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RESEARCH ARTICLE :

Neo-nicotinoids and newer insecticides : A biorational approach for managing sucking pests of groundnut

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SUMMARY : Field experiments were conducted during *Kharif* season of 2010-11, 2011-12 and 2012-13 to evaluate the bioefficacy of newer insecticides (chlorantraniliprole, flubendiamide, spinosad, emamectin benzoate, thiodicarb, fipronil, acetamiprid and thiamethoxam) with conventional insecticides (profenophos , quinalphos, acephate, and chlorpyriphos) against leafhopper and thrips in groundnut. The experiments were conducted in a Randomized Block Design with eight treatments and three replications. The results revealed that the maximum pest control was observed in thiamethoxam 25 WG (200 g/ha) and acetamiprid 20 SP (100 g/ha) and these chemicals also found safe to natural enemies compare to other chemicals, 2010-11, 2011-12 and 2012-13, respectively.

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KEY WORDS :
Efficacy, Groundnut, Newer insecticides, Leaf hopper, Thrips

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BACKGROUND AND OBJECTIVES

Groundnut (*Arachis hypogaea* L.) is a leading oilseed crop in India and grown in an area of 5.52 million ha with a production of 9.67 million tonnes and productivity of 1750 kg/ha. Six states namely Andhra Pradesh, Gujarat, Karnataka, Maharashtra, Rajasthan and Tamil Nadu account for about 90 per cent of the total groundnut area of the country. Andhra Pradesh and Gujarat contribute more than 55 per cent of the total area and production of groundnut (DAC, 2014). Though India ranks first in area under groundnut cultivation, the productivity is quite low compared to that of USA, China, Argentina and Indonesia (Anonymous, 2005). There are many reason for low productivity of groundnut like attack of pests and diseases. Among pest Groundnut crop is attacked by about 100 species of insect pests. The total yield loss due to insect pests of groundnut was worked out to 40.2% as observed by Baskaran and Rajavel (2013). The sucking insect pest complex comprising thrips and leaf hoppers, are the major pests of importance on groundnut crop (David and Ramamurthy, 2011). The chemical management of insect-

pests is most practiced by the groundnut farmers for the management of these pest, Therefore present investigation was, planned to find out the effective insecticides against sucking insect pests of groundnut and safer to natural enemies.

RESOURCES AND METHODS

The field studies were conducted at Entomology section of Oilseeds Research Station, Latur during the year 2010-2011, 2011–2012 and 2012-2013 on groundnut variety LGN-1. Twelve different chemicals comprising of newer insecticides (chlorantraniliprole, flubendiamide, spinosad, emamectin benzoate, thiodicarb, fipronil, acetamiprid and thiamethoxam) and conventional insecticides (Profenofos, Quinalphos, Acephate and chlorpyriphos) along with a untreated control treatment were tested in Randomized Block Design with three replications. The crop was sown at the spacing of 30 cm x 10 cm having gross and net plot size was 5 x 4.2 m^2. and 4.8 x 3.6 m^2, respectively. All the agronomical practices were followed as per recommendations. Spray of insecticides with help of manually operated knapsack sprayer was given after the appearance of the pests. Five plants were selected randomly from each plot and the leafhopper and thrips population was recorded 1 day before and 3 and 7 days after each spraying.

Treatments details

T_1 Chlorantraniliprole 20 SC (100 ml/ha)

T_2 Thiodicarb 75 DF (1000 g/ha)

T_3 Spinosad 45 SC (150 ml/ha)

Table 1 : Evaluation of new molecules for the control of major pests of groundnut pooled data (2010-2012)

Sr. No.	Treatments	Leaf hopper before spray				Leaf hopper after spray				Thrips before spray				Thrips after spray			
		2010	2011	2012	P.M.	2010	2011	2012	P.M.	2010	2011	2012	P.M.	2010	2011	2012	P.M.
1.	Chlorantraniliprole 20 SC	9.00	7.80	5.67	7.49	3.30	3.10	4.87	3.76	20.70	18.33	8.27	15.77	5.20	5.00	6.40	5.53
	(100 ml/ha)	3.08	2.88	2.48	2.83	1.95	1.90	2.32	2.06	4.60	4.34	2.96	4.03	2.39	2.35	2.63	2.46
2.	Thiodicarb 80DF	7.70	8.80	6.07	7.52	5.80	2.30	2.80	3.63	33.60	20.03	8.33	20.65	4.80	4.65	6.00	5.15
	(1000 ml/ha)	2.86	3.05	2.56	2.83	2.51	1.67	1.82	2.03	5.84	4.53	2.97	4.60	2.30	2.27	2.55	2.38
3.	Spinosad 45 SC	8.00	8.00	6.27	7.42	5.00	3.72	4.13	4.28	24.00	18.00	8.07	16.69	5.40	5.90	5.80	5.70
	(150 ml/ha)	2.92	2.92	2.60	2.81	2.35	2.05	2.15	2.19	4.95	4.30	2.93	4.15	2.43	2.53	2.51	2.49
4.	Flubendiamide	7.80	9.00	6.07	7.62	2.40	1.68	1.53	1.87	26.00	20.70	8.00	18.23	3.80	4.10	2.93	3.61
	39.35 SC (150 ml/ha)	2.88	3.08	2.56	2.85	1.70	1.48	1.43	1.54	5.15	4.60	2.92	4.33	2.07	2.14	1.85	2.03
5.	Acephate 75 SP	7.60	7.60	6.20	7.13	2.80	2.20	1.93	2.31	21.40	19.10	8.33	16.28	4.80	4.60	2.93	4.11
	0.07 % (500 g/ha)	2.85	2.85	2.59	2.76	1.82	1.64	1.56	1.68	4.68	4.43	2.97	4.10	2.30	2.26	1.85	2.15
6.	Fipronil 5SC	9.00	7.80	6.07	7.62	2.20	1.50	1.33	1.68	24.60	18.67	8.13	17.13	3.80	4.08	2.00	3.29
	(100 g/ha)	3.08	2.88	2.56	2.85	1.64	1.41	1.35	1.48	5.01	4.38	2.94	4.20	2.07	2.14	1.58	1.95
7.	Acetamiprid	7.83	8.80	6.13	7.59	2.00	1.20	0.87	1.36	25.00	21.00	8.00	18.00	3.30	2.63	1.53	2.49
	20 SP (100 g/ha)	2.89	3.05	2.58	2.84	1.58	1.30	1.17	1.36	5.05	4.64	2.92	4.30	1.95	1.77	1.43	1.73
8.	Thiamethoxam	8.80	9.00	6.07	7.96	1.10	0.50	0.20	0.60	30.70	22.00	8.27	20.32	3.00	2.10	1.13	2.08
	25 WG (200 g/ha)	3.05	3.08	2.56	2.91	1.26	1.00	0.84	1.05	5.59	4.74	2.96	4.56	1.87	1.61	1.28	1.61
9.	Emamectin benzoate 5 WSG	7.80	8.00	6.00	7.27	3.30	3.70	4.80	3.93	20.70	23.33	8.13	17.39	4.80	5.70	7.13	5.88
	(0.01 %)	2.88	2.92	2.55	2.79	1.95	2.05	2.30	2.11	4.60	4.88	2.94	4.23	2.30	2.49	2.76	2.53
10.	Profenofos 50 EC	8.80	7.70	5.93	7.48	4.20	3.00	2.93	3.38	22.80	22.67	8.20	17.89	5.10	5.10	3.87	4.69
	(1000ml/ha)	3.05	2.86	2.54	2.82	2.17	1.87	1.85	1.97	4.83	4.81	2.95	4.29	2.37	2.37	2.09	2.28
11.	Quinalphos 25 EC	9.00	9.00	5.73	7.91	3.30	2.90	2.67	2.96	26.20	20.33	8.27	18.27	5.00	5.00	6.07	5.36
	(1000 ml/ha)	3.08	3.08	2.50	2.90	1.95	1.84	1.78	1.86	5.17	4.56	2.96	4.33	2.35	2.35	2.56	2.42
12.	Chlorpyrifos 20 EC	7.80	8.33	5.87	7.33	6.20	2.91	2.73	3.95	20.00	22.00	8.33	16.78	12.00	4.22	6.07	7.43
	(1000 ml/10 lit)	2.88	2.97	2.52	2.80	2.59	1.85	1.80	2.11	4.53	4.74	2.97	4.16	3.54	2.17	2.56	2.82
13.	Control	8.00	7.70	6.13	7.28	8.67	8.00	6.47	7.71	20.90	22.00	8.20	17.03	15.00	17.47	6.47	12.98
		2.92	2.86	2.58	2.79	3.03	2.92	2.64	2.87	4.63	4.74	2.95	4.19	3.94	4.24	2.64	3.67
	S.E. ±	NS	NS	NS	NS	0.16	0.08	0.07	0.11	NS	NS	NS	NS	0.15	0.11	0.08	0.20
	C.D. (P=0.05)					0.47	0.23	0.21	0.32					0.44	0.33	0.24	0.60
	C.V					13.86	8.00	6.50	10.08					10.75	8.40	6.59	14.87

NS=Non-significant

T_4 Flubendiamide 39.35 SC (150 ml/ha)
T_5 Acephate 75SP (500 g/ha)
T_6 Fipronil5 SC (100 g/ha)
T_7 Acetamiprid 20 SP (100 g/ha)
T_8 Thiamethoxam 25 WG (200 g/ha)
T_9 Emamectin benzoate 5 WSG (100g/ha)
T_{10} Profenophos 50 EC (1000 ml/ha)
T_{11} Quinalphos 25 EC (1000 ml/ha)
T_{12} Chlorpyrifos 20EC (1000 ml/ha)
T_{13} Control

OBSERVATIONS AND ANALYSIS

The mean leafhopper population before spray was ranged from 7.13 to 7.96 hoppers / plant suggesting uniform distribution among treatments and it was found to be non-significant (Table 1). Whereas after spray, significant results were observed for treatments. The overall mean leafhopper population from all treatments after spray ranged from 0.60 to 7.71 hoppers / plant and it differed significantly within the treatments. The lowest (0.60 hoppers/ plant) overall mean leafhopper population was recorded in the treatment, thiamethoxam 25 WG @ 200g /ha fallowed by acetamiprid 20 SP @100 g/ha which were at par with each other and which differed significantly with that of rest of the chemical treatments and untreated control (7.71 hoppers/plant). The treatments which showed on par results with the former were, fipronil5 SC @ 100 g/ha, flubendiamide 39.35 SC

Table 2 : Biosafety of new molecules evaluated for the control of major pests of groundnut pooled data (2010-2012)

Sr. No.	Treatments	*Coccinellids*. before spray				*Coccinellids*. after spray			
		2010	2011	2012	P.M.	2010	2011	2012	P.M.
1.	Chlorantraniliprole 20 SC	1.27	1.00	1.47	1.25	0.40	0.20	0.67	0.42
	(100 ml/ha)	1.33	1.22	1.40	1.32	0.95	0.84	1.08	0.96
2.	Thiodicarb 80DF	1.40	0.80	1.40	1.20	0.00	0.00	0.00	0.00
	(1000 ml/ha)	1.38	1.14	1.38	1.30	0.71	0.71	0.71	0.71
3.	Spinosad 45 SC	1.33	0.93	1.27	1.18	0.80	1.00	0.93	0.91
	(150 ml/ha)	1.35	1.20	1.33	1.29	1.14	1.22	1.20	1.19
4.	Flubendiamide	1.33	1.00	1.47	1.27	0.47	0.60	0.73	0.60
	39.35 SC (150 ml/ha)	1.35	1.22	1.40	1.33	0.98	1.05	1.11	1.05
5.	Acephate 75 SP	1.47	1.20	1.27	1.31	0.33	0.60	0.47	0.47
	0.07 % (500 g/ha)	1.40	1.30	1.33	1.35	0.91	1.05	0.98	0.98
6.	Fipronil 5SC	1.27	1.00	1.27	1.18	0.53	0.53	0.60	0.55
	(100 g/ha)	1.33	1.22	1.33	1.30	1.01	1.01	1.05	1.03
7.	Acetamiprid	1.33	0.80	1.60	1.24	0.73	0.73	0.87	0.78
	20 SP (100 g/ha)	1.35	1.14	1.45	1.32	1.11	1.11	1.17	1.13
8.	Thiamethoxam 25 WG	1.40	1.27	1.60	1.42	1.07	1.20	1.13	1.13
	(200 g/ha)	1.38	1.33	1.45	1.39	1.25	1.30	1.28	1.28
9.	Emamectin benzoate 5 WSG	1.60	1.27	1.40	1.42	0.33	0.40	0.53	0.42
	(0.01 %)	1.45	1.33	1.38	1.39	0.91	0.95	1.02	0.96
10.	Profenofos 50 EC	1.27	1.00	1.33	1.20	0.53	0.47	0.60	0.53
	(1000ml/ha)	1.33	1.22	1.35	1.30	1.01	0.98	1.05	1.02
11.	Quinalphos 25 EC	1.33	1.00	1.47	1.27	0.20	0.33	0.33	0.29
	(1000 ml/ha)	1.35	1.22	1.40	1.33	0.84	0.91	0.91	0.89
12.	Chlorpyrifos 20 EC	1.60	0.80	1.53	1.31	0.27	0.40	0.40	0.36
	(1000 ml/10 lit)	1.45	1.14	1.43	1.35	0.88	0.95	0.95	0.93
13.	Control	1.53	0.80	1.40	1.24	1.20	1.40	1.60	1.40
		1.42	1.14	1.38	1.32	1.30	1.38	1.45	1.38
	S.E.±	NS	NS	NS	NS	0.05	0.06	0.06	0.03
	C.D. (P=0.05)					0.16	0.18	0.17	0.08
	C.V					9.25	10.42	9.45	4.28

NS=Non-significant

@ 150 ml/ha and acephate 75SP (500 g/ha) with the overall mean leafhopper populations, 1.68,1.87 and 2.31 hoppers / plant, respectively. The similar observations were recorded on groundnut by Saradava (2004); Venkanna *et al.* (2010); Karena (2012); Nataraja *et al.* (2014) and Khanpara *et al*. (2016); on cotton by Rajeswaran *et al.* (2005); Suganya Kanna *et al.* (2007) and Rohini *et al.* (2012); on rice by Misra (2009); on okra by Dhanalakshmi and Mallapur (2008) and on brinjal by Sinha and Nath (2012).

Pooled data (Table 1) indicated that significantly low population of thrips was recorded in all the treatments over control. However, significantly low population of thrips (2.08 thrips/plant) was recorded in the treatment of thiamethoxam 25 WG @ 200 g/ha and it was at par with acetamiprid 20 SP @100 g/ha, fipronil 5SC 100 g/ha, Flubendiamide 39.35 SC @ 150 ml/ha and acephate 75SP @ 500 g/ha with the overall mean thrips populations, 2.49, 3.29, 3.61 and 4.11 thrips / plant, respectively. The remaining insecticidal treatments were also found effective in reduction of thrips population after spray. Maximum thrips population (12.98 thrips/plant) was recorded in control. These results are in conformity with the observations recorded on groundnut by Saradava (2004); Venkanna *et al.* (2010); Karena (2012); Mandal (2012); Kandakoor *et al.* (2013); Nataraja *et al.* (2014) and Khanpara *et al.* (2016); on cotton by Rajeswaran *et al.* (2005) and Rohini *et al*. (2012) and on okra by Dhanalakshmi and Mallapur (2008).

The overall mean after spray revealed that ,the population of *Coccinellids* was uniformly distributed in all the treatments including untreated control and ranged between 1.18 - 1.42 larvae/ plant, but from the data after spray we can draw inference that highest and significant population of *Coccinellids i.e.* 1.40 larvae/ plant was recorded in the treatment untreated control. The next significantly safer treatments among chemical insecticides in order of safety were thiamethoxam 25 WG @ 200 g/ha, spinosad 45 SC 150 ml/ha, acetamiprid 20 SP @100 g/ha, fipronil 5SC 100 g/ha, flubendiamide 39.35 SC @ 150 ml/ha, profenophos 50 EC @ 1000 ml/ha, acephate 75SP @1000 g/ha, Chlorantraniliprole 20 SC @100 ml/ha, Emamectin benzoate 5 WSG @100g/ha, Quinalphos 25 EC @1000 ml/ha and Chlorpyrifos 20EC (1000 ml/ha). Whereas the treatment of Thiodicarb 75 DF @1000 g/ha has proven lethal to *Coccinellids*.

Therefore, from the above, it can be concluded considering the effectiveness of insecticides, that spray of thiamethoxam 25 WG @ 200 g /ha or acetamiprid 20 SP @ 100 g/ha after initiation of pests were found the most effective against leafhopper and thrips infesting groundnut. Thus, incorporation of newer chemistry molecules labeled under "Reduced risk" in integrated pest management programme for sucking pests on groundnut will prove less interfering for the natural fauna.

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