



## Efficacy of newer insecticide formulation against white grub, *Holotrichia consanguinea* in groundnut (*Arachis hypogaea*)

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### ABSTRACT

A field experiment was conducted during *kharif* 2011 and 2012 at research farm of Institute of Pesticide Formulation Technology, Gurgaon (Haryana) to evaluate the bioefficacy of new insecticide imidacloprid (0.3 G) @ four differential doses, viz 10, 15, 20 and 40 kg/ha along with standard check, phorate (10G) @ 25 kg/ha and imidacloprid (200SL) @ 500 ml/ha against *Holotrichia consanguinea* Blanch in groundnut crop. All doses of insecticides were used as soil application in groundnut (*Arachis hypogaea* L.). Imidacloprid (0.3 G) @ 15, 20 and 40 kg/ha recorded a significant reduction in percent plant mortality compare to standard checks (phorate (10G) @ 25 kg/ha and imidacloprid (200SL) @ 500 ml/ha) and untreated check during both cropping seasons. The lowest (8.23 and 10.27) percent plant mortality was recorded in imidacloprid (0.3G) @ 40 kg/ha during both the cropping seasons. It was however, at par with its lower doses @ 15 and 20 kg/ha. Imidacloprid (0.3 G) @ 10 kg/ha recorded the percent plant mortality up to 17.97 and 15.73 during 2011 and 2012, respectively. A significantly higher yield was recorded under all the treatments doses over untreated check during both the years. Among the treatments a highest yield (1 810 and 1 830 kg/ha) of dry pod was recorded in imidacloprid (0.3G) @ 40 kg/ha during both the cropping seasons. It was however at par with its lower doses, i.e. imidacloprid 0.3G @ 15 and 20 kg/ha. Imidacloprid (0.3G) @ 20 kg/ha exhibited maximum net return of ₹ 64 078 ha. Hence, imidacloprid 0.3 G at 20 kg/ha may be recommended for the management of *H. consanguinea* on groundnut cultivated in sandy loam soil of Haryana.

**Key words:** Groundnut, *Holotrichia consanguinea*, Insecticide, Imidacloprid, Insecticides

Groundnut (*Arachis hypogaea* L.) is one of the main oilseeds of India ranking second in the world production. Tamil Nadu, Karnataka, Andhra Pradesh and Western states of India together account for close to 80% of the annual output of India. White grub, *Holotrichia consanguinea* Blanchard a polyphagous pest causes serious damage to crops cultivated during rainy season in Haryana, Rajasthan, Gujarat, Punjab and Uttar Pradesh. The presence of one grub per square meter may cause mortality of 80 to 100% plants (Yadav *et al.* 1977). The severity of its damage is noticeable by the difficulty in their management as much of their life-cycle passes in subterranean (Kapadia *et al.* 2006). Damage due to the pest is more evident on plants having tap roots, like groundnut and greengram cultivated under sandy loam conditions. Use of insecticides against *H. consanguinea* on groundnut remains an important management practice. Several insecticides have been recommended as soil application for the management of white grub; however newer chemicals require to be tested to enlarge the list of making a wider choice with different mode of action to prevent the development of resistance and resort to judicious use. Therefore, in present study, some new molecules belonging to neonicotinoid and other groups were tested as

soil application for their efficacy against *H. consanguinea*.

### MATERIALS AND METHODS

A field experiment was conducted during *kharif* 2011 and 2012 at the Research Farm, Institute of Pesticide Formulation Technology, Gurgaon, Haryana in randomised block design with three replications to work out the efficacy of various insecticide applied as soil application against *H. consanguinea* at the time of sowing of groundnut crop (cultivar G 10). All the recommended practices were followed to raise the crop. Four doses of imidacloprid 0.3G @ 10, 15, 20 and 40 kg/ha were tested along with the standard check, viz. imidacloprid (200SL) @ 500 ml/ha and phorate (10G) @25 kg/ha. The germination test was also carried out by counting the number of seeds dibbled in pots and number of seeds germinated at 15 days after sowing. Number of plants and plant mortality due to whitegrub damage was recorded 30, 45 and 60 days after sowing in all the treatments. Damaged plants were removed after each count. From these data, cumulative percent plant mortality was computed following square root transformation. Pod and dry fodder yield was recorded from the net plot area separately for each plot at harvesting and data were converted to kg/ha. After harvesting, grub population was recorded from one square meter area in each plot by digging soil up

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to 75 cm deep and data was analyzed by using square root transformation. Economics of various treatments was worked out considering market price of groundnut pods, dry fodder and insecticides.

## RESULTS AND DISCUSSION

### Effect on seed germination

Maximum germination of groundnut seeds was observed with imidacloprid (0.3G) @ 20kg/ha i.e. 90.67 and 91.00 percent during both the cropping seasons of 2011 and 2012, respectively. The germination percentage was recorded from 84.33% to 83.67% during 2011 and 2012, respectively in imidacloprid (200SL) @ 500 ml/ha. Although, all the treatments were non-significant during tested period. The overall result indicated that soil application of insecticides could not showed any adverse effect on germination of groundnut seed during both cropping seasons. In past, similar results were also obtained by several workers (Patel *et al.* 2010, Patel and Patel 2000).

### Plant mortality due to whitegrub

Table 1 revealed that the application of imidacloprid 0.3G @ 40 kg/ha was found most effective treatment in reducing plant mortality (8.23%) and it was at par with its lower doses and significantly superior from untreated check. Highest percent protection was recorded in imidacloprid (0.3G) @ 40 kg/ha (72.6%) followed by its lower doses @ 20 and 15 kg/ha and imidacloprid (200SL) @ 500 ml/ha (66.2%), phorate (10G) @ 25 kg/ha (65.3%) compared to the untreated control (30%). The same trends were also recorded during *khariif* 2012 (Table 2). Similarly findings were also by Singh *et al.* (2012), Patel *et al.* (2010) and Patel and Patel (2000).

### Grub population

Results presented in the Table 1 and 2 revealed that the grub population in all the treated plots was significantly lower than untreated check (2.78 grub/m<sup>2</sup> and 2.90 grub/m<sup>2</sup> respectively) during both the cropping seasons. It was lowest in imidacloprid (0.3G) @ 40 kg/ha (1.11 grub/m<sup>2</sup>) and it was at par with its lower doses as well as standard treatments imidacloprid (200SL) @ 500 ml/ha (1.33 grub/m<sup>2</sup>), phorate (10G) @ 25 kg/ha (1.67 grub/m<sup>2</sup>) respectively.

Table 2 revealed that the grub population was lowest in imidacloprid (0.3G) @ 40 kg/ha (1.40 grub/m<sup>2</sup>) which was on par with imidacloprid (0.3G) @ 20, 15 and 10 kg/ha and standard treatment imidacloprid (200SL) @ 500 ml/ha (1.50 grub/m<sup>2</sup>), phorate (10G) @ 25 kg/ha (1.83 grub/m<sup>2</sup>). Highest population of *H. consanguinea* was recorded with imidacloprid (0.3G) @ 10 kg/ha (2.13 grub/m<sup>2</sup>) at harvest. Thus, the results obtained in present study corroborate the finding of earlier workers (Singh *et al.* 2012, Patel *et al.* 2010 and Patel and Patel 2000).

### Pod yield

Dry pod yield was recorded significantly higher in all the insecticidal treatments compared to untreated check

Table 1 Efficacy and economics of imidacloprid 0.3G applied as soil application against white grub in groundnut crop during *khariif* 2011-12

Treatment	Dose kg/ha	Germination (%) 15 DAA	Cumulative plant mortality (%) due to white grub 60DAA*	Protection over control (%)	Yield (kg/ha)		% Increase in yield over control	Gross return (₹/ha)	Cost of insecticide treatment including labour treatment	Net return (₹/ha)	NICBR
					Dry pod	Dry fodder					
Imidacloprid 0.3G	10	86.67	17.97 (4.26)	40.1	1 495.00	4 695.00	23.65	55 315	1 400	53 915	38.5
Imidacloprid 0.3G	15	85.00	10.23 (3.26)	65.9	1 590.00	4 810.00	31.51	58 830	1 850	56 980	30.8
Imidacloprid 0.3G	20	90.67	9.30 (3.10)	69.0	1 794.00	5 096.00	48.38	66 378	2 300	64 078	27.9
Imidacloprid 0.3G	40	83.00	8.23 (2.92)	72.6	1 810.00	5 223.00	49.71	66 970	4 100	62 870	15.3
Imidacloprid 200SL	500 ml/ha	84.33	10.13 (3.25)	66.2	1 600.00	4 880.00	32.34	59 200	1 500	57 700	38.5
Phorate 10G	25	86.67	10.41 (3.27)	65.3	1 605.00	5 085.00	32.75	59 385	2 250	57 135	25.4
Untreated Check		81.33	30.0 (5.46)		1 209.00	4 145.00					
SEm+		3.11	0.40		85.63	131.84					
CD (P=0.05)		NS	1.23		263.87	406.26					

\* Mean of three replications. Figures in parenthesis are x+0.5 transformed values, DAA- Days After application, NICBR= Net Incremental Cost Benefit Ratio, MSP Groundnut= ₹ 37000 per q, Imidacloprid 200SL @ ₹ 2000 per litre, Imidacloprid 0.3G @ ₹ 90.0 per kg, Phorate @ ₹ 70 per kg, Labour charges @ ₹ 500 per ha.

Table 2 Efficacy and economics of imidacloprid 0.3G applied as soil application against white grub in groundnut crop during *khariif* 2012-13

Treatments	Dose (kg/ha)	Germination (%) 15 DAA	Cumulative plant mortality (%) due to white grub 60DAA*	Protection over control (%)	Average number of grubs/m <sup>2</sup>	Yield (kg/ha)		% Increase in yield over control	Gross return (₹/ha)	Cost of insecticide treatment including labour treatment	Net return (₹/ha)	NICBR
						Dry pod	Dry fodder					
Imidacloprid 0.3G	10	86.3	15.73 (3.99)	46.2	1.97 (1.56)	1545.0	4720.00	26.4	57165	1400	55765	39.8
Imidacloprid 0.3G	15	89.0	12.80 (3.58)	56.2	1.73 (1.47)	1615.0	4840.00	32.2	59755	1850	57905	31.3
Imidacloprid 0.3G	20	91.0	11.80 (3.46)	59.6	2.13 (1.57)	1814.0	5126.00	48.4	67118	2300	64818	28.2
Imidacloprid 0.3G	40	82.3	10.27 (3.25)	64.9	1.40 (1.36)	1830.0	5273.00	49.7	67710	4100	63610	15.5
Imidacloprid 200SL	500 ml/ha	83.6	13.17 (3.63)	54.9	1.50 (1.41)	1605.0	4830.00	31.3	59385	1500	57885	38.6
Phorate 10G	25	79.6	13.37 (3.66)	54.3	1.83 (1.51)	1591.0	4795.00	30.2	58867	2250	56617	25.2
Untreated Check		80.0	29.23 (5.40)		2.90 (1.83)	1222.0	4165.00					0.0
SEM+		3.82	0.54		0.22	99.47	158.92					
CD (P=0.05)		NS	1.66		0.68	306.54	489.71					

\*Mean of three replications. Figures in parenthesis are x+0.5 transformed values, DAA= Days After application, NICBR= Net Incremental Cost Benefit Ratio, MSP Groundnut= ₹ 3700 per q, Imidacloprid 200SL @ ₹ 2000 per litre, Imidacloprid 0.3G @ ₹ 60.0 per kg, Phorate @ ₹ 70 per kg, Labour charges @ ₹ 500 per ha.

(1 209 kg and 1 222 kg/ha) during both the cropping seasons. Perusal of results (Table 1) indicated that the yield of groundnut pod was significantly higher with all the insecticidal treatments than untreated check. Results further indicated that soil application of imidacloprid (0.3G) @ 40 kg/ha obtained maximum pod yield (1 810 kg/ha), although it was at par with its lower doses at 15 and 20 kg/ha (1 590 kg and 1 794 kg/ha), imidacloprid (200SL) @ 500 ml/ha (1 600 kg/ha) and phorate (10G) @ 25 kg/ha (1 605 kg/ha).

Table 2 revealed that the highest pod yield of 1 830 kg/ha was recorded in imidacloprid (0.3G) @ 40 kg/ha treated plots and it was at par with its lower doses @ 10, 15 and 20 kg/ha and standard treatments. Similar findings were also reported in past by several scientists (Singh *et al.* 2012, Patel *et al.* 2010 and Patel and Patel 2000).

*Dry fodder yield*

Dry fodder yield (Table 1 and 2) was recorded significantly higher in all the insecticidal treatments compared to untreated plots (4 145 and 4 165 kg/ha) during both the cropping seasons. Highest dry fodder yield was recorded in imidacloprid (0.3G) @ 40 kg/ha (5 223 kg/ha) and it was at par with imidacloprid (0.3G) @ 20 kg/ha (5 096 kg/ha), imidacloprid (200SL) @ 500 ml/ha (4 880 kg/ha) and phorate (10G) @ 25 kg/ha (5 085 kg/ha). Similar results were also recorded during *khariif* 2012. Maximum dry fodder yield was recorded with imidacloprid (0.3G) @ 40 kg/ha (5 273 kg/ha) and it was at par with imidacloprid (0.3G) @ 15 and 20 kg/ha (4 840 and 5 126 kg/ha respectively), imidacloprid (200SL) @ 500 ml/ha (4 830 kg/ha) and phorate (10G) @ 25 kg/ha (4 795 kg/ha). Similar findings were also reported by earlier workers (Patel *et al.* 2010 and Patel and Patel 2000).

*Net incremental cost benefit ratio (NICBR)*

Table 1 revealed that among all the treatments, highest NICBR (1:38.5) was recorded with imidacloprid (0.3G) @ 10 kg/ha, imidacloprid (200SL) @ 500 ml/ha followed by imidacloprid (0.3G) @ 15 kg/ha (1:30.8), imidacloprid (0.3G) @ 20 kg/ha (1:27.9), phorate (10G) @ 25 kg/ha (1:25.4). Lowest value of NICBR (1:15.3) was obtained in the imidacloprid (0.3G) @ 40 kg/ha treated plots.

Highest NICBR was recorded in imidacloprid (0.3G) @ 10 kg/ha (1:39.8) followed by imidacloprid (200SL) @ 500 ml/ha (1:38.6), imidacloprid (0.3G) @ 15 kg/ha (1:31.3), imidacloprid (0.3G) @ 20 kg/ha (1:28.2), phorate (10G) @ 25 kg/ha (1:25.2). Lowest NICBR (1:15.5) was obtained in imidacloprid (0.3G) @ 40 kg/ha treated plots (Table 2). It could be concluded from the results that imidacloprid (0.3G) @ 10 kg/ha, imidacloprid (200SL) @ 500 ml/ha revealed highest NICBR compared to other treatments. Similar findings were also reported by earlier workers (Singh *et al.* 2012, Patel *et al.* 2010 and Patel and Patel 2000).

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#### REFERENCES

- Kapadia M, Batani P O and Berla N N. 2006. Whitegrub species attacking groundnut in Saurashtra region in Gujarat, India. *International Arachis Newsletter* **26**: 28–9.
- Patel B D and Patel G M. 2000. Efficacy of new insecticidal formulations as seed treatment against whitegrub in groundnut. *GAU Research Journal* **25**(2): 27–33.
- Patel B A, Patel I S, Patel P S and Patel J K. 2010. Efficacy of newer Insecticidal formulations applied as soil drenching against whitegrub and termite in groundnut. *Pestology* **34**(7): 55–7.
- Singh S, Bhatnagar A and Ahuja D B. 2012. Bioefficacy of insecticides as seed dresser against whitegrub, *Holotrichia consanguinea* Blanch in groundnut. *Indian Journal of Entomology* **74**(1): 24–6.
- Yadava C P S, Saxena R C, Mishra R K and Dadheech L N. 1977. Population management of white grub, *Holotrichia consanguinea* Blanch. In an agro-ecosystem. *Indian Journal of Entomology* **39**(3): 205–10.