



Research Article

EVALUATION OF SOLOMON 300 OD AGAINST JASSID AND WHITEFLY ON COTTON

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Abstract: A Field experiment was undertaken at Agricultural Research Station, Sriganaganagar, SKRAU, Bikaner (during *Kharif*, 2014 and 2015) to evaluate the efficacy of newer insecticides against the important sucking pests of cotton viz., jassid and whitefly on cotton. The insecticides viz., Solomon 300 OD (betacyfluthrin 9% + imidacloprid 21% w/v OD) @ 150, 175 & 200 ml ha⁻¹, Confidor 200 SL (imidacloprid 17.8 % SL) @ 125 & 210 ml ha⁻¹, betacyfluthrin 2.45 % SC @ 750 ml ha⁻¹, Indoxacarb 14.5 % + Acetamiprid 7.7 % SC @ 750 ml ha⁻¹ and Deltamethrin 1% + Triazophos 35 % EC @ 1250 ml ha⁻¹ were applied two times during both the seasons. The results revealed that, application of Solomon 300 OD @ 200 ml/ha was found more effective followed by Solomon 300 OD @ 175 ml/ha and 150 ml/ha in terms of percent population reduction of jassid and whitefly. Maximum seed cotton yield was obtained by the application of Solomon 300 OD @ 200 ml/ha followed by Solomon 300 OD @ 200 ml/ha while it was obtained minimum in the application of Betacyfluthrin 2.45% SC @750 ml/ha.

Keywords: Solomon, Cotton, Jassid, Population, Yield

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Introduction

Cotton (*Gossypium hirsutum* Linn.) is an important commercial fibre crop of India and it plays a key role in national economy. In India, different stages of cotton have been attacked by 162 species of insect pests. Out of these, sucking pests requires necessary monitoring and interventions with insecticides in the early stage of the crop [1]. The sucking pest complex comprising of jassids, whitefly and thrips are key production constraints and cause serious economic losses in cotton ecosystem [2]. The estimated loss due to sucking pests is up to 21.20 percent [3]. Cotton growers in India mainly depend on synthetic insecticides to control sucking pests. Due to continuous and indiscriminate use of these insecticides, it causes resistance, resurgence and pest outbreak like serious problems and hence to overcome such type of problems discovery of novel molecules with different mode of action are needed. Novel molecules are requiring at low doses and have less exposure in the environment. Keeping these in view present studies were undertaken to compare efficacy of application of Solomon and conventional insecticides on sucking insect pests on cotton.

Material and Methods

A field experiment was conducted to evaluate the efficacy of Solomon 300 OD (Betacyfluthrin 9% + Imidacloprid 21%) on cotton crop against major sucking pests of cotton during *Kharif*, 2014 and 2015 at ARS, Sriganaganagar (SKRAU, Bikaner). The experiment was laid out in randomized block design including control there were nine treatments and each treatment was replicated thrice with plot size of 4.05 x 6.0 m². The cotton variety RST-9 was sown on 21st May, 2014 and 19th May, 2015 during *Kharif*, 2014 and 2015, respectively. The row to row and plant to plant distance of 67.5 cm and 30 cm, respectively was maintained in both the seasons. Two applications of prescribed treatments were given at ETL by using knapsack sprayer. Pre and post treatment observations on sucking pests' population of jassid and whitefly were recorded on 3 leaves selected from top, mid and bottom of five randomly selected tagged plants in each plot on 3, 5, 7 and 10

days after spray. Seed cotton yield was also recorded at picking time. The population data were statistically analyzed by formula given by Henderson and Tilton (1955) [4]:

$$\text{Percentage reduction} = 100 [1 - T_a \times C_b / T_b \times C_a]$$

Where,

T_a = Number of insects after treatment

T_b = Number of insects before treatment

C_a = Number of insects in untreated control after treatment

C_b = Number of insects in untreated control before treatment

Results and Discussion

Jassid (*Amrasca biguttula biguttula*)

During *Kharif*, 2014

The data presented in [Table-1] showed that the maximum jassid population reduction was (75.57, 76.52, 73.11 and 67.59 % at 3rd, 5th, 7th and 10th days after first spray, while 77.23, 78.96, 73.36 and 67.61 % 3rd, 5th, 7th and 10th days after second spray) recorded in the treatment containing Solomon 300 OD (betacyfluthrin 9% + imidacloprid 21% w/v OD) @ 200 ml/ha, followed by Solomon 300 OD (betacyfluthrin 9% + imidacloprid 21% w/v OD) @ 175 ml/ha 150 ml/ha with (74.41, 75.50, 71.58 and 65.84 % at 3rd, 5th, 7th and 10th days after first spray, while 76.26, 77.06, 72.44 and 66.42 % 3rd, 5th, 7th and 10th days after second spray) and (72.53, 73.36, 69.29 and 62.95 % at 3rd, 5th, 7th and 10th days after first spray, while 74.37, 74.47, 70.50 and 64.12 % 3rd, 5th, 7th and 10th days after second spray) reduction, all the combination product gave higher percent reduction over solo molecule. The jassid population was remains below ETL level throughout whole crop season.

During *Kharif*, 2015

The data presented in [Table-1] revealed that maximum jassid population reduction was (74.34, 75.36, 72.08 and 65.86 % at 3rd, 5th, 7th and 10th days after

Table-1 Bio-efficacy of new insecticides against jassid on cotton during Kharif, 2014 and 2015 (First and Second spray)

S	Treatments	Dose ml/ha	Percent population reduction of jassid during <i>Kharif</i> , 2014										Percent population reduction of jassid during <i>Kharif</i> , 2015										Mean
			Days after first spray				Mean	Days after second spray				Mean	Days after first spray				Mean	Days after second spray					
			Three	Five	Seven	Ten		Three	Five	Seven	Ten		Three	Five	Seven	Ten		Three	Five	Seven	Ten		
1	Control	-	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00		
2	Solomon 300 OD	150	72.53 (58.40)	73.36 (59.00)	69.29 (56.35)	62.95 (52.49)	69.53	74.37 (59.57)	74.47 (59.75)	70.50 (57.10)	64.12 (53.20)	70.87	70.64 (57.25)	71.61 (57.87)	68.19 (55.67)	59.21 (50.33)	67.41	71.35 (57.62)	72.34 (58.27)	67.79 (55.42)	61.05 (51.39)		68.13
3	Solomon 300 OD	175	74.41 (59.61)	75.50 (60.31)	71.58 (57.76)	65.84 (54.22)	71.83	76.26 (60.83)	77.06 (61.40)	72.44 (58.32)	66.42 (54.58)	73.05	72.08 (58.08)	74.02 (59.41)	70.54 (57.11)	63.17 (52.63)	69.95	73.25 (58.85)	75.71 (60.51)	70.14 (56.87)	63.33 (52.73)		70.61
4	Solomon 300 OD	200	75.57 (60.36)	76.52 (60.99)	73.11 (58.74)	67.59 (55.31)	73.20	77.23 (61.49)	78.96 (62.70)	73.36 (59.07)	67.61 (55.31)	74.29	74.34 (59.72)	75.36 (60.34)	72.08 (58.12)	65.86 (54.28)	71.91	74.95 (59.97)	77.07 (61.44)	71.68 (57.88)	65.54 (54.09)		72.31
5	Confidor 200 SI	125	64.14 (53.19)	65.64 (54.10)	62.21 (52.07)	55.79 (48.32)	61.95	64.79 (53.59)	65.45 (54.01)	63.02 (52.55)	55.42 (48.10)	62.17	62.50 (52.28)	63.29 (52.71)	61.42 (51.60)	54.70 (47.71)	60.48	61.26 (51.50)	64.57 (53.47)	61.26 (51.49)	54.07 (47.33)		60.29
6	Confidor 200 SI	210	69.27 (56.32)	70.37 (57.00)	68.06 (55.56)	59.49 (50.48)	66.80	71.61 (57.79)	73.19 (58.89)	68.59 (55.90)	60.99 (51.34)	69.35	67.41 (55.52)	68.38 (55.84)	66.25 (54.50)	57.26 (49.18)	64.83	68.43 (55.80)	70.99 (57.47)	67.23 (55.06)	58.85 (50.08)		66.38
7	Betacyfluthrin 2.45 % SC	750	57.65 (49.38)	59.73 (50.60)	50.96 (45.53)	47.73 (43.68)	54.02	58.09 (49.62)	59.62 (50.56)	50.04 (45.00)	47.16 (43.31)	53.71	55.68 (48.27)	57.61 (49.39)	49.62 (44.76)	46.07 (42.71)	52.25	54.97 (47.84)	58.25 (49.74)	48.16 (43.92)	45.10 (42.17)		51.62
8	Indoxacarb 14.5% + Acetamiprid 7.7 %	500	71.45 (57.72)	72.55 (58.40)	69.21 (56.29)	63.19 (52.64)	69.10	72.62 (58.45)	73.57 (59.12)	67.86 (55.46)	63.27 (52.70)	70.08	69.07 (56.21)	69.55 (56.59)	67.08 (54.99)	61.70 (51.77)	66.85	69.51 (56.53)	73.03 (58.71)	65.26 (53.88)	61.41 (51.61)		67.30
9	Deltamethrin 1% + Acetamiprid 35%	1250	73.71 (59.22)	73.85 (59.35)	67.50 (55.37)	61.62 (51.75)	69.17	72.44 (58.49)	72.96 (58.84)	64.95 (53.95)	60.03 (50.80)	67.60	71.10 (57.58)	72.14 (58.17)	65.64 (54.10)	60.39 (51.05)	67.32	69.07 (56.26)	71.70 (57.87)	63.02 (52.53)	58.53 (50.01)		65.58
	S.Em±		1.66	1.99	2.24	1.58	-	1.96	1.87	2.49	1.78	-	2.55	1.36	1.81	2.20		1.96	1.98	1.85	3.06		
	CD at 5%		4.99	5.98	6.73	4.74	-	5.87	5.61	7.47	5.33	-	7.65	4.07	5.42	6.60		5.88	5.95	5.55	9.19		

Figures in parentheses are angular transformed values

Table-2 Bio-efficacy of new insecticides against whitefly on cotton during Kharif, 2014 and 2015 (First and Second spray)

S	Treatments	Dose ml/ha	Percent population reduction of whitefly during <i>Kharif</i> , 2014										Percent population reduction of whitefly during <i>Kharif</i> , 2015										Mean
			Days after first spray				Mean	Days after second spray				Mean	Days after first spray				Mean	Days after second spray					
			Three	Five	Seven	Ten		Three	Five	Seven	Ten		Three	Five	Seven	Ten		Three	Five	Seven	Ten		
1	Control	-	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	Solomon 300 OD	150	74.56 59.73	76.49 61.06	72.15 58.13	67.04 54.95	72.56	72.96 58.66	75.08 60.26	70.94 57.37	65.13 53.79	71.03	72.09 58.13	74.54 59.72	70.08 56.90	64.95 53.74	70.42	70.82 57.33	74.03 59.35	68.80 56.04	63.32 52.75	69.24	
3	Solomon 300 OD	175	76.91 61.29	78.73 62.53	74.64 59.74	69.30 56.33	74.90	75.53 60.39	78.40 62.29	73.79 59.20	67.65 55.37	73.84	74.42 59.64	76.63 61.12	72.75 58.53	67.43 55.20	72.81	73.34 58.90	76.61 61.11	70.87 57.32	65.75 54.21	71.64	
4	Solomon 300 OD	200	77.74 61.89	79.61 63.17	75.88 60.62	70.75 57.31	76.00	76.90 61.26	79.18 62.84	74.95 59.95	69.31 56.34	75.09	75.83 60.60	77.56 61.71	74.32 59.58	68.75 56.01	74.12	74.73 59.87	77.65 61.86	71.88 58.11	67.52 55.31	72.95	
5	Confidor 200 SI	125	65.56 54.08	67.06 54.96	63.67 52.92	57.97 49.57	63.57	64.76 53.59	65.86 54.23	62.56 52.26	56.52 48.73	62.43	63.51 52.91	64.99 53.74	61.75 51.80	55.76 48.29	61.50	62.58 52.31	63.67 52.95	60.64 51.14	54.43 47.53	60.33	
6	Confidor 200 SI	210	71.29 57.59	73.95 59.94	70.61 57.15	65.44 53.98	70.32	69.87 56.69	72.78 58.55	68.56 55.88	63.92 53.07	68.78	69.37 56.44	71.90 57.98	68.74 56.03	63.52 52.87	68.38	67.72 55.36	70.87 57.32	66.47 54.61	61.82 51.82	66.72	
7	Betacyfluthrin 2.45 % SC	750	60.26 50.97	61.61 51.79	55.97 48.47	48.17 43.93	56.50	59.91 50.74	60.89 51.30	54.86 47.77	46.82 43.15	55.62	58.54 49.93	59.57 50.50	53.98 47.29	46.43 42.93	54.63	57.64 49.44	58.47 49.87	52.64 46.50	44.43 41.77	53.30	
8	Indoxacarb 14.5% + Acetamiprid 7.7 %	500	72.57 58.40	74.91 59.94	71.68 57.88	66.29 54.50	71.36	70.63 57.19	73.65 59.13	70.05 56.87	64.07 53.18	69.60	70.28 56.95	72.92 58.62	69.74 56.66	64.47 53.40	69.35	68.78 56.03	71.73 57.89	68.12 55.73	62.15 52.02	67.70	
9	Deltamethrin 1% + Acetamiprid 35%	1250	73.62 59.11	75.79 60.54	69.53 56.48	63.75 52.98	70.67	71.92 58.02	74.47 59.68	67.35 55.22	62.15 52.06	68.97	71.70 58.04	73.73 59.27	67.77 55.51	61.52 51.74	68.68	69.76 56.73	72.56 58.71	65.29 54.02	60.07 50.81	66.92	
	S.Em±		1.93	1.95	2.18	1.59	-	1.90	1.93	1.75	1.81	-	2.85	1.72	3.03	2.23	-	2.24	2.46	2.85	2.24	-	
	CD at 5%		5.78	5.86	6.55	4.78	-	5.69	5.79	5.24	5.43	-	8.55	5.17	9.08	6.70	-	6.71	7.36	8.55	6.74	-	

Figures in parentheses are angular transformed values

first spray, while 74.95, 77.07, 71.68 and 65.54 % 3rd, 5th, 7th and 10th days after second spray) recorded in the treatment containing Solomon 300 OD (betacyfluthrin 9% + imidacloprid 21% w/v OD) @ 200 ml/ha, followed by Solomon 300 OD (betacyfluthrin 9% + imidacloprid 21% w/v OD) @ 175 ml/ha and 150 ml/ha with (72.08, 74.02, 70.54 and 63.17 % at 3rd, 5th, 7th and 10th days after first spray, while 73.25, 75.71, 70.14 and 63.33 % 3rd, 5th, 7th and 10th days after second spray) and (70.64, 71.61, 68.19 and 59.21 % at 3rd, 5th, 7th and 10th days after first spray, while 71.35, 72.34, 67.79 and 61.05 % 3rd, 5th, 7th and 10th days after second spray) reduction, all the combination product gave higher percent reduction over solo molecule.

White Fly (*Bemisia tabaci*)

During Kharif, 2014

The data presented in [Table-2] showed that all the treatment found superior over the control, maximum whitefly population reduction was (77.74, 79.61, 75.88 and 70.75 % at 3rd, 5th, 7th and 10th days after first spray and 76.90, 79.18, 74.95 and 69.31 % at 3rd, 5th, 7th and 10th days after second spray) recorded from treatment having Solomon 300 OD (betacyfluthrin 9% + imidacloprid 21% w/v OD) @ 200 ml/ha, followed by Solomon 300 OD (betacyfluthrin 9% + imidacloprid 21% w/v OD) @ 175 ml/ha and 150 ml/ha with (76.91, 78.73, 74.64 and 69.30% at 3rd, 5th, 7th and 10th days after first spray, while 75.53, 78.40, 73.79 and 67.65 % at 3rd, 5th, 7th and 10th days after second spray) and (74.56, 76.49, 72.15 and 67.04% at 3rd, 5th, 7th and 10th days after first spray, while 72.96, 75.08, 70.94 and 65.13% at 3rd, 5th, 7th and 10th days after second spray) reduction. The treatment of indoxacarb 14.5% + acetamiprid 7.7 % w/w SC @ 500 ml/ha and deltamethrin 1% + triazophos 35 % EC @ 1250 ml/ha was found next in order of efficacy against whitefly with (72.57, 74.91, 71.68 and 66.29 % at 3rd, 5th, 7th and 10th days after first spray, while 70.63, 73.65, 70.05 and 64.07% at 3rd, 5th, 7th and 10th days after second spray) and (73.62, 75.79, 69.53 and 63.75% at 3rd, 5th, 7th and 10th days after first spray, while 71.92, 74.47, 67.35 and 62.15 % at 3rd, 5th, 7th and 10th days after second spray) reduction, respectively [Table-2].

During Kharif, 2015

Similar type of efficacy observed after the first and second insecticidal spray in Kharif, 2015 [Table-2]. The maximum whitefly population reduction was (75.83, 77.56, 74.32 and 68.75 % at 3rd, 5th, 7th and 10th days after first spray and 74.73, 77.65, 71.88 and 67.52 % at 3rd, 5th, 7th and 10th days after second spray) recorded in the treatment of Solomon 300 OD (betacyfluthrin 9% + imidacloprid 21% w/v OD) @ 200 ml/ha, followed by Solomon 300 OD (betacyfluthrin 9% + imidacloprid 21% w/v OD) @ 175 ml/ha and 150 ml/ha with (74.42, 76.63, 72.75 and 67.43% at 3rd, 5th, 7th and 10th days after first spray, while 73.34, 76.61, 70.87 and 65.75 % at 3rd, 5th, 7th and 10th days after second spray) and (72.09, 74.54, 70.08 and 64.95 % at 3rd, 5th, 7th and 10th days after first spray, while 70.82, 74.03, 68.80 and 63.32% at 3rd, 5th, 7th and 10th days after second spray) reduction. The treatment of indoxacarb 14.5% + acetamiprid 7.7 % w/w SC @ 500 ml/ha and deltamethrin 1% + triazophos 35 % EC @ 1250 ml/ha was found in next order of efficacy against whitefly. All the treatments were found superior over control.

Seed Cotton yield

The data presented in [Table-3] revealed that seed cotton yield was recorded significantly higher in all the insecticidal treated plots over control.

Table-3 Impact of new insecticides on seed cotton yield during Kharif, 2014 and 2015

S	Treatments	Dose ml/ha	Seed cotton yield (q ha ⁻¹)	
			2014	2015
1	Control	-	19.22	9.82
2	Solomon 300 OD	150	22.69	12.79
3	Solomon 300 OD	175	23.13	13.28
4	Solomon 300 OD	200	23.42	13.56
5	Confidor 200 SI	125	21.50	11.63
6	Confidor 200 SI	210	21.90	12.07
7	Betacyfluthrin 2.45 % SC	750	21.22	11.42
8	Indoxacarb 14.5% + Acetamiprid 7.7 %	500	22.93	13.18
9	Deltamethrin 1% + Acetamiprid 35%	1250	22.36	12.59
	S.Em±	-	0.87	0.65
	CD at 5%	-	2.60	1.96

During Kharif, 2014

The highest seed cotton yield was recorded in the plots treated with Solomon 300 OD (betacyfluthrin 9% + imidacloprid 21% w/v OD) @ 200 ml/ha (23.42 q ha⁻¹) which was found at par with Solomon 300 OD (betacyfluthrin 9% + imidacloprid 21% w/v OD) @ 175 ml/ha (23.13 q ha⁻¹). Indoxacarb 14.5 % + acetamiprid 7.7 % w/w SC @ 500 ml ha⁻¹ and Solomon 300 OD (betacyfluthrin 9% + imidacloprid 21% w/v OD) @ 150 ml/ha found next in order with 22.93 and 22.69 q ha⁻¹ yield, respectively.

During Kharif, 2015

The plots treated with 300 OD (betacyfluthrin 9% + imidacloprid 21% w/v OD) @ 200 ml/ha gave highest seed cotton yield (13.56 q ha⁻¹) which was found at par with Solomon 300 OD (betacyfluthrin 9% + imidacloprid 21% w/v OD) @ 175 ml/ha (13.28 q ha⁻¹). Indoxacarb 14.5 % + acetamiprid 7.7 % w/w SC @ 500 ml ha⁻¹ and Solomon 300 OD (betacyfluthrin 9% + imidacloprid 21% w/v OD) @ 150 ml/ha found next in order with 13.18 and 12.79 q ha⁻¹ yield, respectively. Minimum seed cotton yield (9.82 q ha⁻¹) was recorded in the control plot. Solomon 300 OD was tested against tea mosquito bug and thrips in cashew found very effective in a single spray [5]. Superiority of Solomon 300 OD against sucking pests on different crops was also reported by [6] and [7].

Application of research: Solomon 300 OD contains Imidacloprid and Beta-Cyfluthrin which has combination of systemic and contact properties which gives quick knockdown and anti-feeding effects.

Research Category: Crop Protection and Pest Control

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Author Contributions: All authors equally contributed

Author statement: All authors read, reviewed, agreed and approved the final manuscript. Note-All authors agreed that- Written informed consent was obtained from all participants prior to publish / enrolment

Study area / Sample Collection: ARS, Sriganganagar, 335001

Cultivar / Variety / Breed name: Cotton (*Gossypium hirsutum* Linn.)

Conflict of Interest: None declared

Ethical approval: This article does not contain any studies with human participants or animals performed by any of the authors.

Ethical Committee Approval Number: Nil

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