EFFICACY OF INSECTICIDES AGAINST SUCKING INSECT PESTS IN GROUNDNUT

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ABSTRACT

The study evaluated various insecticide treatments targeting thrips, *Scirtothrips dorsalis* Hood and leafhoppers, *Empoasca kerri* Pruthi, key pests in groundnut cultivation during the summer 2021 and 2022. Among the treatments, seed treatment with imidacloprid 18.5% + hexaconazole 1.50% FS, along with foliar spray of acetamiprid 20% SP, showed notable effectiveness. This approach led to superior pest management, resulting in higher pod yield, net returns, and a favourable benefit-cost ratio. Comparable performance was observed with other treatments, including seed treatment with thiamethoxam 30 FS + acetamiprid 20% SP foliar spray and seed treatment with imidacloprid 60 FS + acetamiprid 20% SP foliar spray. Notably, seed treatments were found to be safer for natural enemies compared to foliar sprays and combinations thereof.

Key words: Acetamiprid, *Empoasca kerri*, foliar spray, imidachloprid, management, population, *Scirtothrips dorsalis*, seed treatment, summer, yield

Groundnut (*Arachis hypogaea* L.) is an essential oilseed crop cultivated extensively across diverse agro-ecological zones, serving as a vital source of edible oil and protein for millions of people worldwide (Kumar and Bhattacharya, 2019). Groundnut crop is attacked by about 90 species of insect pests. The sucking insect pest complex comprising thrips (*Scirtothrips dorsalis* Hood) and leafhopper (*Empoasca kerri* Pruthi) are the major pests of importance on groundnut specially when raised under summer conditions and bunch varieties are severely infested (Khanpara et al., 2017). These pests, noted for their capacity to feed on plant sap, not only harm host plants but also serve as vectors for a variety of plant infections, posing a double danger to crop health and productivity. Several approaches have been explored to manage groundnut insect pests, but the use of chemical methods has proven to be an essential approach for their control due to its quick action, effectiveness, and flexibility to diverse. Moreover, the indiscriminate use of insecticides may lead to unintended consequences, including the development of pest resistance and negative impacts on non-target organisms. As a result, there is a need to develop alternative pest management techniques that are both environmentally friendly and effective against certain insect pests. One such technique is to treat seeds with systemic insecticides, which is an alternative, easy, cost-effective, and feasible means of managing insect pests throughout the early stages of crop growth without harming natural enemies (Murugesan and Annakkodi, 2007). With this background the present study was designed to evaluate the efficacy of different insecticidal treatments by combining seed treatment technique with foliar insecticidal sprays.

MATERIALS AND METHODS

The experiment was carried out in the summer 2021 and 2022 at the AICRP on Groundnut, Main Agricultural Research Station in Dharwad, Karnataka. The variety TAG-24 was used, and the plot size was 5 m x 4 m. Groundnut crops were sown with a row-to-row distance of 30 cm and a plant-to-plant distance of 10 cm under protective irrigation in the randomized block design with 11 treatments and 3 replications. The observations on total number of leaf hoppers (top 3 leaves) and thrips (terminal bud) was recorded on five randomly selected plants from each treatment at 15, 25, 35, 45 and 55 DAG. Later means were worked out. When crop attained maturity, net plots were harvested, pods were separated in each treatment. The weight of pod/ plot was recorded after drying. Plot wise yield was computed on hectare basis for statistical interpretation. Seed yield (pod and haulm kg/ha) and economics (gross income, net profit, benefit cost ratios of each treatments) was calculated by using the formula. The data was transformed using the square root transformation ($\sqrt{X + 0.5}$), as specified by Gomez and Gomez (1984).

Table 1. Efficacy of insecticides against leafhoppers and thrips on groundnut (summer 2021 and 2022) (pooled data)

	Treatments	Dosage	No. of leafhoppers/ top three leaves						No. of thrips/ terminal bud					
			15 DAG	25 DAG	35 DAG	45 DAG	55 DAG	Mean	15 DAG	25 DAG	35 DAG	45 DAG	55 DAG	Mean
T_1	ST with imidacloprid 18.5% +Hexaconazole 1.50% FS	2 g/ kg	0.68 (0.82)^{a}	1.43 (1.19)^{a}	4.65 (2.16)^{a}	5.75 (2.40)^{f}	6.85 (2.61)^{f}	3.87 (1.97)^{c}	0.68 (0.82)^{b}	1.39 (1.17)^{a}	2.69 1.64)^{a}	5.05 (1.64)^{a}	6.36 (2.52)^{a}	3.23 (1.80)^{d}
T_2	ST with thiamethoxam 30 FS	2 ml/ kg	1.42 (1.19)^{b}	1.65 (1.28)^{ab}	4.85 (2.20)^{ab}	6.00 (2.45)^{f}	7.23 (2.69)^{f}	4.23 (2.06)^{cd}	2.26 (1.50)^{e}	3.40 (1.86)^{d}	4.73 (2.17)^{c}	6.97 (2.17)^{c}	7.60 (2.75)^{g}	4.99 (2.23)^{f}
T_3	ST with imidacloprid 60 FS	2 ml/ kg	1.83 (1.35)^{c}	1.95 (1.40)^{b}	5.40 (2.32)^{bc}	6.60 (2.57)^{g}	7.55 (2.75)^{f}	4.67 (2.16)^{d}	1.19 (1.09)^{c}	2.65 (1.62)^{bc}	3.63 (1.90)^{b}	5.91 (1.90)^{b}	6.40 (2.52)^{f}	3.96 (1.99)^{e}
T_4	ST with chlorpyriphos 20EC	12 ml/ kg	6.38 (2.53)^{d}	7.32 (2.70)^{c}	8.10 (2.85)^{d}	9.03 (3.00)^{h}	9.30 (3.05)^{g}	8.02 (2.83)^{f}	4.95 (2.22)^{f}	7.60 (2.75)^{f}	8.43 (2.90)^{fg}	9.20 (2.90)^{fg}	10.10 (3.17)^{h}	8.06 (2.84)^{h}
T_5	T_1 + FS with acetamiprid 20% SP at 35, 45 DAG	2 g/kg + 0.25 g/ l	0.66 (0.81)^{a}	1.44 (1.20)^{a}	4.74 (2.17)^{a}	1.53 (1.23)^{a}	0.30 (0.55)^{a}	1.73 (1.32)^{a}	0.36 (0.59)^{a}	1.43 (1.19)^{a}	2.63 (1.62)^{a}	1.63 (1.62)^{a}	0.44 (0.66)^{a}	1.30 (1.14)^{a}
T_6	T_2 + FS with acetamiprid 20% SP at 35, 45 DAG	2 ml/ kg + 0.25g/ l	1.36 (1.17)^{b}	1.67 (1.29)^{ab}	4.88 (2.21)^{ab}	1.81 (1.35)^{b}	0.65 (0.80)^{b}	2.07 (1.44)^{ab}	1.69 (1.29)^{d}	3.02 (1.73)^{cd}	4.37 (2.08)^{c}	2.44 (2.08)^{c}	0.79 (0.89)^{b}	2.46 (1.57)^{c}
T_7	T_3 + FS with acetamiprid 20% SP at 35, 45 DAG	2 ml/ kg + 0.25 g/ l	1.78 (1.33)^{c}	1.97 (1.40)^{b}	5.43 (2.33)^{bc}	2 .28 (1.51)^{c}	0.81 (0.90)^{b}	2.45 (1.57)^{b}	1.04 (1.01)^{c}	2.51 (1.58)^{b}	3.60 (1.89)^{b}	2.09 (1.89)^{b}	0.67 (0.81)^{b}	1.98 (1.41)^{b}
T_8	T_4 + FS with acetamiprid 20% SP at 35, 45 DAG	12 ml/ kg + 0.25 g/ l	6.54 (2.56)^{d}	7.35 (2.71)^{c}	8.09 (2.84)^{d}	5.75 (2.40)^{f}	4.55 (2.13)^{e}	6.46 (2.54)^{e}	4.62 (2.14)^{f}	7.30 (2.69)^{f}	8.23 (2.86)^{f}	7.50 (2.86)^{f}	5.60 (2.36)^{e}	6.65 (2.58)^{g}
T_9	FS with acetamiprid 20% SP at 15, 25, 35, 45 DAG	0.25 g/ l	10.39 (3.22)^{e}	6.90 (2.63)^{c}	5.10 (2.26)^{ab}	3.55 (1.88)^{d}	2.28 (1.51)^{c}	5.64 (2.38)^{e}	7.65 (2.76)^{g}	6.00 (2.44)^{e}	5.55 (2.35)^{d}	3.71 (2.35)^{d}	2.80 (1.67)^{c}	5.14 (2.27)^{f}
T_{10}	FS with dimethoate 30 EC at 15, 25, 35, 45 DAG (Standard check)	1.7 ml/ l	10.30 (3.21)^{e}	7.60 (2.76)^{c}	5.85 (2.42)^{c}	4.30 (2.07)^{e}	3.55 (1.88)^{d}	6.32 (2.51)^{e}	7.70 (2.77)^{g}	7.60 (2.75)^{f}	7.10 (2.66)^{e}	5.64 (2.66)^{e}	4.05 (2.01)^{d}	6.42 (2.53)^{g}
T_{11}	Untreated control	-	10.37 (3.22)^{e}	11.32 (3.36)^{d}	11.90 (2.42)^{c}	12.68 (3.56)^{i}	13.10 (3.62)^{h}	11.87 (3.44)^{g}	7.73 (2.77)^{g}	8.73 (2.95)^{g}	9.30 (3.04)^{fg}	10.18 (3.04)^{g}	10.58 (3.25)^{h}	9.30 (3.05)^{i}
S.Em. ±			0.05	0.07	0.06	0.04	0.06	0.07	0.03	0.04	0.05	0.05	0.04	0.04
C.D. (p= 0.05)		-	0.12	0.17	0.14	0.10	0.16	0.18	0.09	0.14	0.15	0.15	0.12	0.10
C.V. (%)			10.26	8.49	10.30	8.41	11.40	10.25	8.64	7.95	8.59	8.71	9.68	9.68

DAG- days after germination, ST – seed treatment fs-foliar spray; Figures in parenthesis are square root ($\sqrt{x+0.5}$) transformed values. means showing similar alphabets do not differ significantly by dmrt (p= 0.05)

Table 2. Cost economics of insecticides against sucking insect pests on groundnut (summer 2021 and 2022) (pooled data)

Sl. No.	Treatments	Dosage/ ha	Pod yield	Haulm yield	Total Gross income (Rs./ ha) (pod+haulm yield)	Total cost of cultivation (Rs./ ha)	Net returns (Rs./ ha)	B:C ratio
T_1	ST with imidacloprid 18.5% +hexaconazole 1.50% FS	2 g/ kg	2508.00^{b}	2848.00^{b}	104592.00^{b}	61,835	$42,757.00^{c}$	1.69^{b}
T_2	ST with thiamethoxam 30 FS	2 ml/ kg	2501.50^{b}	2807.50^{b}	104271.50^{b}	62,085	$42,187.00^{c}$	1.68^{bc}
T_3	ST with imidacloprid 60 FS	2 ml/ kg	2510.50^{b}	2773.00^{b}	104579.50^{b}	62,410	$42,170.00^{c}$	1.68^{bc}
T_4	ST with chlorpyriphos 20 EC	12 ml/ kg	2150.50^{cd}	2434.00^{cd}	89631.50^{de}	61,927	27704.50^{f}	1.45^{de}
T_5	T_1 + FS with acetamiprid 20% SP at 35, 45 DAG	2 g/ kg + 0.25 g/ l	3042.50^{a}	3280.00^{a}	126620.00^{a}	62,520	$64,100.00^{a}$	2.03^{a}
T_6	T_2 + FS with acetamiprid 20% SP at 35, 45 DAG	2 ml/ kg + 0.25g/ l	2915.50^{a}	3183.00^{a}	121394.50^{a}	62,770	$58,625.00^{b}$	1.94^{a}
T_7	T_3 + FS with acetamiprid 20% SP at 35, 45 DAG	2 ml/ kg + 0.25 g/ l	2888.50^{a}	3178.00^{a}	120307.00^{a}	63,095	$57,212.00^{b}$	1.91^{a}
T_8	T_4 + FS with acetamiprid 20% SP at 35, 45 DAG	12 ml/ kg + 0.25 g/ l	2244.00^{bcd}	2596.00^{bcd}	93506.25^{cd}	62,612	$30,895.00^{ef}$	1.49^{cde}
T_9	FS with acetamiprid 20% SP at 15, 25, 35, 45 DAG	0.25 g/ l	2431.00^{bc}	2632.00^{bc}	101260.00^{bc}	62,605	$38,655.00^{d}$	1.62^{bcd}
T_{10}	FS with dimethoate 30 EC at 15, 25, 35, 45 DAG (Standard check)	1.7 ml/ l	2335.99^{bc}	2392.50^{bc}	97328.75^{bcd}	64,375	$32,954.00^{e}$	1.52^{bcde}
T_{11}	Untreated control	-	1961.50^{d}	2119.00^{d}	81788.50^{e}	61,280	$20,509.00^{g}$	1.33^{e}
	S.Em. ±		114.50	101.78	3871.97	NS	1350.01	0.08
	C.D. (p= 0.05)		286.24	300.26	9679.93	NS	3510.03	0.20
	C.V. (%)		8.73	9.75	8.46	6.60	8.95	6.97

Pod price: 40 Rs./ kg, haulm price: 1.5 Rs./ kg, ns- non significant

RESULTS AND DISCUSSION

The mean data presented in the Table 1 showed that the treatment T_5, which consisted of treating seeds with imidacloprid 18.5% and hexaconazole 1.50% FS, and spraying with acetamiprid 20% SP, quickly reduced the population of leaf hoppers and thrips recording a mean population that was comparable to T_6 and T_7 (Table 1). T_5 was statistically superior to all other treatments, recording the highest pod yield (3042.50 kg/ha) and haulm yield (3280.00 kg/ ha) with, greatest B:C ratio (1:2.03) respectively (Table 2) and found to be significantly superior among all the treatments which was statistically on par with the T_6 and T_7. The present findings are supported by Pravalika et al. (2023) who reported that seed treated with imidacloprid 600 FS @ 2.0 ml kg^{-1} (+ 4 ml water) seed was found more effective in reduction of leaf hoppers and thrips damage followed by thiamethoxam 70 FS @ 2.0 g kg^{-1} seed when compared to untreated control. Pandiyan (2020) concluded that, acetamiprid 20%SP @ 100 gm ha^{-1}, thiamethoxam 25WG @100 gm.ha^{-1}gm/ ha and imidacloprid 200SL @ 200 ml. ha^{-1} were found to be effective against leaf hoppers, thrips and its damage. The findings support an earlier discovery by Patwari (2019) who showed that imidacloprid 200 SL@ 3 ml/ kg seed treatment was more effective against thrips and thiamethoxam 35 FS @ 2 ml/ kg seed was superior in lowering the population of leaf hoppers and highest pod yield and B:C ratio were recorded by seeds treated with thiamethoxam 35 FS @ (2 ml/ kg seed) and imidacloprid 200 SL (3 ml/ kg seed) which showed at par results with each other. Since the imidacloprid 18.5% + hexaconazole 1.50% FS + foliar spray with acetamiprid 20% SP is a new ready mix molecule, the supporting studies related to this chemical are lacking. They reported that in none of the cases, the combination of insecticides and fungicides had a phytotoxic effect on the leaves. It shows that the compounds being examined are compatible. Pal et al. (2018) revealed that all insecticide-fungicide combinations were efficient in reducing both disease and insects while keeping individual efficacy and having no phytotoxic effect.

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AUTHOR CONTRIBUTION STATEMENT

BM conducted the experiment and wrote the manuscript. RS designed the research and corrected the draft. SBK and BSY corrected and proof reading of the article. KB helped in statistical analysis of data and proof reading of the Article. All the authors read and approved the manuscript.

CONFLICT OF INTEREST

No conflict of interest.

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