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Bio-efficacy of new molecules against sucking pests in summer cowpea

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ABSTRACT

Investigations was conducted to evaluate bio-efficacy of some new molecules of insecticides against major sucking pests of summer cowpea at Instructional Farm, College of Agriculture, Junagadh Agricultural University, Junagadh during summer 2016 with ten treatments and three replications. Among the tested insecticides, dinotefuran 0.006 per cent, acetamiprid 0.004 per cent and dimethoate 0.03 per cent were found most effective against jassids. The treatments of acetamiprid 0.004 per cent, dimethoate 0.03 per cent and spiromesifen 0.08 per cent were found most effective in reducing the whitefly population. The application of dinotefuran 0.006 per cent acetamiprid 0.004 per cent and dimethoate 0.03 per cent proved effective in recording minimum aphid population. The highest grain yield of cowpea 853 kg/ ha was recorded from the treatment of dinetofuran 0.006 per cent which was statistically at par with acetamiprid 0.004 per cent (816 kg/ha), spiromesifen 0.08 per cent (795 kg/ha), dimethoate 0.03 per cent (790 kg/ha) and flonicamid 0.02 per cent (752 kg/ha). On the basis of economics, acetamiprid 0.004 per cent (1: 21.8) proved to be most economically viable treatment followed by dimethoate 0.03 per cent (1:21.2), spiromesifen 0.08 per cent (1:9.8), dinetofuran 0.006 per cent (1:9.4), chlorfenapyr 0.0075 per cent (1:5.8), clothianidin 0.003 per cent (1:5.5) and flonicamid 0.02 per cent (1:4.8).

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INTRODUCTION

Cowpea [*Vigna unguiculata* (L.) Waip] belongs to family Leguminoceae and sub family Faboidae. Cowpea plays an important role in human nutrition in a predominantly vegetarian country like India because it is considered as vegetable meat due to high amount of proteins. Cowpea grain contains about 60 per cent carbohydrates, 22 to 28 per cent proteins and 11.8 per cent fat. Moreover, it is a rich source of calcium and iron (Sharma and Franzmann, 2000). In India, cowpea is cultivated in about 1.5 million hectare with an annual production of 0.5 million tones and average productivity

608 kg/ha (Swaminathan, 2007). In Gujarat, cowpea (grain legume) is cultivated in about 30470 ha area with an annual production of 322084 tones and average productivity of 845 kg/ha (Anonymous, 2014). Even though all the efforts have been made by the scientists for increasing the production, the higher yield potential of various pulses including cowpea could not be able to achieve. Among the constraints responsible for low yield of such an important pulses crop, the losses due to insect-pests are considered to be an important.

As many as 21 insect pests of different groups were observed in cowpea during summer and *Kharif* season. Sucking pests like aphid, jassid and whitefly are important pests limiting profitable cultivation of cowpea not only by direct sap sucking but also by virus transmission. Cowpea aphid, *Aphis craccivora* causes significant yield losses of 20-40 per cent in Asia and upto 35 per cent in Africa (Kotadia and Bhalani,1992). A virus "rosette" is known to be transmitted by this aphid (Atwal, 1976). Yield reduction upto 39 per cent due to jassid, *Empoasca kerri* infestation in cowpea has been reported by Singh and Van Emden in 1976. Whitefly, *Bemisia tabaci* is also of considerable important because not only it feeds on leaves but also transmits the yellow vein mosaic virus in cowpea.

In the recent years, these pests created a serious threat to agriculture industry due to development of resistance towards commonly used insecticides. In this view there is scope of utilizing the newer chemistry molecules which are required in small quantity to control the pests and are comparatively environmental safe and economically effective for control of sucking pests in cowpea ecosystem. Keeping this in mind present study was carried out to evolve the efficacy of newer molecules of insecticides for the management of major sucking pests of cowpea.

MATERIAL AND METHODS

With a view to find out the effective and economical insecticides against sucking pests of cowpea, the field experiment was carried out during summer seasons of 2015-16 at Instructional Farm, Junagadh Agriculture University, Junagadh on cowpea variety AVS-1. Ten treatments including control were tested in Randomized Block Design with three replications. The crop was sown at the spacing of 45 cm x 15 cm having gross and net plot size was 5.00 × 2.70 m and 4.0 x 1.80 m, respectively. All the agronomical practices were followed. First spray of insecticides was applied on the appearance of the pests. The second spray was applied after 15 days of first spray with help of manually operated knapsack sprayer. The data were collected on pest population from randomly selected five plants from each treatment before 24 hrs of spraying and 1, 3 and 7 days after spraying. The population of jassid and whitefly were recorded from three leaves (top, bottom and lower) portion of each plant. Population of aphid was recorded through aphid index. Leaves, flowers and pods in selected plants were observed and the degree of infestation level was recorded and categorized into grades as 0, 1, 2, 3 and 4 according to visual and inspection counts.

Aphid index :

0 = No aphid (Nil)
1 = One or two aphids observed on plant but no colony formation
2 = Small colonies of aphids observed with countable numbers on plant but no damage symptoms seen
3 = Big colonies of aphids observed on plant and aphid can be counted and damage symptoms seen
4 = Big colonies of aphids observed on plant and aphid could not be counted and sever damage symptoms seen and plant twisted.

The economics of different treatments were worked out based on the pod and haulm yield and cost of protection. The cost, sale price of the pod and haulm of respective treatment was considered to calculate gross profit. Based on the cost of cultivation and the gross profit in different treatments, the CBR and net profit was calculated.

RESULTS AND DISCUSSION

Data presented in Table 1 indicated that dinotefuran 0.006 per cent recorded the highest mortality per cent (90.01%) after one day of insecticidal spray, which was found statistically at par with acetamiprid 0.004 per cent and dimethoate 0.03 per cent as they registered 87.94 and 82.07 per cent mortality, respectively. Whereas, the treatments of flonicamid 0.02 per cent, cyantraniliprole 0.02 per cent, clothianidin 0.003 per cent and chlorfenapyr 0.0075 per cent were found moderate in their suppressive action against the leaf hopper population with 70.39, 61.86, 58.56 and 55.12 per cent mortality, respectively. Spinosad 0.009 per cent was found least

effective against the jassid population in summer cowpea. Similar trend of mortality was observed on 3 and 7 days of insecticidal spray. The present findings are comparable with the results of Sinha *et al*. (2007) who reported that foliar spray of acetamiprid @ 20 g a.i./ha was effective in managing okra leafhopper population.

The data on mortality of whiteflies (Table 2) revealed that dimethoate 0.03 per cent was found to be the most effective treatment with 90.99 per cent mortality and it was found to be statistically at par with spiromesifen 0.08 per cent (90.57%) and acetamiprid 0.004 per cent (87.67%) at one day after spraying. The treatments of dinotefuran 0.006 per cent, flonicamid 0.02 per cent, clothianidin 0.003 per cent and chlofenapyr 0.0075 per cent were found next best in their action with 75.13, 70.67, 67.09 and 65.23 per cent mortalities, respectively. The remaining treatments were not upto the mark in their individual efficacies. More or less similar trend of mortality was observed on 3 and 7 days of insecticidal spray. The effectiveness of acetamiprid 20 SP @ 0.01 per cent whitefly in cotton has been reported by Bharpoda *et al*. (2014), hence, confirm the present findings in this respect. Roshan and Babu (2015) also proved that seed treatment with dimethoate 30 EC @ 5 ml/kg seeds gave

Table 1 : Bio-efficacy of different insecticides against jassid, *E. kerri* on cowpea

Sr. No.	Treatments	Per cent mortality of jassid					
		First spray			Second spray		
		1 DAS	3 DAS	7 DAS	1 DAS	3 DAS	7 DAS
1.	Flonicamid 50 WG @ 0.02%	57.03 (70.39)	63.20 (79.68)	59.99 (75.01)	58.84 (73.25)	64.72 (81.78)	61.47 (77.21)
2.	Dinotefuran 20 SG @ 0.006%	71.56 (90.01)	74.73 (93.08)	69.81 (88.10)	69.93 (88.24)	72.82 (91.28)	70.37 (88.72)
3.	Cyantraniliprole 10 OD @ 0.02%	51.85 (61.86)	55.99 (68.73)	50.42 (59.42)	53.80 (65.14)	58.11 (72.10)	55.17 (67.39)
4.	Clothianidin 50 WDG @ 0.003%	50.10 (58.56)	55.27 (67.56)	52.03 (62.17)	52.57 (63.07)	56.36 (69.33)	50.38 (59.35)
5.	Chlorfenapyr 10 EC @ 0.0075%	47.93 (55.12)	53.64 (64.87)	50.36 (59.32)	46.53 (52.68)	51.22 (60.78)	49.21 (57.34)
6.	Spinosad 45 SC @ 0.009%	43.53 (47.45)	42.49 (45.64)	40.54 (42.25)	45.82 (51.44)	43.53 (47.45)	38.97 (39.57)
7.	Acetamiprid 20 SP @ 0.004%	69.66 (87.94)	69.22 (87.43)	65.82 (83.24)	67.86 (85.21)	71.91 (90.38)	68.59 (86.69)
8.	Spiromesifen 48 EC @ 0.08%	46.40 (52.45)	44.56 (49.24)	42.62 (45.87)	47.42 (54.23)	45.93 (51.65)	43.40 (47.23)
9.	Dimethoate 30 EC @ 0.03%	64.94 (82.07)	67.47 (85.34)	63.20 (81.68)	65.90 (83.35)	69.70 (87.98)	65.88 (83.32)
	S.E.±	2.70	2.89	3.24	2.67	2.12	3.09
	C.D. (P=0.05)	8.09	8.67	9.72	8.01	6.35	9.25
	C. V. %	10.01	10.23	10.21	10.73	9.15	14.42

Figures in parentheses are retransformed values, those outside are arcsine values DAS= Days after spraying

Table 2 : Bio-efficacy of different insecticides against white fly, *B. tabaci* on cowpea

Sr. No.	Treatments	Per cent mortality of white fly					
		First spray			Second spray		
		1 DAS	3 DAS	7 DAS	1 DAS	3 DAS	7 DAS
1.	Flonicamid 50 WG @ 0.02%	57.20 (70.67)	67.71 (77.56)	59.50 (74.26)	56.56 (69.67)	61.03 (76.56)	58.21 (72.26)
2.	Dinotefuran 20 SG @ 0.006%	60.07 (75.13)	66.31 (83.87)	62.21 (78.28)	58.77 (73.13)	64.05 (80.87)	60.84 (76.28)
3.	Cyantraniliprole 10 OD @ 0.02%	51.04 (60.48)	51.70 (61.60)	48.41 (55.96)	45.84 (51.48)	53.48 (64.60)	51.32 (60.96)
4.	Clothianidin 50 WDG @ 0.003%	54.98 (67.09)	52.70 (63.29)	54.56 (66.40)	54.98 (67.09)	56.34 (69.29)	54.56 (66.40)
5.	Chlorfenapyr 10 EC @ 0.0075%	53.86 (65.23)	56.54 (69.62)	52.44 (62.86)	52.66 (63.23)	56.85 (70.12)	55.94 (68.65)
6.	Spinosad 45 SC @ 0.009%	46.70 (52.97)	41.86 (44.55)	40.00 (41.33)	43.90 (48.10)	42.19 (45.11)	40.60 (42.36)
7.	Acetamiprid 20 SP @ 0.004%	69.43 (87.67)	74.49 (92.86)	68.63 (86.74)	67.35 (85.19)	74.57 (92.93)	70.92 (89.33)
8.	Spiromesifen 48 EC @ 0.08%	72.10 (90.57)	69.78 (88.06)	67.66 (85.57)	70.33 (88.68)	66.03 (83.52)	64.50 (81.47)
9.	Dimethoate 30 EC @ 0.03%	72.51 (90.99)	69.93 (88.24)	65.09 (82.28)	73.71 (92.15)	69.06 (87.24)	63.77 (80.48)
	S.E.±	4.17	4.27	3.39	3.58	3.58	4.02
	C.D. (P=0.05)	10.29	10.54	8.38	8.85	8.84	9.93
	C. V.%	12.08	12.07	10.32	10.89	10.22	12.04

Figures in parentheses are retransformed values, those outside are arcsine values DAS= Days after spraying

the minimum population of whiteflies upto 30 days after spraying. Mahalakshmi *et al.* (2015) concluded that spiromesifen 240 SC @ 0.4 ml/l was found the most effective treatments with more than 75 per cent mean reduction in nymphal population of whiteflies. Parmar *et al.* (2015) also reported that higher effectiveness of clothianidin 50 WDG @ 0.003 per cent against whiteflies in blackgram.

Among the different insecticides tested (Table 3), dinotefuran 0.006 per cent was found most effective treatment (0.31 aphid index/plant) against aphid population and it was statistically at par with acetamiprid 0.004 per cent (0.44 aphid index/plant) and dimethoate 0.03 per cent (0.49 aphid index/plant) at one day after spraying. The application of spiromesifen 0.08 per cent, clothianidin 0.003 per cent and chlorfenapyr 0.0075 per cent were found next best effective showing the aphid population in the range of 0.86, 0.89 and 0.95 aphid index/ plant, respectively. The remaining treatments were found to fare poorly in this context. Similar trend of aphid population was observed on 3 and 7 days of insecticidal spray. These findings more or less similar with the results obtained by Gaurkhede *et al.* (2015) who reported that dinotefuran 20 SG @ 0.008 per cent successfully checked the incidence of aphids in cotton. Gowtham *et al.* (2016) also evaluated that acetamprid 20 SL @ 0.125g/ml proved to be highly

Table 3 : Bio-efficacy of different insecticides against aphid, *A. craccivora* in cowpea

Sr. No.	Treatments	Mean aphid index/plant					
		First spray			Second spray		
		1 DAS	3 DAS	7 DAS	1 DAS	3 DAS	7 DAS
1.	Flonicamid 50 WG @ 0.02%	1.09	0.94	1.56	1.02	1.61	2.06
2.	Dinotefuran 20 SG @ 0.006%	0.31	0.42	0.59	0.27	0.49	0.72
3.	Cyantraniliprole 10 OD @ 0.02%	1.13	1.04	1.83	1.26	1.68	2.18
4.	Clothianidin 50 WDG @ 0.003%	0.89	0.65	1.13	0.92	1.12	1.77
5.	Chlorfenapyr 10 EC @ 0.0075%	0.95	0.79	1.17	0.98	1.24	1.89
6.	Spinosad 45 SC @ 0.009%	1.26	1.82	2.55	1.76	1.99	2.59
7.	Acetamiprid 20 SP@ 0.004%	0.44	0.49	0.66	0.39	0.56	0.84
8.	Spiromesifen 48 EC @ 0.08%	0.86	1.25	1.86	1.48	1.89	2.26
9.	Dimethoate 30 EC @ 0.03%	0.49	0.55	0.79	0.43	0.68	0.98
	S.E.±	0.06	0.09	0.08	0.07	0.10	0.14
	C.D. (P=0.05)	0.19	0.16	0.24	0.22	0.31	0.41
	C. V.%	13.55	10.43	10.80	13.52	14.02	14.53

DAS= Days after spraying

Table 4 : Yield and economics of different insecticidal treatments applied for the control of sucking pests of summer cowpea during 2016

Sr. No.	Treatments	Quantity of insecticide for two sprays (lit./ha or kg/ha)	Cost of insecticides for two sprays (Rs./ ha)	Total cost of control measure (Rs./ ha)	Yield (kg/ ha)	Gross realization (Rs./ ha)	Net realization (Rs./ ha)	CBR
1.	Flonicamid 50 WG @ 0.02%	0.4 kg	3466	4186	752	67680	20430	1:4.8
2.	Dinotefuran 20 SG@ 0.006%	0.3 kg	2400	3120	853	76770	29520	1:9.4
3.	Cyantraniliprole 10 OD @ 0.02%	2.0 lit	26000	26720	652	58560	11310	1:0.4
4.	Clothianidin 50 WDG @ 0.003%	0.06 kg	810	1530	624	56160	8910	1:5.8
5.	Chlorfenapyr 10 EC @ 0.0075%	0.75 lit	2100	2820	700	63000	15750	1:5.5
6.	Spinosad 45 SC @ 0.009%	0.2 lit	3400	4120	614	55260	8010	1:1.9
7.	Acetamiprid 20 SP@ 0.004%	0.2 kg	480	1200	816	73440	26190	1:21.8
8.	Spiromesifen 48 EC @ 0.08%	1.6 lit	6560	7280	795	71550	24300	1:9.8
9.	Dimethoate 30 EC @ 0.03%	1.0 lit	400	1120	790	71100	23850	1:21.2
10.	Control	-	-	-	525	47250	-	-

effective against cowpea aphid *A. craccivora* with mortality percentage of 98.33. Higher effectiveness of clothianidin 50 WDG @ 0.003 per cent against aphids was also recorded in blackgram (Parmar *et al.,* 2015) and cotton crop (Shreevani *et al*., 2012). Same trend of efficacy was observed after second spraying.

Yield :

The yield of cowpea grain (Table 4) in different treatments was significantly higher over control. The highest grain yield of 853 kg/ ha was obtained from the treatment of dinetofuran 0.006 per cent which was statistically at par with acetamiprid 0.004 per cent (816 kg/ha), spiromesifen 0.08 per cent (795 kg/ha), dimethoate 0.03 per cent (790 kg/ha) and flonicamid 0.02 per cent (752 kg/ha). The insecticidal treatments of chlorfenapyr 0.0075 per cent, cyantraniliprole 0.02 per cent, clothianidin 0.003 per cent and spinosad 0.009 per cent were the next in the order giving yields of 700, 652, 624 and 614 kg/ ha, respectively and they did not differ significantly from the control (525 kg/ ha).

It is evident from the data that the net realization of different insecticides treatments varied from 8010 to 29520 Rs./ha. The treatments of dinetofuran 0.006 per cent recorded maximum net realization *i.e*. 29520 Rs./ ha, followed by acetamiprid 0.004 per cent (26190 Rs./ ha), whereas, minimum net realization was observed in the treatment of spinosad 0.009 per cent (8010 Rs./ha). The economics of various insecticidal treatments revealed that the highest cost benefit ratio (1: 21.8) was obtained from the treatment of acetamiprid 0.004 per cent followed by dimethoate 0.03 per cent (1:21.2), spiromesifen 0.08 per cent (1:9.8), dinetofuran 0.006 per cent (1:9.4), chlorfenapyr 0.0075 per cent (1:5.8), clothianidin 0.003 per cent (1:5.5) and flonicamid 0.02 per cent (1:4.8). The other treatments such as spinosad 0.009 per cent (1:1.9) and cyantraniliprole 0.02 per cent (1:0.4) registered low cost benefit ratios.

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