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Efficacy and economics of different insecticidal treatments for the management of major sucking insect pests of sesame

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Abstract
An experiment to test the efficacy and economics of seed treatment using imidacloprid 70 WS along with foliar spray of different newer insecticides against major sucking insect pests of sesame was conducted at the experimental field of AICRP Sesame and Niger, College of Agriculture, JNKVV, Jabalpur during the Summer 2013 and 2014. The result revealed that all the insecticidal treatments were found significantly superior over untreated controls. Among the treatments, treatment T_2 *i.e.*, seed treatment with imidacloprid 70 WS (7.5g/kg seed) + foliar spray of imidacloprid 17.8 SL (0.25 ml/l) recorded lowest population of leaf hopper (0.17 leaf hopper /three leaves/plant), mirid bug (0.68 mirid bug/ three leaves/plant) and white fly (0.21 white fly/three leaves/plant) with minimum disease severity (0.47% phyllody), higher seed yield (770 kg/ha) and BC ratio of 4.22. Treatment T_5 (seed treatment with imidacloprid 70 WS (7.5g/kg seed) + foliar spray of thiamethoxam 25 WG (0.25 g/l) was the next better treatment and recorded 0.24 leaf hopper /three leaves, 0.78 % severity of phyllody and 760 kg seed yield /ha. Superiority of treatment T_2 was also envisaged with a percent reduction in sucking insect pest populations (96.51, 93.43 and 95.68% leaf hopper, mirid bug and white fly respectively) over control. Moreover out of nine treatments, all the seven treatment combinations gave a higher seed yield in comparison to control plot along with plot receiving seed treatment alone. Among these mentioned treatment combinations, treatment T_2 out performed over others in terms of percent increase in seed yield (120.00%) over control, however, treatment T_5 (seed treatment with imidacloprid 70 WS (7.5g/kg seed) and foliar spray of thiamethoxam 25 WG) was next the better treatment in percent increase in seed yield (117.14%) and reduction of disease severity (88.57%) over control.

Keywords: sesame sucking insect pests, insecticidal management and economics

Introduction
Sesamum is a member of the order Tubiflorae, family Pedaliaceae is perhaps the oldest oilseed known and used by human beings [25]. It is an important annual oilseed crop in the tropics and warm subtropics, where it is usually grown in small plots [4]. Sesame is described as the "Queen of oilseeds" because it contains high oil (38- 54%), protein (18-25%), calcium, phosphorous, oxalic acid and excellent qualities of seed oil and meal [20]. Sesame seed oil has long shelf life due to the presence of lignans (Sesamin, Sesaminol, Sesamolinol), which have a remarkable antioxidant function, resisting the oxidation. It is predominantly grown in Madhya Pradesh, Rajasthan, Gujarat, West Bengal, Uttar Pradesh, Orissa, Andhra Pradesh, Tamil Nadu, Karnataka, Bihar and Assam. India is a world leader in area, production and export of sesame. However, the productivity is low in India as compared to world's average. Among various factors responsible for the low productivity levels of sesame, the insect pests, usually inflicts very severe damage to the crop. The physical damage may be less than those of foliage pests, yet their impact on final yield is colossal, directly by sucking plant sap or indirectly by transmission of virus and mycoplasma diseases [9]. Biswas and Das [6] have listed 29 insect species infesting sesame at various stages of plant growth. However, Ahuja and Bakhetia[2] recorded 65 insect species and one mite feeding and damaging the crop at one or the other stages of plant growth in different agro-ecological regions. Among the various sucking insect pests, nymphs and adults of leaf hopper [*Orosius albicinctus* (Distant)], mirid bug [*Nesidiocoris tenuis* (Rent.)] and white fly [*Bemisia tabaci* (Gennadius)] are serious pests which suck the cell sap from the tender parts of the plants. Due to this leaf margin curl down and turned red resulting in to stunted growth of the plants, sickly appearance of the crop and abnormal growth of the leaf tissue occur. The peculiar yellow spots are found on the upper

surface of leaves affected by whitefly. Leaf hopper and white fly are also responsible for transmitting phyllody and leaf curl disease in sesame respectively [1]. Among them, Phyllody is major one which is caused by a phloem limiting phytoplasmas like organism (phytoplasma) and transmitted by leaf hopper [23]. The affected plants become stunted and the floral parts get modified into leafy structures bearing no fruits and seeds, causing yield loss up to 100 per cent. Murugesan *et al*. [15] estimated that an increase in phyllody disease by one per cent decreased the sesame yield by 8.4 kg/ha. The spread of phyllody pathogens (MLO) and leaf curl virus depends on the abundance of insect vectors and their inter plant movement, the tenure time on plants and the mode of pathogen transmission. Keeping in view the importance of the crop, the devastating capacity of the pest and the ever dynamic pesticide market, the present research work was initiated to investigate the suitability of some chemicals and neem based insecticides for effective and safe suppression of sucking insect pests of sesame.

Materials and Methods

The present experiment was conducted at the experimental field of AICRP Sesame and Niger, College of Agriculture, JNKVV, Jabalpur during Summer 2013 and 2014 for determining the efficacy and economics of seed treatment and foliar spray of insecticides against major sucking insect pests (leaf hopper, mirid bug and white fly) on sesame crop. The experiment was designed in RCBD (Randomized Complete Block Design) with nine (09) treatments including control and four (4) replications. The variety JTS-8 was sown with all other agronomical practices to raise good and healthy crop. Seed of all the plots except control were treated with imidacloprid 70WS (7.5g/kg seed). Two foliar sprayings were done first spray at the initial appearance of the disease and the second at 15 days after the first spray. All the insecticides were applied with KnapSack spray machine and the application was done in the early morning. Before spray of each insecticide, the spray tank was washed carefully to avoid chemical mixture.

The data on population of sesame leaf hopper, mirid bug and white fly were recorded on three leaves (top, middle and bottom canopy of the plants) per plant by randomly selecting five plants from each plot. The pretreatment observation was recorded at one day before 1st spray and post treatment observations were recorded at 3, 7 and 10 days after each spray. To know the impact of these insecticides on other sucking insect pests the data on white fly and mirid bug were also recorded. The percent phyllody infestation was also worked out by counting the number of phyllody infested plant per plot. The percent reduction in insect pests population over the control were also workedout. Based on pooled data marketable yield, B: C ratio and percent increase in seed yield over control for different treatments were worked out. Statistical analysis of all the recorded data were subjected to analysis of variance in Randomized Block Design with the procedure followed by [16].

Preparation of neem seed kernel extract (NSKE) 5 per cent: Fifty gram of neem seeds were shade dried, crushed and then soaked overnight in little quantity of water. Later the mixture was squeezed and filtered through the muslin cloth and the volume was made upto one litre so as to obtain 5 per cent NSKE.

Table 1: Treatment Details

S. No	Treatments	Dose
1	T_1 – ST with Imidacloprid 70WS	(7.5 g/kg seed)
2	T_2- T_1+ FS of Imidacloprid 17.8 SL	(0.25 ml/l)
3	T3- T_1+ FS of Acetamiprid 20 SP	(0.30 g/l)
4	T_4 - T_1+ FS of Thiocloprid	(1.0 ml/l)
5	T_5 - T_1+ FS of Thiamethoxam 25WG	(0.25 g/l)
6	T_6- T_1+ FS of Lambda cyhalothrin	(1.0 ml/l)
7	T_7- T_1+ FS of Azadirachtin 0.03% EC	(5.0 ml/l)
8	T_8- T_1 + FS of NSKE 5%	(5.0%)
9	T_9- Control	-

ST= Seed Treatment, FS = Foliar Spray

Results and Discussions

Data on the effect of different treatments on the incidence of sucking insect pests (leaf hopper, mirid bug and white fly) showed significant differences at the different intervals of observations. Pre treatment counts of insect pests at initial stage of the plant growth showed that all the plots having treated seed reduced the incidence of leaf hopper from 38.32 to 57.04%, mirid bug from 29.36 to 42.09% and white fly from 20.21 to 37.71% over the control. The present findings are in agreement with the results reported by [13, 17] they concluded that seed treatment with imidacloprid reduced the sucking pest population below the economic threshold level up to 40 days after sowing. Similarly Seed treatment of cotton with imidacloprid was effective against leafhopper population up to 61 days after germination [7, 14]. Zhang *et al*. [26] also reported that after seed treatment, imidacloprid shows systemic and residual toxicity in several crop plants and interferes with the transmission of stimuli or impulses in the nervous system of insect herbivores, and gives excellent control against a broad range of commercially important sucking insect pests. Post treatment counts of insect pests showed that the lowest population of leaf hopper (0.17 leaf hopper/three leaves/plant), mirid bug (0.68 mirid bug/three leaves/plant) and white fly (0.21 white fly/three leaves/plant) was recorded in treatment T_2 in which seed treatment with imidacloprid 70 WS (7.5g/kg seed) and foliar spray of imidacloprid 17.8SL (0.25 ml/l) was applied. These results are in agreement with the findings of [11] who reported that application of imidacloprid 70 WS as a seed treatment (5 g/kg seed) + imidacloprid 200 SL (0.01%) as a foliar spray drastically reduced leafhopper (*Empoasca kerri* Pruthi) population and increased the pod yield of groundnut. Venkanna *et al*. [24] reported that foliar application of imidacloprid @ 26.7g a.i./ha at 25 and 40 days after sowing was found effective in reducing leafhoppers (*E. kerri* Pruthi) on groundnut and also superior among various neonicotinoid group *viz.*, acetamiprid and thiamethoxam. Treatment T_5 was the next better treatment in respect to lowest no of leaf hopper (0.24 leaf hopper/three leaves) and white fly (0.30 white fly/three leaves) while in case of mirid bug (0.85 mirid

bug/three leaves) treatment T_3 [seed treatment with imidacloprid and foliar spray of acetamiprid 20 SP (0.25 ml/l)] performed better than other treatments except treatment T_2. The highest incidence of leaf hopper (4.90 leaf hopper/three leaves), mirid bug (10.28 mirid bug/three leaves) and white fly (4.74 white fly) were recorded in control plot followed by T_1 (4.60 leaf hopper, 9.29 mirid bug and 4.24 white fly/three leaves) in which only seed treatment was applied. Both the neem based insecticides were found significantly superior over the control to reduce the incidence of leaf hopper, mirid bug and white fly. Present findings are in conformity with the findings of [1] they reported that the incidence of nymph and adults of sucking pests viz., leaf hopper, mirid bug and white fly decreased significantly by natural and indigenous products viz., neem oil, neem seed kernel extract, neem leaf extract, garlic bud + red pepper extract, cow urine and cow butter milk as compared to control.

Table 2: Effect of different insecticidal treatments on the incidence of leaf hopper (vector of Phyllody) during summer 2013 and 2014 (Average of two years)

Treatment	Leaf hopper population/three leaves/plant											% reduction over control
	PTC	% reduction over control	Days after 1st spraying				Days after 2nd spraying				Overall Mean	
			3rd	7th			3rd	7th	10th	Mean		
T_1 - ST with Imidacloprid 70 WS (7.5 g/kg seed)			4.48 (2.22)	5.51 (2.45)	6.33 (2.61)	5.44	5.08 (2.36)	3.49 (2.00)	2.75 (1.79)	3.77	4.60	6.03
T_2- T_1+ FS of Imidacloprid 17.8 SL (0.25 ml/l)	2.68 (1.78)	52.23	0.00 (0.71)	0.05z (0.74)	0.75 (1.12)	0.27	0.00 (0.71)	0.05 (0.74)	0.18 (0.81)	0.08	0.17	96.51
T3- T_1+ FS of Acetamiprid 20 SP (0.3 g/l)	2.83 (1.82)	49.55	0.00 (0.71)	0.13 (0.79)	1.11 (1.27)	0.41	0.00 (0.71)	0.08 (0.76)	0.26 (0.86)	0.11	0.26	94.64
T_4 - T_1+ FS of Thiocloprid (1.0 ml/l)	2.91 (1.84)	48.13	0.15 (0.81)	0.16 (0.81)	1.13 (1.27)	0.48	0.00 (0.71)	0.03 (0.72)	0.31 (0.89)	0.11	0.30	93.94
T_5 - T_1+ FS of Thiamethoxam 25WG (0.25 g/l)	2.86 (1.83)	49.02	0.10 (0.77)	0.10 (0.77)	0.98 (1.21)	0.39	0.00 (0.71)	0.05 (0.74)	0.23 (0.85)	0.09	0.24	95.05
T_6- T_1+ FS of Lambda cyhalothrin (1.0 ml/l)	3.25 (1.93)	42.07	0.15 (0.80)	0.15 (0.80)	1.28 (1.33)	0.53	0.09 (0.76)	0.08 (0.76)	0.34 (0.91)	0.17	0.35	92.94
T_7- T_1+ FS of Azadirachtin (0.03%)	3.31 (1.94)	41.00	0.16 (0.81)	0.26 (0.87)	1.50 (1.41)	0.64	0.15 (0.80)	0.21 (0.83)	0.43 (0.95)	0.26	0.45	90.77
T_8- T_I + FS of NSKE (5%)	3.46 (1.99)	38.32	0.10 (0.77)	0.21 (0.84)	1.40 (1.37)	0.57	0.14 (0.79)	0.18 (0.81)	0.35 (0.92)	0.22	0.40	91.94
T_9- Control	5.61 (2.47)	-	5.24 (2.39)	5.41 (2.43)	6.70 (2.68)	5.78	4.96 (2.33)	3.93 (2.10)	3.19 (1.91)	4.03	4.90	
SEm ±	0.20		0.56	0.59	0.50	-	0.58	0.47	0.36			
CD (P= 0.05)	0.58		1.62	1.72	1.45	-	1.69	1.36	1.05			

*Figures in parenthesis are square root of $\sqrt{x+0.5}$

Table 3: Effect of different insecticidal treatments on the incidence of mirid bug during summer 2013 and 2014 (Average of two years)

Treatment	Mirid bug population/three leaves/plant											% reduction over control
	PTC	% reduction over control	Days after 1st spraying				Days after 2nd spraying				Overall Mean	
			3rd	7th	10th	Mean	3rd	7th	10th	Mean		
T_1 - ST with Imidacloprid 70 WS (7.5 g/kg seed)	3.58 (2.01)	41.60	5.51 (2.44)	9.19 (3.11)	10.05 (3.25)	8.25	11.43 (3.45)	11.69 (3.49)	7.88 (2.88)	10.33	9.29	9.64
T_2- T_1+ FS of Imidacloprid 17.8 SL (0.25 ml/l)	3.55 (1.99)	42.09	0.18 (0.82)	0.40 (0.94)	1.75 (1.49)	0.78	0.10 (0.77)	0.30 (0.89)	1.33 (1.35)	0.58	0.68	93.43
T3- T_1+ FS of Acetamiprid 20 SP (0.3 g/l)	3.90 (2.08)	36.38	0.10 (0.77)	0.63 (1.06)	2.15 (1.61)	0.96	0.13 (0.79)	0.50 (1.00)	1.60 (1.44)	0.74	0.85	91.73
T_4 - T_1+ FS of Thiocloprid (1.0 ml/l)	4.16 (2.15)	32.14	0.18 (0.82)	0.53 (1.01)	2.48 (1.72)	1.06	0.05 (0.74)	0.50 (1.00)	1.85 (1.53)	0.80	0.93	90.96
T_5 - T_1+ FS of Thiamethoxam 25WG (0.25 g/l)	3.69 (2.04)	39.80	0.35 (0.92)	0.63 (1.06)	2.55 (1.73)	1.18	0.15 (0.80)	0.43 (0.96)	2.33 (1.67)	0.97	1.07	89.58
T_6- T_1+ FS of Lambda cyhalothrin (1.0 ml/l)	4.33 (2.19)	29.36	0.23 (0.84)	0.63 (1.06)	2.68 (1.76)	1.18	0.13 (0.79)	0.43 (0.96)	2.25 (1.64)	0.93	1.05	89.75
T_7- T_1+ FS of Azadirachtin 0.03%	4.19 (2.15)	31.65	0.43 (0.96)	1.05 (1.24)	3.03 (1.85)	1.50	0.15 (0.80)	0.78 (1.12)	2.70 (1.77)	1.21	1.35	86.83
T_8- T_I + FS of NSKE 5%	4.50 (2.23)	26.59	0.28 (0.87)	1.03 (1.23)	3.65 (1.98)	1.65	0.10 (0.77)	0.68 (1.08)	3.28 (1.92)	1.35	1.50	85.41
T_9- Control	6.13 (2.57)		7.20 (2.77)	10.03 (3.24)	11.09 (3.40)	9.44	12.45 (3.60)	12.54 (3.61)	8.38 (2.96)	11.12	10.28	
SEm ±	0.18		0.64	0.76	0.60		0.99	0.92	0.51			
CD (P= 0.05)	0.54		1.86	2.21	1.75		2.88	2.68	1.48			

*Figures in parenthesis are square root of $\sqrt{x+0.5}$

Table 4: Effect of different insecticidal treatments on the incidence of white fly during summer 2013 and 2014 (Average of two years)

Treatment	White fly population/three leaves/plant											% reduction over control
	PTC	% reduction over control	Days after 1st spraying				Days after 2nd spraying				Overall Mean	
			3rd	7th	10th	Mean	3rd	7th	10th	Mean		
T_1 -ST with Imidacloprid, 70 WS (7.5 g/kg seed)	4.96 (2.33)	25.19	5.84 (2.51)	6.38 (2.61)	5.73 (2.49)	5.98	4.10 (2.14)	2.41 (1.71)	1.00 (1.22)	2.50	4.24	10.72
T_2-T_1+ FS of Imidacloprid 17.8 SL (0.25 ml/l)	4.68 (2.27)	29.41	0.05 (0.74)	0.23 (0.84)	1.01 (1.23)	0.43	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	0.00	0.21	95.68
T3- T_1+ FS of Acetamiprid, 20 SP (0.3 g/l)	5.29 (2.40)	20.21	0.08 (0.76)	0.33 (0.91)	1.51 (1.41)	0.64	0.00 (0.71)	0.08 (0.76)	0.00 (0.71)	0.03	0.33	93.22
T_4 -T_1+ FS of Thiocloprid, (1.0 ml/l)	4.83 (2.30)	27.15	0.11 (0.78)	0.50 (0.98)	1.63 (1.45)	0.74	0.00 (0.71)	0.05 (0.74)	0.00 (0.71)	0.02	0.38	92.19
T_5 -T_1+ FS of hiamethoxam, 25WG (0.25 g/l)	4.90 (2.32)	26.09	0.15 (0.81)	0.35 (0.91)	1.33 (1.35)	0.61	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	0.00	0.30	93.79
T_6- T_1+ FS of Lambda cyhalothrin (1.0 ml/l)	4.63 (2.26)	30.17	0.23 (0.85)	0.63 (1.06)	1.90 (1.55)	0.92	0.10 (0.77)	0.00 (0.71)	0.00 (0.71)	0.03	0.48	90.19
T_7- T_1+ FS of Azadirachtin 0.03%	4.13 (2.15)	37.71	0.28 (0.88)	0.75 (1.10)	2.34 (1.67)	1.12	0.19 (0.83)	00.00 (0.71)	0.00 (0.71)	0.06	0.59	87.73
T_8- T_I + FS of NSKE 5%	4.63 (2.26)	30.17	0.25 (0.86)	0.90 (1.17)	2.04 (1.59)	1.06	0.10 ()	0.00 (0.71)	0.00 (0.71)	0.03	0.55	88.65
T_9- Control	6.63 (2.67)		6.90 (2.71)	6.53 (2.65)	6.56 (2.66)	6.66	4.81 (2.30)	2.65 (1.77)	1.01 (1.22)	2.83	4.74	
SEm ±	0.13		0.65	0.60	0.42		0.54	0.37	0.19			
CD (P= 0.05)	0.39		1.90	1.75	1.23		1.56	1.07	0.55			

*Figures in parenthesis are square root of √ x+0.5

Table 5: Effect of different insecticidal treatments on the incidence of sesame phyllody and seed yield during summer 2013 and 2014 (Average of two years)

Treatment	Plant Infestation (%)	(%) reduction of disease over control
T_1 - ST with Imidacloprid 70 WS, 7.5 g/kg seed	5.63 (13.62)	18.17
T_2- T_1+ FS of Imidacloprid 17.8 SL, 0.25 ml/l	0.47 (2.74)	93.11
T3- T_1+ FS of Acetamiprid 20 SP, 0.3 g/l	1.25 (4.55)	81.76
T_4 - T_1+ FS of Thiocloprid, 1.0 ml/l	1.88 (6.17)	72.67
T_5 - T_1+ FS of Thiamethoxam 25 WG, 0.25 g/l	0.78 (2.55)	88.57
T_6- T_1+ FS of Lambda cyhalothrin, 1.0 ml/l	2.03 (7.97)	70.48
T_7- T_1+ FS of Azadirachtin 0.03%	2.34 (8.70)	65.93
T_8- T_I + FS of NSKE 5%	2.03 (8.03)	70.48
Control	6.88 (14.82)	-
SEm ±	1.85	-
CD (P= 0.05)	5.39	-

*Figures in parenthesis are arcsine transformed values

Table 6: Economics of different insecticidal treatments against major sucking insect pests infesting sesame (Average of Two Years)

Treatment	Seed yield Kg/ha	Gross Return (Rs/ha)	Net Profit (Rs/ha)	Cost of cultivation (Rs/ha)	BC Ratio	% increase in seed yield over control	Value of Increased yield over control
T_1 - ST with Imidacloprid 70 WS, 7.5 g/kg seed	392.50	31400	18350	13050.0	2.41	12.14	3400
T_2- T_1+ FS of Imidacloprid 17.8 SL, 0.25 ml/l	770.00	61600	46990	14610.0	4.22	120.00	33600
T3- T_1+ FS of Acetamiprid 20 SP, 0.3 g/l	720.00	57600	43146	14454.0	3.99	105.71	29600
T_4 - T_1+ FS of Thiocloprid, 1.0 ml/l	695.00	55600	40636	14964.0	3.72	98.57	27600
T_5 - T_1+ FS of Thiamethoxam 25 WG, 0.25 g/l	760.00	60800	44711	16089.0	3.78	117.14	32800
T_6- T_1+ FS of Lambda cyhalothrin, 1.0 ml/l	630.00	50400	35400	15000.0	3.36	80.00	22400
T_7- T_1+ FS of Azadirachtin 0.03%	615.00	49200	33500	15700.0	3.13	75.71	21200
T_8- T_I + FS of NSKE 5%	627.50	50200	36500	13700.0	3.66	79.29	22200
Control	350.00	28000	15000	13000.0	2.15	-	-
SEm ±	17.23						
CD (P= 0.05)	50.20						

Effect of different treatments on the incidence of Phyllody disease

All the treatments differed significantly in reducing the incidence of phyllody disease. The lowest phyllody infested plants (0.47%) with highest reduction of disease severity (93.11%) was recorded with treatment T_2 (seed treatment with imidacloprid 70 WS (7.5 g/kg seed) and foliar spray of imidacloprid 17.8SL (0.25 ml/l) followed by treatment T_5 (0.78% disease incidence and 88.57% reduction over the control) and treatment T_3 (1.25% disease incidence with 81.76% reduction over the control). The highest number of phyllody infested plants were recorded from control plot followed by treatment T_1 and T_7. Treatment T_1 in which only seed treatment was applied to reduced the disease incidence up to 18.17% over the control. Imidacloprid (Gaucho 70 WS) being a low cost, selective and less polluting compound is found to be promising against sucking pests of cotton [18, 7, 22, 8, 19]. These results are also in agreement with findings of [3, 10] as they recorded increased seed yield in cotton when the seeds were treated with imidacloprid 70 WS @ 7.0g per kg. Among

the neem products, foliar spray of NSKE 5% performed better and reduced the disease severity up to 70.48% over the control.

Percent increase in seed yield

Different treatments were found to have their significant effect on the yield of sesame seed. All the treated plots produced significantly higher seed yield than the control. The plots in which only seed treatment was applied recorded less seed yield than those receiving seed treatment and foliar spray of chemicals and neem based insecticides but higher than the control. Percentage increase in seed yield in each treatment was calculated based on control. As indicated in Table 6, the higher seed yield (770 kg/ha) with highest increment in seed yield (120% over the control) and highest B:C ratio (4.22) was recorded with treatment T_2 [seed treatment with imidacloprid 70 WS (7.5 g/kg seed) and foliar spray of imidacloprid 17.8 SL (0.25 ml/l)] was applied. This was followed by treatment T_5 (755 kg seed yield/ha with 117.14% increment in seed yield over the control) in which seed treatment and foliar spray of thiamethoxam 25 WG (0.25g/l) was applied but the B:C ratio (3.78) was low as compared to treatment T_3 (3.99) in which seed treatment and the foliar spray of acetamiprid 20 SP (0.3g/l) was applied. Our results are in conformity with the results of [21] who reported that the insecticide fenvalerate, 0.01% gave the most effective control of *O. albicinctus* [*O. orientalis*] on sesame and increased average seed yield to 0.77 t/ha as compared to 0.30 t/ha in the untreated control. In case of neem based insecticides, foliar spray of NSKE 5% gave maximum increase in seed yield (70.48%) over the control. Our results are in conformity with the results of [12] who reported that insecticide application also increased seed yields (725 to 870 kg/ha vs. 326 kg/ha in the control).

Gross return from sesame seed due to different treatment applications varied from Rs. 31400/ha. to Rs. 61600/ha as against only Rs. 28000/ ha in the untreated control. However, the value of increased seed yield (Rs. 33600/ ha) and net profit (Rs. 46990/ha) over control was maximum in the treatment T_2 followed by treatment T_5 (Rs. 32800/ha). Similarly,[5] reported that the highest Incremental Cost Benefit Ratio (ICBR) was obtained from the plots treated with imidacloprid (16.54) followed by acetamiprid (11.06). Considering the effectiveness and economics, neem based insecticides, NSKE 5% can be sprayed for the management of concerned insect pests for the production of export purpose sesame.

It can be concluded that the seed treated with imidacloprid 70WS @ 7.5g/kg of seed and foliar spray of imidacloprid 17.8 SL recorded higher seed yield of 770 kg/ha as compared to control (350.00 kg/ha). The treatment T_5 (seed treatment and foliar spray of thiamethoxam) was the next better treatment in terms of higher seed yield (760 kg/ha) while the B:C ratio was low as compared to treatment T_3 in which foliar spray of acetamiprid was applied. Both the neem based insecticides were found significantly superior over seed treatment alone and control (350 kg/ha).

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