. per kg seed was found effective against thrips in greengram. The same results were proved by Karabhantanal *et al*. (2007) [4] who evaluated the effectiveness imidacloprid 70 WS as seed treatment at 10 g kg^{-1} seed and registered significantly lowest number of thrips. Duraimurugan and Tyagi (2014) [4] reported that seed treatment with imidacloprid 17.8 SL caused 40.2 to 81.4 per cent reduction in sucking pests in blackgram.

Mallikarjuna Rao *et al*. (2007) [7] found seed treatment with imidacloprid 70 WS at 3 g kg^{-1} seed and thiamethoxam 70 WS at 3 g kg^{-1} seed was effective against thrips on blackgram.

Uttakkala *et al*. (2016) [20] reported that the seed treatment with thiamethoxam at 4.3 g and 8.6 g kg^{-1}, imidacloprid at 5 ml and 10 ml kg^{-1}, acetamiprid at 15 g and 30 g kg^{-1}, carbosulfan at 30 ml and 40 ml kg^{-1} was highly effective against thrips upto 30 days after germination in greengram. Subash and Singh (1993) [18] reported that seed treatment with dimethoate at 5 ml and 10 ml kg^{-1} seed was found effective against thrips in greengram.

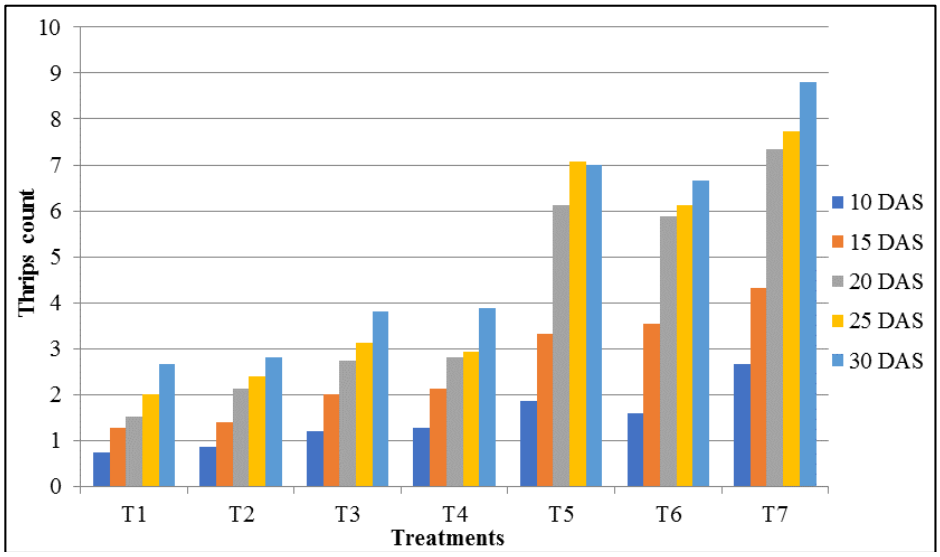

Fig 1.3: Efficacy of insecticides as seed treatment against Thrips in blackgram

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Table 1.2: Efficacy of different insecticides as seed treatment against whiteflies in *rabi* blackgram 2017-18

Treatment	Dosage	No. of Whiteflies per six leaves			
		15 DAS	20 DAS	25 DAS	30 DAS
Imidacloprid 70 WS	5 g kg^{-1}	1.60 (1.61)	1.73 (1.65)	2.53 (1.88)	2.60 (1.89)
Thiamethoxam 25 WG	3 g kg^{-1}	1.47 (1.56)	1.60 (1.61)	2.40 (1.84)	2.40 (1.84)
Imidacloprid 17.8 SL	10 ml kg^{-1}	2.27 (1.81)	4.20 (2.28)	3.27 (2.07)	3.20 (2.05)
Acetamiprid 20 SP	15 g kg^{-1}	2.13 (1.77)	2.33 (1.82)	2.53 (1.88)	2.87 (1.97)
Dimethoate 20 EC	5 ml kg^{-1}	4.00 (2.24)	4.24 (1.86)	5.87 (2.62)	5.73 (2.59)
Carbosulfan 25 EC	30 ml kg^{-1}	3.73 (2.18)	4.27 (2.29)	5.33 (2.51)	5.47 (2.54)
Control	--	4.73 (2.39)	4.87 (2.42)	6.93 (2.82)	6.93 (2.82)
SE(m)±1		0.07	0.06	0.07	0.06
C.D.		0.20	0.18	0.22	0.20

Table 1.3: Efficacy of different insecticides as seed treatment against leafhoppers in *rabi* blackgram 2017-18

Treatment	Dosage	No. of leafhopper per six leaves			
		15 DAS	20 DAS	25 DAS	30 DAS
Imidacloprid 70 WS	5 g kg^{-1}	1.33 (1.52)	1.73 (1.65)	1.73 (1.65)	2.27 (1.80)
Thiamethoxam 25 WG	3 g kg^{-1}	1.40 (1.55)	1.80 (1.67)	2.13 (1.77)	2.40 (1.84)
Imidacloprid 17.8 SL	10 ml kg^{-1}	2.00 (1.73)	2.13 (1.77)	2.60 (1.9)	2.67 (1.91)
Acetamiprid 20 SP	15 g kg^{-1}	2.07 (1.75)	2.53 (1.88)	2.27 (1.81)	3.07 (2.12)
Dimethoate 20 EC	5 ml kg^{-1}	3.87 (2.21)	4.13 (2.27)	5.33 (2.52)	5.53 (2.55)
Carbosulfan 25 EC	30 ml kg^{-1}	3.13 (2.03)	4.00 (2.24)	5.07 (2.46)	5.27 (2.50)
Control	--	4.20 (2.28)	5.07 (2.46)	6.27 (2.69)	6.73(2.78)
SE(m)±1		0.06	0.06	0.06	0.07
C.D.		0.19	0.20	0.20	0.20

Table 1.4: Efficacy of different insecticides as seed treatment against thrips in *rabi* blackgram 2017-18

Treatment	Dosage	No. of thrips per six leaves				
		10 DAS	15 DAS	20 DAS	25 DAS	30 DAS
Imidacloprid 70 WS	5 g kg^{-1}	0.73 (1.31)	1.27 (1.50)	1.53 (1.59)	2.00 (1.72)	2.67 (1.89)
Thiamethoxam 25 WG	3 g kg^{-1}	0.87 (1.36)	1.40 (1.55)	2.13 (1.77)	2.40 (1.84)	2.80 (1.94)
Imidacloprid 17.8 SL	10 ml kg^{-1}	1.20 (1.48)	2.00 (1.73)	2.73 (1.93)	3.13 (2.03)	3.80 (2.19)
Acetamiprid 20 SP	15 g kg^{-1}	1.27 (1.50)	2.13 (1.77)	2.80 (1.95)	2.93 (1.98)	3.87 (2.21)
Dimethoate 20 EC	5 ml kg^{-1}	1.87 (1.69)	3.33 (2.18)	6.13 (2.67)	7.07 (2.84)	7.00 (2.83)
Carbosulfan 25 EC	30 ml kg^{-1}	1.60 (1.61)	3.53 (2.13)	5.87 (2.62)	6.13 (2.67)	6.67 (2.77)
Control	--	2.67 (1.92)	4.33 (2.31)	7.33 (2.89)	7.73 (2.96)	8.80 (3.13)
SE(m)±1		0.05	0.07	0.07	0.09	0.09
C.D		0.16	0.22	0.21	0.26	0.28

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