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Evaluation of Different Doses of Diafenthiuron 47.8 Sc Against Sucking Pests of Cotton

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ABSTRACT

The present experiments were conducted to evaluate the bio efficacy of different doses of Diafenthiuron 47.8 SC as foliar application against sucking pests of cotton crop along with standard checks i.e. Diafenthiuron 50% WP @ 600g, Imidacloprid 17.8 % SL @ 125 ml, Acetamiprid 20 % SP@ 100 g ha^{-1} at Agricultural Research Station-Borwat Farm, Banswara (Rajasthan) during *kharif* 2017 and 2018. Among the different treatments, the maximum per cent reduction of 86.05 and 82.33 and 86.83 and 81.06 was recorded in Diafenthiuron 47.8 SC @ 300 g a.i. ha^{-1} at 10 days after second spray against whiteflies and jassids during 2017 and 2018, respectively and it was statistically at par with its lower dose i.e. Diafenthiuron 47.8 SC @ 250 g a.i. ha^{-1}. Diafenthiuron 50 WP @ 300g a.i. ha^{-1} was found to be the next best treatment. There were no symptoms of phytotoxicity observed on spraying the crop with higher dose of the chemical.

Keywords Efficacy, Diafenthiuron 47.8 SC, Acetamiprid 20% SP, Cotton, Sucking pests.

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INTRODUCTION

Cotton (*Gossypium* spp.) that is also known as ''White gold'' is one of the important cash crops in tropical and sub-tropical regions of the world. It provides more than 65% of raw material for the textile industry and plays an important role in the agricultural and industrial economy. Even though India has the largest area under cotton cultivation in the world but its productivity is very low. One of the major reasons for low productivity in cotton is damage by insect pests (Agrawal *et al*. 1984). Cotton ecosystem harbours a lot of insect pests. The number of insect pests in the crop may range from a few hundred to more than thousands (Matthews and Tunstall 1994). To protect the crop from these insect pests, a number of insecticides are freely sprayed upon. Rigorous use of insecticides has resulted in insect resistance to insecticides, pesticide residues, and resurgence of minor pests and has caused immense problems to cultivators. To overcome these problems, various new chemistry molecules are on the scene, whose periodical evaluation for their comparative efficacy, specificity, selectivity and economics of control operations is essential.

MATERIALS AND METHODS

The field experiments were conducted at Agricultural Research Station-Borwat Farm, Banswara (Rajasthan) during *kharif*-2017 and 2018 to evaluate the efficacy of different doses of Diafenthiuron 47.8 SC as foliar spray against major insect pests of cotton. The trial was laid out in Randomized Block Design (RBD) with three replications and eight treatments.

The treatments taken were Diafenthiuron 47.8 SC @ 400, 500, 600g; Diafenthiuron 50% WP @ 600g; Imidacloprid 17.8 % SL @ 125ml; Acetamiprid 20 % SP@ 100g; untreated check and Diafenthiuron 47.8 SC @ 1200 g ha^{-1} (only for phytotoxicity treatment). The seed of Bt cotton hybrid (Jai Bt) were dibbled at 90 × 45 cm spacing. The plot size was kept 6.0 × 5.0 m. All recommended package and practices were followed to raise the crop, except plant protection measures.

Observations on pest incidence were recorded from five fixed plants/plot which were tagged after selecting randomly for this purpose. The number of sucking pests namely, jassids (*Amrasca biguttula biguttula*) and whiteflies (*Bemisia tabaci*) were recorded from 3 leaves per plant before spray and 7 days after spray. The seed cotton yield was recorded plot wise at harvest and it was converted into kg ha^{-1} for analysis and comparison.

The per cent reduction in population of insect pests vis-a-vis control was computed using the method described by Henderson and Tilton (1955):

$$\text{Percent reduction in population} = 100 \times \left[1 - \frac{T_a \times C_b}{T_B \times Ca} \right]$$

Where, T_a = Number of insects after treatment
T_b = Number of insects before treatment
C_a = Number of insects in untreated check after treatment
Cb = Number of insects in untreated check before treatment

The reduction percentage figures were transformed into arc sine values and subjected to analysis of variance. The seed cotton yield was recorded plot wise at harvest and it was converted into kg ha^{-1} for analysis and comparison. The visual observations on the phytotoxicity to the crop was rated using the criteria developed by Clay and Davison (1978) on a scale of 0-10 where; 0 represents no injury and 10 represents dead plants. The observations on the phytotoxicity symptoms viz. leaf injury, wilting, stunting, vein clearing, necrosis, chlorosis, epinasty and hyponasty on crop due to application Diafenthiuron 47.8 SC @ 1200 g ha^{-1} were recorded at 1, 3, 5, 7, 10 and 15 days after spray using the scores shown in Table 1.

Table 1. Phytotoxicity rating.

Score	Percent crop affected	Score	Percent crop affected
0	No. adverse effect	6	51-60
1	1-10	7	61-70
2	11-20	8	71-80
3	21-30	9	81-90
4	31-40	10	91-100
5	41-50		

RESULTS AND DISCUSSION

The efficacy of different doses of Fipronil 5% + Buprofezin 20% SC @ 750, 1000, 1250 and 1500 ml a.i. ha^{-1} along with standard checks Fipronil 5% SC @ 2000 ml a.i. ha^{-1}, Buprofezin 25% SC @ 1000 ml a.i. ha^{-1} and Chlorpyriphos 50% + Cypermethrin 5% EC @ 1000 ml a.i. ha^{-1} were evaluated against major insect pests of cotton under field condition at Agricultural Research Station- Borwat Farm (Banswara) during the year 2016 and 2017, the results of which are summarized in Tables 2-6.

Bio-efficacy of Diafenthiuron 50% WP against whiteflies, *Bemisia tabaci* (Genn.)

During the year 2017, the pre-treatment population of whiteflies in all the treatments was statistically at par and was in the range of 18.00 to 20.33/3 leaves. The maximum reduction in the whiteflies population with a mean of 60.27, 69.35, 77.20 and 84.31% was recorded in Diafenthiuron 47.8 SC @ 300 g a.i. ha^{-1} at 3, 5, 7 and 10 days after first spray, respectively and statistically at par with its lower dose i.e. Diafenthiuron 47.8 SC @ 250 g.a.i. ha^{-1}. Diafenthiuron 50 WP @ 300g a.i. ha^{-1} was found the next best treatment. Whereas, minimum per cent reduction in whiteflies population with mean of 45.37, 51.67, 57.20 and 60.44 was recorded in Imidacloprid 17.8 SL @ 25 ml a.i. ha^{-1} at 3, 5, 7 and 10 days after first spray, respectively. The similar trend was also observed in second spray at 3, 5, 7 and 10 days after spray (Table 2).

During the year 2018, the pre-treatment population of whiteflies was uniform and no significant difference was observed among the treatments/plots with respect to number of 22.67 to 24.67 per three

Table 2. Bio efficacy of different insecticides against whiteflies during *kharif*-2017.

Treatments and Dosage	Dose g a.i./ha	PTP*	Mean reduction in population (%) of whiteflies							
			1st spray				2nd spray			
			3 DAS	5 DAS	7 DAS	10 DAS	3 DAS	5 DAS	7 DAS	10 DAS
T_1 = Diafenthiuron 47.8% SC	200g	18.33	44.38 (48.92)	48.85 (56.69)	53.12 (63.98)	54.96 (67.04)	46.43 (52.49)	50.75 (59.97)	54.28 (65.91)	56.74 (69.93)
T_2= Diafenthiuron 47.8% SC	250g	20.00	49.32 (57.52)	54.69 (66.60)	59.89 (74.83)	63.89 (80.64)	51.84 (61.82)	57.05 (70.41)	61.89 (77.79)	64.50 (81.46)
T_3 = Diafenthiuron 47.8% SC	300g	20.33	50.93 (60.27)	56.38 (69.35)	61.48 (77.20)	66.66 (84.31)	53.56 (64.72)	59.28 (73.91)	64.14 (80.98)	68.06 (86.05)
T_4 = Diafenthiuron 50 % WP	300g	18.00	44.74 (49.55)	49.95 (58.60)	54.47 (66.23)	57.55 (71.21)	47.17 (53.78)	52.50 (62.94)	56.51 (69.56)	58.71 (73.03)
T_5 = Imidacloprid 17.8 % SL	25ml	19.00	42.34 (45.37)	45.96 (51.67)	49.14 (57.20)	51.03 (60.44)	44.36 (48.89)	49.28 (57.44)	50.68 (59.85)	53.10 (63.94)
T_6 = Acetamiprid 20 % SP	20g	18.67	44.58 (49.28)	49.12 (57.17)	53.18 (64.08)	56.99 (70.32)	46.55 (52.71)	51.29 (60.89)	54.45 (66.19)	57.29 (70.79)
T_7 = Untreated check	-	20.33	-	-	-	-	-	-	-	-
SEm ±	-	1.79	1.53	1.65	2.00	1.53	1.56	1.77	2.22	
CD at 5%		NS	5.34	4.56	4.93	5.98	4.55	4.67	5.27	6.63

* Pre-treatment population/3leaves, Figures in parenthesis are retransformed per cent values, DAS= Day/days after spray, NS=Non-significant.

leaves before first spray. The maximum reduction in the whitefly population with a mean of 63.17, 68.68, 76.18 and 81.80% was recorded in Diafenthiuron 47.8 SC @ 300 g a.i. ha^{-1} at 3, 5, 7 and 10 days after first spray, respectively and was statistically at par with its lower dose i.e. Diafenthiuron 47.8 SC @ 250 ga.i. ha^{-1}. Diafenthiuron 50 WP @ 300g a.i. ha^{-1} was found as the next best treatment. Whereas, minimum per cent reduction in whiteflies population with mean of 47.54; 54.29; 58.97 and 61.88 was recorded in Imi-

Table 3. Bio efficacy of different insecticides against whiteflies during *kharif*-2018.

Treatments and Dosage	Dose g a.i./ha	PTP*	Mean reduction in population (%) of whiteflies							
			1st spray				2nd spray			
			3 DAS	5 DAS	7 DAS	10 DAS	3 DAS	5 DAS	7 DAS	10 DAS
T_1 = Diafenthiuron 47.8% SC	200g	22.67	46.01 (51.75)	49.16 (57.24)	51.84 (61.82)	53.51 (64.64)	47.56 (54.46)	50.17 (58.97)	52.78 (63.41)	54.46 (66.21)
T_2= Diafenthiuron 47.8% SC	250g	23.33	50.52 (59.57)	53.19 (64.67)	58.21 (72.24)	61.99 (77.95)	52.08 (62.22)	54.93 (66.99)	58.49 (72.69)	62.17 (78.21)
T_3 = Diafenthiuron 47.8% SC	300g	23.33	52.64 (63.17)	55.97 (68.68)	60.79 (76.18)	64.75 (81.80)	53.79 (65.10)	57.33 (70.85)	60.96 (76.43)	65.14 (82.32)
T_4 = Diafenthiuron 50 % WP	300g	24.00	47.57 (54.48)	50.21 (59.05)	53.72 (64.98)	56.56 (69.63)	49.05 (57.04)	51.86 (61.87)	55.00 (67.10)	57.52 (71.17)
T_5 = Imidacloprid 17.8 % SL	25ml	22.67	43.59 (47.54)	47.46 (54.29)	50.17 (58.97)	51.87 (61.88)	45.21 (50.37)	47.88 (55.02)	49.56 (57.92)	51.30 (60.90)
T_6 = Acetamiprid 20 % SP	20g	24.33	46.04 (51.82)	49.61 (58.01)	53.07 (63.90)	56.34 (69.27)	48.46 (56.03)	51.52 (61.28)	54.05 (65.53)	57.50 (71.13)
T_7 = Untreated check	-	24.67	-	-	-	-	-	-	-	-
SEm ±		-	1.42	1.73	1.72	1.68	1.54	1.60	1.89	1.86
CD at 5%		NS	4.23	5.18	5.13	5.98	4.61	4.76	4.63	4.65

* Pre-treatment population/3leaves, Figures in parenthesis are retransformed per cent values, DAS= Day/days after spray, NS=Non-significant.

Table 4. Bio efficacy of different insecticides against jassids during *kharif*-2017.

Treatments and Dosage	Dose g a.i./ha	PTP*	Mean reduction in population (%) of jassids							
			1st spray				2nd spray			
			3 DAS	5 DAS	7 DAS	10 DAS	3 DAS	5 DAS	7 DAS	10 DAS
T_1 = Diafenthiuron 47.8% SC	200g	12.67	43.08 (46.66)	47.83 (54.93)	50.73 (59.93)	54.37 (66.07)	44.01 (48.27)	48.18 (55.54)	51.88 (61.89)	55.52 (67.95)
T_2= Diafenthiuron 47.8% SC	250g	14.00	48.10 (55.40)	53.67 (64.91)	59.72 (74.57)	64.72 (81.76)	49.42 (57.69)	55.77 (68.36)	61.95 (77.89)	66.55 (84.16)
T_3 = Diafenthiuron 47.8% SC	300g	13.33	49.11 (57.15)	54.83 (66.83)	61.69 (77.52)	67.08 (84.83)	50.48 (59.51)	57.16 (70.59)	63.22 (79.70)	68.72 (86.83)
T_4 = Diafenthiuron 50 % WP	300g	14.67	45.98 (51.71)	51.37 (61.03)	56.02 (68.77)	59.62 (74.42)	46.46 (52.55)	51.34 (60.97)	56.18 (69.03)	59.47 (74.20)
T_5 = Imidacloprid 17.8 % SL	25ml	13.67	42.73 (46.35)	46.26 (52.20)	49.92 (58.54)	52.28 (62.57)	43.13 (46.73)	47.13 (53.71)	50.65 (59.79)	52.89 (63.59)
T_6 = Acetamiprid 20 % SP	20g	15.00	45.68 (51.18)	49.82 (58.38)	54.40 (66.12)	57.97 (71.87)	46.41 (52.46)	51.31 (60.92)	55.76 (68.34)	58.98 (73.45)
T_7 = Untreated check	-	14.67	-	-	-	-	-	-	-	-
SEm ±			1.42	1.70	1.73	1.79	1.29	1.13	1.16	1.15
CD at 5%			4.23	5.07	5.16	5.35	3.84	3.38	3.45	3.43

* Pre-treatment population/3leaves, Figures in parenthesis are retransformed per cent values, DAS= Day/days after spray, NS=Non-significant.

dacloprid 17.8 SL @ 25 ml a.i. ha^{-1} at 3, 5, 7 and 10 days after first spray, respectively. The similar trend was also observed in second spray at 3, 5, 7 and 10 days after spray (Table 3).

Bio-efficacy of Diafenthiuron 50% WP against jassids, *Amrasca biguttula biguttula* (Ishida)

During the year 2017, the pre-treatment population of jassids was uniform and no significant difference was observed among the treatments/plots (12.67 to 15.00 per three leaves before first spray). The maximum reduction in the jassids population with a mean of 57.15, 66.83, 77.52 and 84.83% was recorded in Diafenthiuron 47.8 SC @ 300 g a.i. ha^{-1} at 3, 5, 7 and 10 days after first spray, respectively and was statistically at par with its lower dose i.e. Diafenthiuron 47.8 SC @ 250 ga.i. ha^{-1}. Diafenthiuron 50 WP @ 300g a.i. ha^{-1} was found the next best treatment. Whereas, minimum per cent reduction in jassids population with mean of 46.35, 52.20, 58.54 and 62.57 was recorded in Imidacloprid 17.8 SL @ 25 ml a.i. ha^{-1} at 3, 5, 7 and 10 days after first spray, respectively. The similar trend was also observed in second spray at 3, 5, 7 and 10 days after spray (Table 4).

During the year 2018, the pre-treatment population of jassids did not vary significantly in all the plots (11.33 to 13.67 per three leaves). The maximum reduction in the jassids population with a mean of 58.34, 68.73, 76.64 and 83.35% was recorded in Diafenthiuron 47.8 SC @ 300 g a.i. ha^{-1} at 3, 5, 7 and 10 days after first spray, respectively and was statistically at par with its lower dose i.e. Diafenthiuron 47.8 SC @ 250 ga.i. ha^{-1}. Diafenthiuron 50 WP @ 300g a.i. ha^{-1} was found next best treatment. Whereas, minimum percent reduction in jassids population with mean of 46.51, 53.63, 58.17 and 61.65 was recorded in Imidacloprid 17.8 SL @ 25 ml a.i. ha^{-1} at 3, 5, 7 and 10 days after Ist spray, respectively. The similar trend was also observed at 3, 5, 7 and 10 days after second spray (Table 5).

Phytotoxicity of Diafenthiuron 47.8 % SC on cotton

There were no visual symptoms of phytotoxicity on cotton at 1, 3, 5, 7, 10 and 15 days after spraying the test doses of Diafenthiuron 47.8 % SC @ 300 and 600 g a.i. ha^{-1}

Effect on seed cotton yield (kg ha^{-1})

The maximum seed cotton yield of 1206 and 2156

Table 5. Bio efficacy of different insecticides against jassids during *kharif*-2017.

Treatments & Dosage	Dose g a.i./ha	PTP*	Mean reduction in population (%) of jassids							
			1st spray				2nd spray			
			3 DAS	5 DAS	7 DAS	10 DAS	3 DAS	5 DAS	7 DAS	10 DAS
T_1 = Diafenthiuron 47.8% SC	200g	13.00	43.52 (47.42)	47.87 (55.01)	51.17 (60.68)	52.73 (63.33)	43.08 (46.65)	46.93 (53.37)	52.96 (63.71)	55.12 (67.29)
T_2= Diafenthiuron 47.8% SC	250g	11.33	48.84 (56.68)	54.85 (66.85)	59.30 (73.93)	63.60 (80.23)	48.35 (55.84)	53.62 (64.82)	58.15 (72.15)	62.22 (78.27)
T_3 = Diafenthiuron 47.8% SC	300g	12.33	49.80 (58.34)	56.00 (68.73)	61.16 (76.74)	65.92 (83.35)	49.34 (57.54)	54.73 (66.66)	60.30 (75.45)	64.20 (81.06)
T_4 = Diafenthiuron 50 % WP	300g	12.67	46.30 (52.26)	51.80 (61.76)	56.33 (69.26)	57.80 (71.61)	46.33 (52.33)	48.73 (56.50)	54.05 (65.53)	57.63 (71.33)
T_5 = Imidacloprid 17.8 % SL	25ml	13.67	43.00 (46.51)	47.08 (53.63)	49.70 (58.17)	51.74 (61.65)	42.59 (45.80)	45.02 (50.04)	48.89 (56.77)	51.09 (60.54)
T_6 = Acetamiprid 20 % SP	20g	13.67	45.58 (51.02)	50.88 (60.19)	56.05 (68.80)	56.87 (70.13)	45.16 (50.28)	48.27 (55.70)	53.31 (64.30)	56.70 (69.85)
T_7 = Untreated check	-	14.00	-	-	-	-	-	-	-	-
SEm. ±	-	-	1.75	1.37	1.63	1.09	1.44	1.34	1.31	1.38
CD at 5%	-	NS	5.23	4.09	4.87	3.25	4.30	4.01	3.91	4.11

* Pre-treatment population/3leaves, Figures in parenthesis are retransformed per cent values, DAS= Day/days after spray, NS=Non-significant.

kg ha^{-1} was recorded in Diafenthiuron 47.8 % SC @ 300 g a.i. ha^{-1} during the year 2017 and 2018, respectively. It was statistically at par with its lower doses i.e. Diafenthiuron 47.8 SC @ 250 g a.i. ha^{-1} during both the years. Whereas, minimum seed cotton yield of 601 and 1324 kg ha^{-1} was recorded in untreated check during 2017 and 2018, respectively (Table 6).

In the present study, two doses of Diafenthiuron 47.8 % SC i.e. 300 and 250 g a.i. ha^{-1} were found very effective in controlling the population of jassids and whiteflies with highest seed cotton yield and were statistically at par. The present findings are in close conformity with the findings of Zala *et al.* (2014) who reported that diafenthiuron 50 WP @ 300 g a. i. ha^{-1} was found highly effective in reducing the population of sucking pest in cotton followed by imidacloprid 17.8 SL @ 20 g a.i. ha^{-1}. The seed cotton yield was also recorded to be significantly highest in diafenthiuron 50 WP @ 300 g a.i. ha^{-1} (32.5 q ha^{-1}) followed by imidacloprid 17.8 SL @ 20 g a.i./ha (30.2 q/ ha^{-1}) and diafenthiuron 50 WP @ 250 g a.i. ha^{-1} (30.1 q ha^{-1}). Kumar *et al.* (2015) also reported that diafenthiuron was the most effective insecticide with 77.84% reduction of leafhoppers population with highest yield (2227 kg ha^{-1}) followed by imidacloprid 70% WG,

Table 6. Seed cotton yield (kg ha^{-1}) in different treatments.

Sl. No.	Treatments	Dose g a.i./ha	Formulation (ml or ha^{-1})	Seed cotton yield (kg ha^{-1})		
				2017	2018	Mean
1	T_1 = Diafenthiuron 47.8% SC	200g	400	978	1766	1372
2	T_2= Diafenthiuron 47.8% SC	250g	500	1109	1920	1514
3	T_3 = Diafenthiuron 47.8% SC	300g	600	1206	2156	1691
4	T_4 = Diafenthiuron 50 % WP	300g	600	970	1745	1358
5	T_5 = Imidacloprid 17.8 % SL	25ml	125	821	1612	1217
6	T_6 = Acetamiprid 20 % SP	20g	100	939	1869	1404
7	T_7 = Untreated check	-	-	601	1324	963
	SEm ±			231.09	403.00	-
	CD at 5%			219	382	-
	CV%			13.03	12.14	-

fipronil, buprofezin and acephate. Similar trend regarding the efficacy of diafenthiuron and buprofezin against sucking pests in cotton and other crops has also been reported by Bajya *et al.* (2016), Sathyan *et al.* (2016), Jadhav *et al*. (2017), Nemade *et al.* (2017), Mahalakshmi *et al*. (2018) and Binu (2019).

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