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Patel TM

PG Student, Department of
Entomology, COA, JAU,
Junagadh, Gujarat, India

Baraiya KP

Senior Scientist and Head, KVK,
JAU, Jamnagar, Gujarat, India

Kaneria PB

Ph. D. Scholar, Department of
Entomology, COA, JAU,
Junagadh, Gujarat, India

Jadav AH

Ph. D. Scholar, Department of
Plant Pathology, COA, JAU,
Junagadh, Gujarat, India

Corresponding Author:**Patel TM**

PG Student, Department of
Entomology, COA, JAU,
Junagadh, Gujarat, India

Efficacy of insecticides against white grub, *Holotrichia consanguinea* infesting groundnut

Patel TM, Baraiya KP, Kaneria PB and Jadav AH

Abstract

A field experiment comprised of eight insecticides tested against white grub on groundnut was conducted in endemic area of Junagadh District at Oil Seed Research Station, Manavadar. The soil drenching of Imidacloprid 40% + Fipronil 40% - 80% WG @ 250 g per ha and Clothianidin 50% WDG @ 250 gm per ha was the safe and most effective treatments against white grub in groundnut followed by Chlorpyrifos 20% EC @ 4000 ml per ha. Although, soil drenching of Imidacloprid 40% + Fipronil 40% - 80 WG @ 250 g per ha was the most profitable treatment (NICBR = 1:2.38), however, Imidacloprid 40% + Fipronil 40% - 80 WG @ 250 g per ha proved as the best treatment against white grub in groundnut crop.

Keywords: White grub, Imidacloprid + Fipronil, Clothianidin, Chlorpyrifos, grub population

Introduction

Groundnut (*Arachis hypogea* Linnaeus) is an annual prostrate herbaceous leguminous oilseed crop. Soil arthropod pests pose one of the most difficult problems for groundnut growers. The term white grub or root grub is applied to immature stage of beetles popularly known as cochafters, chafers beetle, May beetle or June beetles. They belong to the family Scarabaeidae of the order Coleoptera. White grub is major bottlenecks that limit the cultivation of groundnut in many region of Gujarat. The different insect pests infesting this crop in Saurashtra region of Gujarat state, white grub, *Holotrichia consanguinea* is considered as key soil dwelling insect. Yadava and Sharman (1995) ^[1], reported that the presence of one grub/m² may cause 80-100 per cent plant mortality. Kapadia *et al.*, (2006) ^[2] studied that in India out of 171 species of white grub, 12 are of major importance and 14 are of major importance for Gujarat state. Raodeo *et al.* (1976) ^[3] reported that the adult collection and insecticidal applications are the major tactics of management followed against all the white grub species. Yield reduction occurs because larvae kill plants in the seedling stage and impair pod production by weakening the plants. White grubs also damage pods causing direct yield losses. Maximum damage occurs when the grubs are in 3rd instar. Considering the above facts, more emphasis is now being laid on use of chemical pesticides as one of the important components of control strategies. Proper utilization of safer pesticides can help to overcome the existing environment problems. Now-a-days large numbers of newer insecticidal formulation in form of ready mixture individual are also available in market. So, a different insecticide was made to test the efficacy against white grub in groundnut crop.

Materials and Methods**Location**

Field experiments were conducted in endemic area of Junagadh District at Oil Seed Research Station, Manavadar. Study about the efficacy of insecticides against white grub, *H. consanguinea* infesting groundnut during Kharif – 2017-18.

Experimental Design

The experiment design for Randomized Block Design with nine treatments and three replications, the plot size was 5.0 m x 3.6 m and plant spacing was 60 cm x 10 cm. The crop was raised following the recommended agronomic practices except plant protection measures. The application of different insecticides was done by drenching method applied at the time of pest initiation.

Observations

The experiment observations are recorded total number of plants and plants damaged by white grub were recorded at 30, 45, 60, 75 and 90 days after germination. The damaged plant was removed after each count. From these data, per cent plant

mortality due to White grub was calculated. White grub population were recorded from one square meter are in each plot by digging soil up to 50 cm deep. The data thus obtained was analysed by $\sqrt{x+0.5}$ transformation statistical methods.

Table 1: Treatments Detail

Treatment	Common name	Trade name	Manufacture Company	Dose g or ml. a.i.ha ⁻¹	g or ml formulation per ha
T ₁	Thiamethoxam 75% SG	Devsena	HPM Chemical & fertilizer Ltd.	113	150.6 g
T ₂	Clothianidin 50% WDG	Dantop	Nagarjuna Agrichem Ltd.	125	250 g
T ₃	Chlorpyriphos 20% EC	Dursban	DowAgro Sciences	800	4000 ml
T ₄	Imidacloprid + fipronil 40+40-80% WG	Lesenta	Bayer CropScience	200	250 g
T ₅	Fipronil 5% SC	Regent SC	Bayer CropScience	125	2500 ml
T ₆	Fipronil 0.3% G	Regent GR	Bayer CropScience	100	33333 g
T ₇	Flubendiamide 480% SC	Fame	Bayer CropScience	288	600 ml
T ₈	Chlorantraniliprole 18.5% SC	Coragen	DuPont Co.	116	625 ml
T ₉	Untreated control			-	-

Results and Discussion

The plant mortality due to white grub in different insecticidal treatment was significantly low as compared to untreated plots at 30, 45, 60, 75 and 90 days after germination (DAG). Result thus, obtained are presented in (Table-2).

30 days after germination

Observations recorded 30 days after germination indicated that all the treatments were found significantly superior over untreated control. The treatment Imidacloprid 40% + Fipronil 40% - 80% WG @ 250 g per ha was significantly superior over all other treatments and at par with Clothianidin 50% WDG @ 250 gm per ha. The mortality of the plants varies from 8.74 to 21.21 per cent as compared to 30.82 per cent in untreated control.

45 days after germination

In treatment Imidacloprid 40% + Fipronil 40% - 80% WG @ 250 g per ha was found significantly superior over all other treatments and recorded 8.83 per cent plant mortality however, it was at par with treatment of Clothianidin 50% WDG @ 250 gm per ha were 9.70 per cent plant mortality. In untreated control 31.71 per cent plant mortality was observed. The mortality of plants varied from 8.83 to 26.80 per cent of

treatments.

60 days after germination

The results revealed that treatment of Imidacloprid 40% + Fipronil 40% - 80% WG @ 250 g per ha was found most effective treatment recording minimum plant mortality (9.06%) and it was at par with Clothianidin 50% WDG @ 250 gm per ha (10.19%). In untreated control 32.78 per cent plant mortality was observed.

75 days after germination

The treatment of Imidacloprid 40% + Fipronil 40% - 80% WG @ 250 g per ha recorded (9.41%) plant mortality and it was at par with Clothianidin 50% WDG @ 250 gm per ha (10.44%). All the treatments proved significantly superior to untreated check (33.40%).

90 days after germination

The treatment of Imidacloprid 40% + Fipronil 40% - 80% WG @ 250 g per ha was found significantly superior over all other treatments and it was at par with Clothianidin 50% WDG @ 250 gm per ha. The mortality of the plants varies from 10.92 to 28.05 per cent as compared to 34.19 per cent in untreated control.

Table 2: Bio efficacy of insecticides against white grub infesting groundnut

Sr. No.	Treatments	g or ml formulation per ha	Plant Mortality (%)					Average Number of Grub/m ²
			30 DAG*	45 DAG	60 DAG	75 DAG	90 DAG	
1	THIAMETHOXAM 75% SG	150.6	8.75** (17.20)	11.43 (19.76)	11.75 (20.04)	12.51 (20.72)	14.44 (21.23)	1.34*** (1.35)
2	CLOTHIANIDIN 50% WDG	250	2.69 (9.44)	2.84 (9.70)	3.13 (10.19)	3.28 (10.44)	3.68 (11.05)	0.96 (1.00)
3	CHLORPYRIPHOS 20% EC	4000	6.82 (16.14)	9.94 (18.37)	10.29 (18.71)	10.50 (18.90)	12.51 (20.40)	1.13 (1.17)
4	IMIDACLOPRID + FIPRONIL 80% WG	250	2.31 (8.74)	2.36 (8.83)	2.48 (9.06)	2.68 (9.41)	3.59 (10.92)	0.86 (0.88)
5	FIPRONIL 5% SC	2500	10.70 (19.10)	15.98 (23.56)	16.33 (23.80)	17.99 (25.09)	18.04 (25.13)	1.68 (1.67)
6	FIPRONIL 0.3% G	33333	13.08 (21.21)	20.33 (26.80)	20.66 (27.04)	21.59 (27.69)	22.11 (28.05)	1.84 (1.90)
7	FLUBENDIAMIDE 480% SC	600	12.27 (20.51)	17.49 (24.72)	18.81 (25.70)	19.20 (25.99)	20.19 (26.70)	1.77 (1.78)
8	CHLORANTRANILIPROLE 18.5% SC	625	11.66 (19.96)	11.78 (20.07)	12.09 (20.35)	13.75 (21.76)	15.51 (23.19)	1.58 (1.59)
9	CONTROL	-	26.26	27.64	29.29	30.31	31.57	2.14

		(30.82)	(31.71)	(32.78)	(33.40)	(34.19)	(2.16)
	S.Em. ±	1.08	1.19	1.27	1.01	1.54	0.09
	C.D. at 5%	3.27	3.59	3.82	3.03	4.462	0.27
	C.V. %	10.46	10.18	10.6	8.15	11.90	12.93

Note:
* DAG = Days after germination. ** Arcsine percentage transformed value. *** $\sqrt{X + 0.5}$ transformed values. Figures in Parentheses are retransformed value.

Grub population

The results presented in (Table-2) revealed that the grub population in all the treated plots was significantly lower than untreated control (2.16 grubs/m²). It was lowest in Imidacloprid 40% + Fipronil 40% - 80% WG @ 250 g per ha (0.88 grubs/m²) and it was at par with Clothianidin 50% WDG @ 250 gm per ha (0.88 grubs/m²) and Chlorpyrifos 20% EC @ 4000 ml per ha (1.17 grubs/m²). Thus, the results obtained in present study corroborate the finding earlier worker.

Pod Yield

The results (Table-3) further indicated that soil drenching with Imidacloprid 40% + Fipronil 40% - 80% WG @ 250 g per ha proved most effective by achieving the maximum pod yield (1907 kg/ha), although it was at par with Clothianidin 50% WDG @ 250 gm per ha (1803 kg/ha) and Chlorpyrifos 20% EC @ 4000 ml per ha (1664 kg/ha). However, Thiamethoxam 75% SG @ 150.6 gm per ha (1525 kg/ha), Chlorantranilprole 18.5% SC @ 625 gm per ha (1510 kg/ha), Fipronil 5% SC 2500 ml per ha (1180 kg/ha) and

Flubendiamide 480% SC @ 600 ml per ha (1170 kg/ha) found moderately yield. It was also evident that the, Imidacloprid 40% + Fipronil 40% - 80 WG @ 250 g per ha was significantly superior to Fipronil 0.3% G @ 33.33 gm per ha (1100 kg/ha).

Dry fodder yield

The dry fodder yield (Table-3) was recorded significantly higher in all the insecticidal treatments as compared to control plots (4932 kg/ha). The highest dry fodder yield was recorded in Imidacloprid 40% + Fipronil 40% - 80 WG @ 250 g per ha (6146 kg/ha) and it was at par with Clothianidin 50% WDG @ 250 gm per ha (6042 kg/ha), Chlorpyrifos 20% EC @ 4000 ml per ha (5903 kg/ha) and Thiamethoxam 75% SG @ 150.6 gm per ha (5833 kg/ha). The moderately yield in Chlorantranilprole 18.5% SC @ 625 gm per ha (5694 kg/ha) and it was at par with Fipronil 5% SC 2500 ml per ha (5590 kg/ha) and Flubendiamide 480% SC @ 600 ml per ha (5387 kg/ha). Where lowest yield found in Fipronil 0.3% G @ 33.33 gm per ha (5387 kg/ha).

Table 3: Economics of different insecticides evaluated against white grub

Sr. No.	Treatments	Cost of Cultivation (Rs/ha)			Average Yield (kg/ha)		Gross return			Net profit (Rs/ha)	ICBR
		Cost of insecticides	Common cultivation practices	Total (Rs/ha)	Pod	Dry fodder	Pod	Dry fodder	Total		
1	Thiamethoxam 75% Sg	470	50000	50470	1525	5833	61000	46664	107664	57194	1:2.13
2	Clothianidin 50% Wdg	3200	50000	53200	1803	6042	72120	48336	120456	67256	1:2.26
3	Chlorpyrifos 20% Ec	1400	50000	51400	1664	5903	66560	47224	113784	62384	1:2.21
4	Imidacloprid + Fipronil 80% Wg	2750	50000	52750	1907	6146	76280	49168	125448	72698	1:2.38
5	Fipronil 5% Sc	2950	50000	52950	1180	5590	47200	44720	91920	38970	1:1.74
6	Fipronil 0.3% G	2400	50000	52400	1100	5587	44000	44696	88696	36296	1:1.69
7	Flubendiamide 480% Sc	9080	50000	59080	1170	5482	46800	43856	90656	31576	1:1.53
8	Chlorantranilprole 18.5% Sc	10450	50000	60450	1510	5694	60400	45552	105952	45502	1:1.75
9	Control		50000	50000	900	4932	36000	39456	75456	25456	1:1.51

Note:

Price of groundnut pod: Rs. 40/kg.

Price of dry fodder: Rs. 8/kg.

Price of insecticides :

THIAMETHOXAM 75% SG : Rs. 450/250gm

CLOTHIANIDIN 50% WDG : Rs. 600/50gm

CHLORPYRIFOS 20% EC : Rs. 300/1litre

IMIDACLOPRID + FIPRONIL 80% WG : Rs. 1100/100gm

FIPRONIL 5% SC : Rs. 1100/1litre

FIPRONIL 0.3% G : Rs. 450/5kg

FLUBENDIAMIDE 480% SC : Rs. 950/100ml

Rs. 50000/- was calculated as cost of production common agronomic practices

Chlorantranilprole 18.5% SC : Rs. 2460/150ml

Net incremental cost benefit ratio

It could be proved from the results that the treatment of the Imidacloprid 40% + Fipronil 40% - 80 WG @ 250 g per ha and Clothianidin 50% WDG @ 250 gm per ha were found highest NICBR. Among the different application method, seed treatment found most effective for management of soil pest (white grub) this type study was supported Mane and Mohite (2015) [4], Bajya *et al.* (2015) [5], Rabari (2015) [6], Gangwar *et al.* (2016) [7].

Conclusion

Thus, it can be inferred from overall results that the Imidacloprid 40% + Fipronil 40% - 80 WG @ 250 g per ha and Clothianidin 50% WDG @ 250 gm per ha proved equally effective and better than other treatments. Among the different insecticides Imidacloprid 40% + Fipronil 40% - 80 WG and Clothianidin 50% WDG found most effective for management of soil pest (white grub).

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