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EVALUATION OF EFFICACY OF SEED TREATMENT AND FOLIAR SPRAY ON SUCKING INSECT PEST INCIDENCE IN GROUNDNUT

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ABSTRACT

Seed treatment was done at the time of sowing with imidacloprid 600 FS and thiamethoxam 30 FS. Among the different treatments, seed treated with imidacloprid 600 FS @ 2.0 ml kg^{-1} (+ 4 ml water) seed was found more effective in reduction of thrips and leafhopper damage followed by thiamethoxam 70 FS @ 2.0 g kg^{-1} seed when compared to untreated control. At 35 days after sowing, foliar spray was imposed to known the efficacy of foliar spray in groundnut against sucking pests. Among the different treatments imidacloprid 600 FS seed treatment + imidacloprid 17.8 SL spray (T_8) and imidacloprid 600 FS seed treatment + thiamethoxam 25 WDG (T_6) were the best treatments with 64.3 and 63.9 per cent reduction over control against thrips. The treatments imidacloprid 600 FS seed treatment + thiamethoxam 25 WDG spray (T_6) and imidacloprid 17.8 SL spray (T_5) were the best treatments with 66.5 and 63.4 per cent reduction over control against leafhoppers.

KEYWORDS: Groundnut, Seed treatment, Sucking pests Imidacloprid, Thiamethoxam.

INTRODUCTION

Groundnut (*Arachis hypogaea* L.) is one of the most important oilseed crops grown in India and contributes about 30 per cent of the total domestic supply of oil. Though India ranks first in area under groundnut cultivation, the productivity is quite low (1000 kg/ha) compared to that of USA (3000 kg/ha), China (2600 kg/ha), Argentina (2100 kg/ha) and Indonesia (1550 kg/ha). It is grown on 5.09 million hectares in India, with annual production of 10.41 million tonnes. Gujarath (4.13 million tonnes) is the leading producer of groundnut followed by Rajasthan (1.93 million tonnes) and Tamil nadu (0.94 million tonnes). [Anonymous, 2020-21. DES, Ministry of Agri. & FW (DAC & FW) Govt of India]. In Andhra Pradesh groundnut crop is grown in an area of 7.74 million hectares with annual production of 0.84 million tonnes and productivity of 1426 kg^{-1} ha, majoring in Chittoor, Anantapur and Kadapa districts. The reason for low productivity of groundnut is due to biotic and abiotic stresses. Insect pests and diseases are the major biotic stresses for groundnut production. The sucking insect pest complex comprising thrips (*Scirtothrips dorsalis* Hood) and leafhopper (*Empoasca kerri* Pruthi) are the major pests of importance on groundnut particularly during summer seasons and bunch varieties are severely infested. Among the sucking pests attacking the groundnut crop, thrips species occur as a complex, starting from vegetative stage till the harvest of the crop. Objective of the present study is to evaluate the effectiveness of the seed dressing chemicals in order to develop an effective management strategies for leafhoppers and thrips in groundnut ecosystem.

MATERIAL AND METHODS

A field experiment was conducted to evaluate the relative "efficacy of seed treatment and foliar spray on sucking insect pest incidence in groundnut" at college farm, S.V. Agricultural College, Tirupati, Andhra Pradesh during *kharif* 2021 in randomized block design with twelve treatments of three replications. The groundnut variety Dharani was used as test variety which is susceptible to the insect pests. The groundnut seed was treated with insecticides *viz.,* Imidacloprid 600 FS @ 2.0 ml kg-1 seed thiamethoxam @ 2.0 ml kg-1 seed (+ 4 ml water), For uniform covering of 1 kg seed, 5.0 ml of water was added to 1.0 ml of insecticide formulation and foliar spray was done at 35 DAS with thiamethoxam 25 WDG, imidacloprid 17.8 SL and monocrotophos 36 SL. Number of damaged leaves per plant dueto thrips and leafhoppers was recorded from five selected plants in each plot as per method suggested by Amin (1983). Data on per cent damage were subjected to angular transformation before statistical analysis. Per cent reduction of leaf damage by trips and leaf hoppers in treatments over control plots was estimated by using the formula given by Abbott (1925). The yield of groundnut was recorded from each plot and converted into yield per hectare.

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Population reduction over control (%) =

$$\frac{\text{Population in untreated cheek - Population in treatment}}{\text{Population in untreated cheek}} \times 100$$

RESULTS AND DISCUSSION

Foliar damage due to thrips at various intervals of seed treatment

Foliar damage due to thrips at 14 days after seed treatment

Foliar damage due to thrips was ranged from 3.1 to 14.1 per cent in different treatments. The seed treatment with imidacloprid (T_1, T_6, T_7, T_8) and thiamethoxam (T_2, T_9, T_{10}, T_{11}) recorded the lowest foliar damage compared to the treatments without seed treatment (T_3, T_4, T_5, T_{12}). The highest per cent reduction in thrips damage was observed in plots treated with imidacloprid 600 FS @ 2 ml kg^{-1} seed and thiamethoxam 70 WP @ 2 ml kg^{-1} seed with 78.25, 77.78, 77.54, 77.30, 76.83 and 76.60 per cent reduction over control, respectively and all treatments were on par with each other.

Foliar damage due to thrips at 21 days after seed treatment

Foliar damage at 21 days after treatment was ranged from 3.80 to 15.70 per cent in different plots. The highest per cent reduction over control was observed in plots treated with imidacloprid 600 FS @ 2 ml kg^{-1} seed and thiamethoxam 70 WP @ 2 ml kg^{-1} seed with 75.64, 75.42, 75.21, 75.00, 74.58, 74.15 and 73.52 per cent reduction over control, respectively and all treatments were on par with each other. The treatments T_3, T_4 and T_5 which are untreated with insecticides showed similar pest incidence as of control.

Foliar damage 28 days after seed treatment

Highest per cent reduction over control was observed in plots treated with imidacloprid 600 FS @ 2 ml kg^{-1} seed and thiamethoxam 70 WP @ 2 ml kg^{-1} seed with 63.74, 62.18, 61.99, 61.60, 61.01 and 60.43 per cent reduction over control, respectively and all treatments were on par with each other. The treatments T_3, T_4 and T_5 which are untreated with insecticides showed similar pest incidence as of control.

Foliar damage due to thrips at 35 days after seed treatment

The highest per cent reduction over control was observed in plots treated with imidacloprid 600 FS @ 2 ml kg^{-1} seed and thiamethoxam 70 FS @ 2 ml kg^{-1} seed with 59.24, 58.33, 57.79, 57.61, 57.07 and 56.70 per cent reduction over control, respectively and all treatments were at par with each other. The current results are in conformity with the findings of Neetam *et al.* (2013) who evaluated the bio-efficacy of imidacloprid 600 FS when applied as seed treatment at the rate of 2 g a.i kg^{-1} seed proved most effective against the sucking pests up to four weeks of seed germination. The results were also in agreement with that of Venkateswarlu and Vemana (2015) who found that imidacloprid 600 FS @ 2.0 ml kg^{-1} seed proved more effective in reduction of thrips damage followed by thiamethoxam 30 FS. Bhadane *et al*. (2007) postulated that imidacloprid could be used as effective insecticidal treatment for the control of thrips in groundnut cropping system. Dey *et al*. (2005) and Sinha and Sharma (2007) also reported that imidacloprid provided effective control of early sucking pest complex such as aphids, leafhoppers, thrips and whiteflies at 25 days after sowing in okra.

Table 1. Details of insecticides used for seed treatment and foliar spray in groundnut against sucking pests during *kharif,* 2021-22

S. No.	Insecticide	Tradename	Formulation	Dosage
Seed treatment				
1	Imidacloprid	Gaucho	600 FS	2 ml + 4 ml of waterkg^{-1} seed
2	Thiamethoxam	Averasuper	30 FS	2 ml + 4 ml of waterkg^{-1} seed
Foliar spray				
3	Thiamethoxam	Actara	25 WDG	0.2 g l^{-1}
4	Monocrotophos	Monokill	36 SL	1.6 ml l^{-1}
5	Imidacloprid	Confidor	17.8 SL	0.3 ml l^{-1}

Efficacy of different insecticides as seed treatment against thrips damage in groundnut

S. No.	Treatments	14 DAS		21 DAS		28 DAS		35 DAS		Mean per cent reduction	
		Per cent damage	Per cent reduction over untreated control	Per cent damage	Per cent Reduction over untreated control	Per cent damage	Per cent reduction over untreated control	Per cent damage	Per cent reduction over untreated control	Per cent damage	Per cent reduction over untreated control
1	Imidacloprid 600 FS (ST)	3.1	78.25 (62.19)	3.8	75.21 (60.15)	6.2	63.74 (44.62)	7.5	59.24 (41.40)	5.15	68.5 (49.91)
2	Thiamethoxam 70 FS (ST)	3.3	76.83 (61.22)	4.0	73.94 (59.29)	6.7	61.01 (41.47)	7.8	57.61 (40.34)	5.30	66.7 (49.52)
3	Thiamethoxam 25 WDG(FS)	11.5	18.44 (25.39)	13.8	12.08 (20.34)	16.2	5.07 (12.86)	17.1	6.88 (14.89)	14.68	10.2 (18.51)
4	Monocrotophos 36 SL (FS)	11.2	20.57 (26.81)	14.1	10.17 (17.76)	16.1	6.04 (14.10)	17.0	7.61 (15.82)	14.60	10.6 (18.95)
5	Imidacloprid 17.8 SL (FS)	11.6	17.97 (24.96)	14.0	10.81 (19.22)	16.2	5.26 (13.24)	17.3	5.98 (14.09)	14.78	9.5 (17.99)
6	T_1 followed by T_3	3.3	77.54 (61.71)	4.2	73.52 (59.01)	6.8	60.43 (42.23)	7.9	57.07 (42.22)	5.53	66.1 (50.29)
7	T_1 followed by T_4	3.2	77.30 (61.55)	3.9	74.15 (59.43)	6.6	61.60 (43.01)	7.8	57.79 (42.97)	5.37	67.1 (50.76)
8	T_1 followed by T_5	3.1	77.78 (261.88)	3.9	74.8 (59.73)	6.5	62.18 (41.79)	7.7	58.33 (41.54)	5.28	67.7 (50.15)
9	T_2 followed by T_3	3.3	76.83 (61.23)	4.1	75.00 (59.98)	6.8	60.43 (41.01)	8.0	56.70 (40.80)	5.52	66.2 (49.70)
10	T_2 followed by T_4	3.1	77.78 (61.88)	3.9	74.15 (59.47)	6.5	61.99 (41.70)	7.7	58.33 (40.65)	5.30	67.6 (49.82)
11	T_2 followed by T_5	3.2	77.30 (61.55)	4.0	74.58 (59.73)	6.7	61.01 (41.57)	7.8	57.79 (40.51)	5.41	66.9 (49.76)
12	Untreated control	14.1	-	15.7	-	17.1	-	18.4	-	16.33	-
	SE.m±	1.07		1.37		0.91		0.87		0.62	
	CD (5%)	3.26		4.15		2.75		2.65		1.88	
	CV (%)	2.28		3.10		2.91		2.33		1.52	

Figures in parathensis are angular transformed values
ST : Seed treatment; DAS : Days after treatment; FS : Foliar spray

Efficacy of different insecticides as foliar spray against thrips damage in groundnut

S. No.	Treatments	7 Days after spraying		14 Days after spraying		Percent mean reduction	
		Per cent damage	Per cent Reduction over untreated control	Per cent damage	Per cent reduction over untreated control	Per cent damage	Per cent reduction over untreated control
1	Imidacloprid 600 FS (ST)	10.5	44.48^{g} (41.83)	12.0	39.29^{e} (38.82)	11.27	41.8^{f} (41.88)
2	thiamethoxam 30 FS (ST)	11.2	41.15^{h} (39.89)	12.5	36.93^{f} (37.43)	11.82	39.0^{g} (38.99)
3	Thiamethoxam 25 WDG (FS)	7.4	61.17^{d} (51.46)	8.8	55.31^{b} (48.05)	8.10	59.0^{b} (58.18)
4	Monocrotophos 36 SL (FS)	8.5	55.02^{ef} (47.88)	10.2	48.57^{d} (44.18)	9.35	51.7^{e} (51.73)
5	Imidacloprid 17.8 SL (FS)	8.2	56.78^{e} (48.90)	9.5	51.77^{c} (46.02)	8.87	54.2^{d} (54.22)
6	T_1 followed by T_3	5.9	68.73^{b} (56.00)	8.1	59.19^{ab} (50.30)	7.00	63.9^{a} (63.86)
7	T_1 followed by T_4	6.3	66.97^{c} (54.92)	9.8	56.32^{b} (45.34)	8.02	58.6^{bc} (58.61)
8	T_1 followed by T_5	5.6	70.48^{a} (57.12)	8.2	60.54^{a} (49.81)	6.92	64.3^{a} (64.30)
9	T_2 followed by T_3	6.6	65.21^{cd} (53.86)	9.4	53.29^{bc} (46.49)	7.98	58.8^{bc} (58.78)
10	T_2 followed by T_4	6.7	64.69^{cd} (53.54)	9.2	54.13^{bc} (46.98)^{bc}	7.95	59.0^{b} (58.96)
11	T_2 followed by T_5	6.3	66.62^{cd} (54.71)	10.2	53.46 (43.98)	8.28	57.2 (57.24)
12	Untreated control	19.00	0.00	19.8	0.00	19.37	0.00
	SE.m±		0.54		0.55		0.34
	CD (5%)		1.63		1.64		1.02
	CV(%)		1.16		1.32		0.77

Figures in parathensis are angular transformed values
ST : Seed treatment; DAS : Days after treatment; FS : Foliar spray

Efficacy of different insecticides as seed treatment against leafhopper damage in groundnut

S. No.	Treatments	28 DAS		35 DAS		Percent mean reduction	
		Per cent damage	Per cent Reduction over untreated control	Per cent damage	Per cent Reduction over untreated control	Per cent damage	Per cent Reduction over untreated control
1	Imidacloprid 600 FS (ST)	3.0	49.15 (44.44)	4.0	46.71 (43.10)	3.5	48.0 (43.72)
2	Thiamethoxam 70 FS (ST)	3.1	46.89 (43.16)	4.1	44.80 (42.00)	3.6	46.3 (42.55)
3	Thiamethoxam 25 WDG (FS)	5.3	10.17 (27.41)	6.8	8.89 (18.18)	6.1	9.5 (23.09)
4	Monocrotophos 36 SL (FS)	5.3	9.60 (25.39)	6.7	10.22 (23.33)	6.0	10.00 (24.30)
5	Imidacloprid 17.8 SL (FS)	5.4	8.47 (23.74)	6.5	9.78 (21.89)	6.1	9.2 (22.77)
6	T_1 followed by T_3	3.0	49.72 (44.81)	3.8	48.89 (43.12)	3.4	49.3 (43.94)
7	T_1 followed by T_4	3.2	45.20 (42.19)	4.2	44.44 (43.69)	3.7	44.8 (43.04)
8	T_1 followed by T_5	3.1	48.02 (43.85)	3.7	43.56 (44.02)	3.7	45.5 (43.99)
9	T_2 followed by T_3	3.2	46.33 (42.81)	3.8	43.67 (43.22)	3.7	44.3 (43.07)
10	T_2 followed by T_4	3.0	48.59 (44.15)	3.6	43.11 (44.33)	3.7	45.5 (44.25)
11	T_2 followed by T_5	3.1	46.89 (43.02)	3.7	45.33 (43.37)	3.6	46.0 (43.23)
12	Untreated control	5.9	0.00 (0.00)	7.1	0.00 (0.00)	6.7	
	SE.m±		2.23		2.22		1.78
	CD (5%)		6.77		6.73		5.41
	CV (%)		6.37		6.55		5.18

Figures in parathensis are angular transformed values
ST : Seed treatment; DAS : Days after treatment; FS : Foliar spray

Efficacy of different insecticides as foliar spray against leafhopper damage in groundnut

S. No.	Treatments	7 Days after spraying		14 Days after spraying		Percent mean reduction	
		Per cent damage	Per cent reduction over untreated control	Per cent damage	Per cent reduction over untreated control	Per cent damage	Per cent reduction over untreated control
1	Imidacloprid 600 FS (ST)	4.7	44.12^{e} (41.60)	5.6	42.47 (40.65)	5.2	43.3^{d} (41.14)
2	Thiamethoxam 30 FS (ST)	4.6	45.49^{d} (42.38)	5.7	41.44 (40.07)	5.0	44.8^{d} (42.01)
3	Thiamethoxam 25 WDG (FS)	2.8	64.71^{b} (53.56)	3.9	52.40^{bc} (46.38)	3.3	58.9^{c} (50.11)
4	Monocrotophos 36 SL (FS)	3.2	61.96^{c} (51.92)	4.5	52.05^{bc} (46.18)	3.9	57.8^{cd} (49.47)
5	Imidacloprid 17.8 SL (FS)	3.1	66.67^{b} (54.71)	4.4	54.45^{bc} (47.54)	3.8	63.4^{b} (52.79)
6	T_1 followed by T_3	2.5	70.59^{a} (57.14)	3.6	63.00^{a} (52.54)	3.1	66.5^{a} (54.66)
7	T_1 followed by T_4	3.3	65.10^{b} (53.79)	4.5	57.86^{b} (48.32)	3.9	57.0^{cd} (49.04)
8	T_1 followed by T_5	3.2	64.31^{b} (53.29)	4.6	55.82^{b} (48.34)	3.9	57.2^{cd} (49.15)
9	T_2 followed by T_3	3.0	65.10^{b} (53.76)	4.4	56.51^{b} (48.73)	3.7	59.8^{c} (50.64)
10	T_2 followed by T_4	3.2	64.71^{b} (53.55)	4.6	56.13^{b} (50.33)	3.8	57.2^{cd} (49.14)
11	T_2 followed by T_5	3.3	65.49^{b} (53.99)	4.5	59.25^{b} (49.52)	3.9	57.6^{cd} (49.37)
12	Untreated control	8.5	0.00	9.7	0.00	9.1	
	SE.m±		1.15		0.90		0.73
	CD (5%)		3.50		2.73		2.20
	CV(%)		2.46		2.11		1.64

Figures in parathensis are angular transformed values
ST : Seed treatment; DAS : Days after treatment; FS : Foliar spray

Foliar damage due to thrips after spray

Effect of foliar spray on incidence of thrips in groundnut crop is presented in table 2. Highest per cent reduction in foliar damage due to thrips was recorded in imidacloprid 600 FS seed treatment + imidacloprid 17.8 SL spray (T_8) followed by imidacloprid 600 FS seed treatment + thiamethoxam 25 WDG spray (T_6) with 70.48 and 68.73 per cent over untreated control. Foliar damage by thrips at 14 days after spraying was ranged from 8.2 to 19.80 per cent, the highest per cent reduction in thrips damage was recorded in T_8 (imidacloprid 600 FS seed treatment + imidacloprid 17.8 SL spray) and T_6 (imidacloprid 600 FS seed treatment+ thiamethoxam 25 WDG spray) with 60.54 and 59.19 per cent reduction over untreated control

From present study it was observed that the efficacy of seed treatment followed by sequential spray on groundnut, imidacloprid 600 FS seed treatment + imidacloprid 17.8 SL spray (T_8) and imidacloprid 600 FS seed treatment+ thiamethoxam 25 WDG spray (T_6) were the best treatments with 64.3 and 63.9 per cent reduction over control and the treatments were statistically at par with each other because of seed treatment at the sowing and foliar spray of insecticides at 35 DAS which shown better protection than the untreated control.

Pandiyan (2020) also reported that imidacloprid 17.8 SL @ 200 ml ha^{-1} was found to be effective in reducing thrips damage (16%) followed by thiamethoxam 25WG @ 200 g ha^{-1} (18%) as against 33% in untreated control. Khanpara *et al*. (2016) reported that spray of imidacloprid 200 SL @ 125 ml ha^{-1} or thiamethoxam 25 WG @ 200 g ha^{-1} or acephate 75 % SP @ 500 gm ha-1 at 15 days interval after initiation of pests were the most effective against thrips in groundnut.

Foliar damage due to leafhoppers at various intervals of seed treatment

Foliar damage at 28 Days After Seed Treatment

Leafhopper damage was absent during 14 and 21 days after seed treatment in all the treatments including untreated control due to weather conditions. Foliar damage due to leafhoppers was ranged from 3.0 to 5.9 per cent. The seed treatments with imidacloprid (T_1, T_6, T_7, T_8) and thiamethoxam (T_2, T_9, T_{10} ,T_{11}) recorded the lowest foliar damage compared recorded the lowest foliar damage compared to the treatments without seed treatment (T_3, T_4, T_5, T_{12}).The highest per cent reduction over control was observed in plots treated with imidacloprid 600 FS @ 2 ml/kg seed and thiamethoxam 70 WP @ 2ml kg^{-1} seed with 49.72, 49.15, 48.59, 48.02, 46.89, 46.33 and 45.20 per cent reduction over control, respectively and all treatments were on par with each other. The treatments T_3, T_4 and T_5 which are untreated with insecticides showed similar pest incidence as of control.

Foliar damage 35 Days After Seed Treatment

Foliar damage at 35 days after treatment was ranged from 3.6 to 7.1 per cent. imidacloprid and thiamethoxam treated plots offered protection against leafhoppers. The highest per cent reduction over control was observed in plots treated with imidacloprid 600 FS @ 2 ml/kg seed and thiamethoxam 30 FS @ 2ml/kg seed with 48.89, 46.58, 46.12, 45.66 and 45.21 per cent reduction over control, respectively and all treatments were at par with each other.

Foliar damage due to leafhoppers after spraying

Foliar damage due to leaf hoppers at 7 days after spraying was recorded from 2.8 to 8.5 per cent. The highest per cent reduction over control was recorded in plots treated with imidacloprid 600 FS seed treatment + thiamethoxam 25 WDG spray (T_6) was the best treatment with 70.59 per cent reduction over control. Foliar damage at 14 days after spraying was recorded from 3.6 to 9.7 per cent. The highest per cent increase in reduction over control among combination of seed treatment and spraying was recorded in plots treated with imidacloprid 600 FS seed treatment + thiamethoxam 25 WDG spray (T_6) with 63.0 per cent reduction over control.

The present studies are also in confirmation with the finding of Baraiay and Vyas (2002) who reported that imidacloprid 0.006 per cent as foliar spray found to be effective against *Empoasca keri* Pruthi in groundnut with moderately economic. Application of imidacloprid 17.8 SL @ 0.5 ml l^{-1} was found superior over the other treatments with higher per cent reduction (85.21 per cent) of leafhoppers followed by thiamethoxam 25 WG @ 0.3 g l^{-1} on okra (Hemadri *et al*., 2018).

Among the different treatments, seed treated with imidacloprid 600 FS was found to be more effective in reduction of the thrips and leafhopper damage by followed by thiamethoxam 30 FS. At 35 days after sowing the plots treated with (T_8) imidacloprid 600 FS seed treatment + imidacloprid 17.8 SL spray and imidacloprid 600 FS seed treatment + thiamethoxam 25 WDG (T_6) spray were the next best treatments with 64.3 and 63.9 per cent reduction over control against thrips and for leafhoppers the plots treated with imidacloprid 600 FS seed treatment + thiamethoxam 25 WDG spray (T_6) and imidacloprid 17.8 SL spray (T_5) were the best treatments with 66.5 and 63.4 per cent reduction over control.

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