Original Research Article

Impact of various IPM Modules in the management of major insect pests of sesame under Bundhelkhand Zone of Madhya Pradesh

Abstract:
A field experiment was conducted at AICRP (Sesame) centre, College of Agriculture, JNKVV, Tikamgarh (M.P.) during the*kharif* season of 2017 in a Randomized Block Design to study the Impact of various IPM module in the management of major insect pests of sesame under Tikamgarh agro climatic condition .The experiment was organized in Randomized Block Design with three replication and sixtreatment having 21.6 m^2 plot each and sesame varietymoderate resistance TKG22 was taken as a test variety. The seeds of all the plots were treated with imidacloprid 600FS (5g/kg seed) plus intercropping with Black gram (3:3) and yellow sticky trap @1trap per plot was done expect control. The treatment taken were single foliar spraying of profenofos 50EC (2ml/l),NSKE 5% (T1 and T2),Two spraying of NSKE 5%+NSKE5% ,profenofos 0.1% (2ml/l) + NSKE 5% ,NSKE 5% + profenofos 0.1% respectively be sides untreated control. The result revealed that all the insecticide treatment were found significantly superior over untreated control .among the treatment ,treatment T 5 (imidacloprid 600 FS (5g/kg seed) foliar spray of NSKE 5% at 30 &profenofos 0.1% (2ml/l) 45 DAS) was better treatment and recorded the lowest population of *antigashtra* (0.17) larvae /5 plant) bud fly was significantly reduced and, major bsucking pests lowest population (0.16)leaf hopper /three leaves/plant), mirid bug (0.24 mirid bug/ three leaves/plant) and white fly (0.48 white fly/three leaves/plant) . Seed equivalent yield was also significantly increased in T5 (imidacloprid 600 FS (5g/kg seed + intercropping with black gram 3:3) foliar spray of NSKE 5% at 30 &profenofos 0.1% (2ml/l) 45 DAS)the highest Seed equivalent yield the maximum of 1176 kg /ha ,maximum net profit of (Rs 78667) and B:C ratio (6.11) and followed by T4 the highest Seed equivalent yield the of 1075 kg /ha , net profit of (Rs 70297) and B:C ratio (5.48).
Keywords: *Antigastracatalaunalis*, IPM modules, sesame pests, abiotic factors, neem products,Bud fly

Introduction :

Sesame (*Sesamum indicum* Lin.) known as the “queen of oil seeds” is one of the most ancient oilseed crop of the world. In India, it is grown in the entire crop growing season’s *viz*., *kharif*, late *kharif*, *rabi*, andsummer seasons(Ahirwar*eat al*2009).Sesame is one of the oldest crop grown in india .India ranks first in the area under cultivation representing 30% of the world production .Gujarat ,Rajsthan, Maharastra,UttarPradesh,Madhya Pradesh ,Andhra Pradesh ,Karnataka,Westbengal ,Orissa,Punjab and Tamilnadu are the major states of sesame cultivation (Singhal 1999) Sesame is used as food, edible oil, bio-medicine and health care. Due to the presence of tocopherol and lignins sesame has remarkable antioxidant function also. The seeds are rich in proteins and essential amino acids, especially methionine which have an anti-ageing property. The seed is rich source of vitamins E, A & B complex

Comment [DSAHR1]: Start with Importance and need of Novel pest management strategies. As you used Neem as source, so need to cite literature
Cite these articles as source

Toxicity and enzyme inhibition activities of the essential oil and dominant constituents derived from Artemisia absinthium L. against adult Asian citrus psyllid Diaphorina

Population Dynamics, Efficacy of Botanical Extracts and Synthetic Insecticides for The Control of Pea Leaf Miner (Phytomyza horticola Goureau)(Diptera: Agromyzidae) Under the …

Development and evaluation of emulsifiable concentrate formulation containing *Sophora alopecuroides* L. extract for the novel management of Asian citrus psyllid

including calcium and phosphorus. Sesame oil has reducing effect on cholesterol and prevents coronary heart diseases. Due to excellent nutritional, medicinal, skin care and cooking qualities of sesame oil. It gains importance because of quality edible oil, protein, calcium and phosphorus (Seegler, 1983) [. In India it is grown on 1.78 million ha with a total production of 0.81 million tonneswith very poor average productivity of 456 kg ha-1 as compared to the world average productivity of 518kg ha-1 .(Anonymous,2021 **)**.The main reasons of low productivity of sesame are its rain fed cultivation in marginal andsub marginal lands under poor management practices. Damage due to insect pests is also one of the majorfactors causing low productivity. The crop is attacked by 29 species of insect pests in different stages ofits plant growth (Biswal *et al* 2001. Among these, leaf roller and capsule borer (*Antigastracatalaunalis*Dup.) are majorinsect pest in all sesame growing areas in India. It damages the crop at all three stages *viz.*, vegetative,flowering and maturity. Newly hatched larvae feed the young leaves and shoot tips and at a later growthstage they roll the leaves together and feed inside. There after feed on flowers, pods and seeds. InBundelkhand zone of Madhya Pradesh sesame is grown in *kharif* season. Activity of *Antigastra*isobserved high during the month of August to October. Therefore, in Bundelkhand region *Antigastra*is akey insect pest of sesame and causing economical loss to an extent of 43.1%(Gupta et al 2002). Sesame leaf Webber and capsule borer, *Antigastracatalaunalis*(Lepidoptera: Pyralidae) is the most harmful pest of sesame crop with causes losses up to 90% (Ahuja and Bakhetia, 1995) and causes losses up to 80.42% (Wazire& Patel, 2016).Nymph and adults ofsome sucking insect pests, jassid (*Orosiusalbicinctus*Distant),mirid bug (*Nesidiocoris tenuis* Rent.) andwhite fly (*Bemisiatabaci*Gennadius) suck the cell sap from leaf, flower, and pods. This leads to curling ofleaf margin downwards, stunted the growth of the plant and ultimately reduce the yield. Jassid and whitefly are also responsible to transmit phyllody and leaf curl diseases in sesame, respectively. Keeping thesefacts in view, present study on incidence of *Antigastra*, jassid, mirid bug and white fly was undertaken It attack the crop from seedling stage and continues till maturity of pod and causing severe damage to all the plant parts such as leaf, flower and pod. Intercropping with pigeon pea (Nath *et al*, 2003) and black gram, green gram, cluster bean, sorghum and pearl millet (Ahirwar*et al*, 2009, Ahuja *et al*, 2009, Behera., 2013) are found to be quite effective in reducing the leaf Webber damage. (Abraham *et al*,1977) that reported 27-40% of the damage was caused by the larvae of sesamum leaf webber and capsule borer. Saxena and Jakhmola 1993) recorded that the shoot webber and pod borer was causing 10-60% loss in yield. Avoidable grain yield loss due to incidence of sesamum leaf roller and capsule borer was reported to varied from 6.2 to 43.1% in Madhya Pradesh (Gupta%., 2002) [14]. In Odisha, the avoidable loss due to sesamum leaf webber was estimated to be 79.75% (Patnaik%., 2002).

Comment [DSAHR2]: Need to cite these references as source of IPM

Efficacy of some selected synthetic chemical insecticides and bio-pesticides against cotton mealybug, Phenacoccus solenopsis Tinsley (Stemorrhyncha: Pseudococcidae) under agro

Development and evaluation of emulsifiable concentrate formulation containing *Sophora alopecuroides* L. extract for the novel management of Asian citrus psyllid

Volatile signals from guava plants prime defense signaling and increase jasmonate-dependent herbivore resistance in neighboring citrus plants

3. Materials and Methods

The present experiment was conducted at AICRP on oilseeds sesame trials , Department of Entomology, JNKVV, College of Agriculture, Tikamgarh during the *kharif* season of 2017 in a Randomized Block Design to study the cost effective Integrated Pest Management (IPM) module for the management of major insect pests of sesame. The field experiment was laid out in Randomized Block Design (RBD) with six (6) treatments and three (3) replications. The variety “TKG22” was sown along with all other agronomical practices as usual to raise

good and healthy crop. Each subplot measured 21.6 m2 (5.4 m × 4 m). Sesamum variety "TKG22" was taken as the test (National Chack) cultivar. This variety released by JNKVV,COA,Tikamgarhis grown in many parts of the state both during *kharif* and Rabi seasons. It is suitable for medium and upland conditions. The black gram variety Ajad 1 was grown as intercrop with sesame in 3:3 ratio. Sesame variety of, 'TKG22' was sown on 01/07/ 2017 with a spacing of 30 cm × 10 cm. All the recommended agronomic practices were adopted for raising the crop.Seed of all the plots except control were treated with insecticides and their response as a seed treatment alone and with the combination of foliar spray of insecticides was tested. All the treatments were applied in the form of foliar sprays by means of high volume hand compression sprayer using 500 litre of spray solution per hectare to ensure thorough coverage of plants and the application was done in the early morning. Before spray of each insecticide, the spray tank was washed carefully to avoid chemical mixture. Sufficient care was taken to avoid drifting of the insecticides while spraying. The insecticides were applied after the appearance of pests in economic proportions i.e., beyond ETL level at 30 days after sowing except the maximum protection level at T5 treatment. The data on the population of sesame leaf roller/capsule borer was recorded from randomly selected ten plants in each treatment. The pre-foliar spray count of larval population of *Antigastra*was recorded one day before first spray and post-foliar counts of larval populations were recorded on 7th and 14th day after each spray. The observations were also recorded at vegetative (30 DAS), flowering (45 DAS) and capsule (60 DAS) stage of crop growth and percent plant, flower and capsule damage were worked out by counting the total number of damaged and healthy plants, flowers and capsules per plant. The percent reduction of larval population, plant, flower and capsule damage over the control were also worked out. Statistical analysis of all the recorded data were subjected to analysis of variance in Randomized Block Design with the procedure laid out by Gomez and Gomez (1984) [25].

Preparation of NSKE5%:

3 kilogram of freshly neem seed kernel was taken and crushed the kernel gently and tied it loosely with a cotton cloth. It was soaked in a vessel containing 10 litres of water over night. After this, it is filtered, on filtering 6 litre of extract was obtained. 500 ml of this extract diluted with 9½ litres of water. Before spraying soap solution @ 10 ml/litre was added to help the extract stick well to the leaf surface.

Comment [DSAHR3]: Refence? Why you not used solvent?

Table 1: The detailed of Experiment Treatments are:

SNo.	**Seed treatment**	**Intercropping**	**Trap**	**Foliar application**	
				30 DAS	**45 DAS**
T1	Seed treatment with imidacloprid 600 FS @ 5g/kg seed	Intercropping with black gram (3:3)	Yellow sticky trap @ 1 trap per plot	Profenofos 0.1% @ 2ml/liter	-
T2	Seed treatment with imidacloprid 600 FS (5g/kg seed)	Inter Cropping with Black gram (3:3)	Yellow sticky trap @ 1 trap per plot	NSKE 5%	-
T3	Seed treatment with imidacloprid 600 FS (5g/kg seed)	Inter Cropping with Black gram (3:3)	Yellow sticky trap @ 1 trap per plot	NSKE 5%	NSKE 5%
T4	Seed treatment with imidacloprid 600 FS (5g/kg seed)	Inter Cropping with Black gram (3:3)	Yellow sticky trap @ 1 trap per plot	Profenofos 0.1% (2ml/litre)	NSKE 5 %
T5	Seed treatment with imidacloprid 600 FS (5g/kg seed)	Inter Cropping with Black gram (3:3)	Yellow sticky trap @ 1 trap per plot	NSKE 5%	Profenofos 0.1% (2ml/litre)
6	Control	-	-	-	-
***Maximum protection spraying at 15 days interval starting from 30 days after sowing (DAS) alternatively**					

Table 2: The details of pesticide tested

Sl. No	**Chemical Name**	**Trade Name**	**Pkg available**	**Price in Rupees**
1	Profenofos 50 EC	Kemcron	1 Litre	625
2	Neem Seed Kernel Extract (NSKE)	-	25kg	1000

Table 3a: Efficacy of different IPM modules on the incidence of shoot webber and capsule borer, Bud fly in sesame during *kharif*, 2017

Treatments	*Antigastracatalaunalis*							*Desineuralini*	
	Population /plant			Per cent damage				Flower (45 DAS)	
	PTC	Plant (30 DAS)	Flower (45 DAS)	PTC	Plant (30 DAS)	Flower (45 DAS)	Capsule (60 DAS)	Population/ plant	Per cent damage
T_1	0.35 (0.92)	0.20 (0.84)	0.60 (0.96)	47.5 (43.5)	27.5 (31.4)	8.40 (16.7)	2.52 (8.90)	1.15 (1.28)	6.30 (14.2)
T_2	0.40 (0.95)	0.50 (0.99)	0.63 (1.05)	55.0 (47.9)	32.5 (34.7)	10.13 (18.50)	2.07 (8.20)	2.35 (1.58)	7.10 (14.7)
T_3	0.63 (1.05)	0.48 (0.99)	0.75 (1.11)	55.0 (47.9)	27.5 (30.6)	9.56 (17.9)	1.76 (7.10)	1.60 (1.31)	6.90 (15.2)
T_4	0.48 (0.98)	0.25 (0.86)	0.40 (0.95)	45.0 (42.1)	25.0 (29.7)	7.66 (16.0)	1.29 (6.50)	0.55 (1.00)	6.50 (14.4)
T_5	0.33 (0.91)	0.08 (0.75)	0.25 (0.86)	52.5 (46.4)	22.5 (27.7)	3.97 (9.7)	1.27 (6.30)	0.45 (0.97)	5.30 (12.8)
T_6	0.48 (0.98)	0.55 (1.02)	0.78 (1.12)	62.5 (52.3)	55.0 (47.9)	25.0 (29.7)	10.67 (21.5)	4.25 (2.18)	12.4 (22.0)
SEm±	0.05	0.03	0.04	3.45	3.82	2.33	1.23	0.24	1.42
CD at 5 %	NS	0.9	0.12	NS	11.50	6.80	3.57	0.69	4.06

*** Figure within parentheses aresquire root transformed values, "PTC- Pre treatment count**

Table 3b :Efficacy of different IPM modules on plant damage by shoot webber and capsule borer and Bud fly in sesame during *kharif*, 2017

Treatments	Mean population *Antigastracatalaunalis larvae* /plant					Bud fly	
	PTC	Plant (30 DAS)	Flower (45 DAS)	Mean	Percentage reduction over control	Population/ plant	Percentage reduction over control
T_1	0.35 (0.92)	0.20 (0.84)	0.60 (0.96)	0.40	40.29	1.15(1.28)	72.94
T_2	0.40 (0.95)	0.50 (0.99)	0.63(1.05)	0.57	14.92	2.35(1.58)	44.70
T_3	0.63 (1.05)	0.48 (0.99)	0.75 (1.11)	0.62	7.46	1.60(1.31)	62.35
T_4	0.48 (0.98)	0.25 (0.86)	0.40 (0.95)	0.33	50.74	0.55(1.00)	87.05
T_5	0.33 (0.91)	0.08 (0.75)	0.25 (0.86)	0.17	74.63	0.45(0.97)	89.41
T_6	0.48 (0.98)	0.55 (1.02)	0.78 (1.12)	0.67	-	4.25(2.18)	-
SEm+	0.05	0.03	0.04			0.24	
CD at 5 %	NS	0.9	0.12			0.69	

*** Figure within parentheses aresquire root transformed values, "PTC- Pre treatment count**
values **DAS**-Days after spraying ,**NS**- Non Significant ,**DBS**- Day before spraying
*Treatment facing only Two spraying

Percentage reduction over control= Starting e of controlvalu –Final valueX 100
Starting control value

Table 4:Efficacy of different IPM modules on plant ,Flower and Capsule damage by leaf roller and capsule borer and Flower damage Bud fly in sesame during *kharif*, 2017

Treatments		Percent damage *Antigastracatalaunalis*						Bud fly *Desineuralini*	
	PTC	Plant (30 DAS)	Percentage reduction over control	Flower (45 DAS)	Percentage reduction over control	% Capsule damage 60DAS	Percentage reduction over control	% damage Flower (45 DAS)	Percentage reduction over control
T_1	47.5 (43.5)	27.5 (31.4)	50	8.40 (16.7)	66.40	2.52 (8.90)	76.38	6.30 (14.2)	49.19
T_2	55.0 (47.9)	32.5 (34.7)	40.90	10.13 (18.50)	59.48	2.07 (8.20)	80.59	7.10 (14.7)	42.74
T_3	55.0 (47.9)	27.5 (30.6)	50	9.56 (17.9)	61.76	1.76 (7.10)	83.50	6.90 (15.2)	44.35
T_4	45.0 (42.1)	25.0 (29.7)	54.54	7.66 (16.0)	69.36	1.29 (6.50)	87.91	6.50 (14.4)	47.58
T_5	52.5 (46.4)	22.5 (27.7)	50.09	3.97 (9.7)	84.12	1.27 (6.30)	88.09	5.30 (12.8)	57.25
T_6	62.5 (52.3)	55.0 (47.9)	-	25.0 (29.7)	-	10.67 (21.5)		12.4 (22.0)	-
SEm±	3.45	3.82		2.33		1.23		1.42	
CD at 5 %	NS	11.50		6.80		3.57		4.06	

*** Figure within parentheses aresquire root transformed values, "PTC- Pre treatment count**

NS- Non Significant DAS- Days after spraying DBS- Day before spraying

*Treatment facing only Two spraying

Table-5 :Evaluation of sucking pest population in different bio-intensive module in sesame in kharif 2017

	Population /three leaves

Treatments	Jassid					Mirid bug					White fly				
	PTC	30 DAS	45 DAS	Mean	% reduction over control	PTC	30 DAS	45 DAS	Mean	% reduction over control	PTC	30 DAS	45 DAS	Mean	% reduction over control
T1	0.24 (0.86)	0.10 (0.77)	0.53 (1.01)	0.32	52.94	0.48 (0.98)	0.13 (0.79)	0.65 (1.07)	0.39	55.17	1.00 (1.22)	0.48 (0.98)	1.15 (1.28)	0.82	46.40
T2	0.29 (0.87)	0.18 (0.82)	0.38 (0.93)	0.28	58.82	0.38 (0.93)	0.23 (0.82)	0.55 (1.02)	0.39	55.17	0.85 (1.16)	0.55 (1.02)	1.03 (1.23)	0.79	48.37
T3	0.22 (0.83)	0.20 (0.83)	0.33 (0.90)	0.27	60.29	0.43 (0.96)	0.38 (1.03)	0.50 (1.00)	0.44	49.43	0.83 (1.14)	0.58 (1.03)	0.68 (1.08)	0.63	58.82
T4	0.19 (0.83)	0.20 (0.84)	0.40 (0.94)	0.30	55.88	0.55 (1.02)	0.20 (0.78)	0.38 (0.93)	0.29	66.67	1.05 (1.24)	0.53 (1.00)	0.90 (1.17)	0.72	52.94
T5	0.20 (0.82)	0.18 (0.82)	0.13 (0.79)	0.16	76.47	0.58 (1.03)	0.28 (0.89)	0.20 (0.84)	0.24	72.41	1.23 (1.30)	0.63 (1.06)	0.33 (0.91)	0.48	44.42
T6	0.28 (0.86)	0.53 (1.01)	0.83 (1.15)	0.68	-	0.63 (1.06)	0.65 (1.42)	1.08 (1.25)	0.87	-	0.93 (1.19)	1.10 (1.26)	1.95 (1.56)	1.53	-
SEm ±	0.04	0.04	0.05	0.045		0.07	0.13	0.06	0.095		0.07	0.05	0.07	0.06	
CDat 5%	0.13	0.13	0.14	0.135		0.21	0.38	0.17	0.275		0.20	0.16	0.20	0.19	

*** Figure within parentheses aresquire root transformed values, "PTC- Pre treatment count**

NS- Non Significant DAS- Days after spraying DBS- Day before spraying

*Treatment facing only two spraying

Table-6: Evaluation of economics of cost-effective IPM module of sesameyield .

Treatments	Black gram yield (Kg/ha)	Sesame seed yield (Kg/ha)	Seed equivalent yield Rs/ha	Additional profit(Rs/ha)	Additional cost (rs/ha)	Net profit (Rs/ha)	Incremental cost: Benefit ratio	% increase in seed yield over control	Value of Increased yield over control
T1	486	648	982	78560	15013	63547	4.23	31.11	18640
T2	462	601	919	73520	14560	58960	4.01	22.70	13600
T3	509	625	975	78000	15120	62880	4.16	30.17	18080
T4	520	717	1075	86000	15663	70337	4.49	43.52	26080
T5	532	810	1176	94080	15393	78687	5.11	57.00	34160
T6	416	463	749	59920	13500	46420	3.43		
SEm±	**SEm±**	**41**							
CDat 5%	**CD at 5%**	**123**							

*** Figure within parentheses aresquire root transformed values, "PTC- Pre treatment count**

NS- Non Significant DAS- Days after spraying DBS- Day before spraying

*Treatment facing only twospraying

Table-7: Evaluation of economics of cost effective IPM module for management of major insect pest of sesame(*Kharif* 2017).

Sale price of sesame seed @Rs 80 /kg and black gram seed @Rs 55 /kg

Treatment	Black gram yield (Kg/ha)	Sesame seed yield (Kg/ha)	Seed equivalent yield (Kg/ha)	Cost of cultivation (Rs/ha)	Gross return (Rs/ha)	NMR (Rs/ha)	B:C ratio
T_1: Seed treatment with imidacloprid 600 FS @ 5g/kg seed + Intercropping with black gram (3:3) followed by foliar spray of Profenofos 0.1% @ 2ml/liter at 30 DAS	486	648	982	15013	78570	63557	5.23
T_2: Seed treatment with imidacloprid 600 FS @ 5g/kg seed + Intercropping with black gram (3:3) followed by foliar spray NSKE 5% at 30 DAS	462	601	919	14560	73490	58930	5.04
T_3: Seed treatment with imidacloprid 600 FS @ 5g/kg seed + Intercropping with black gram (3:3) followed by foliar spray of NSKE 5% at 30 & 45 DAS	509	625	975	15120	77995	62875	5.15
T_4: Seed treatment with imidacloprid 600 FS @ 5g/kg seed + Intercropping with black gram (3:3) followed by foliar spray of Profenofos 0.1% @ 2ml/liter at 30 DAS and NSKE 5 % at 45 DAS	520	717	1075	15663	85960	70297	5.48
T_5: Seed treatment with imidacloprid 600 FS (5g/kg seed)+Intercropping with black bram(3:3) followed by foliar spray of NSKE 5% at 30 DAS and Profenofos 0.1% @ 2ml/liter at 45 DAS	532	810	1176	15393	94060	78667	6.11
T_6:Intercropping with black gram (control) (3:3)	416	463	749	13500	59920	46420	4.43
SEm±			41				
CD at 5%			123				

4. Results and Discussion :

Pre and Post foliar spray observations on population of *Antigastra*larvae per plant, percentage damage by Shoot webber and capsule borer, population grub /plant *Dasenurasesame* , population of leaf hopper per plant white fly and mirid bug were recorded to evaluate the efficacy of different IPM modules against the incidence of shoot webber and capsule borer (*Antigastracatalaunalis*), leaf hopper ,white fly and mirid bug. Pre foliar spraying observations was taken one day before spraying (DBS) and post foliar spraying observations were taken at 30 DAS and 45 day after spraying for *Antigastra*larvae per plant, population of leaf hopper per plant and mirid bug per plant. Pre and Post foliar spray observations on percentage damage by shoot webber and capsule borer was recorded at 1 day before spraying (1 DBS) and 30 DAS (days after spraying) while capsule damage were recorded at 60 DAS.Theresult presented in (Table: 3b) revealed that all the treatment were found significantly superior over the untreated control (T6) among the the treatment T5 (with seed treatmentimidacloprid 600 FS (5g/kg seed)+Intercropping with black bram(3:3) NSKE 5% at 30 DAS and Profenofos 0.1% @ 2ml/liter at 45 DAS) lowest population of *Antigastra*(0.17 larvae/plant at 30 and 45 DAS respectively) compare to other treatment and a mean reduction of 74.63% in larval population over control. treatment T4 (Seed treatment with imidacloprid 600 FS @ 5g/kg seed + Intercropping with black gram (3:3) followed by foliar spray of Profenofos 0.1% @ 2ml/liter at 30 DAS and NSKE 5 % at 45 DAS)was next better treatment with respect to lowest mean larval population (0.33 larvae/plant) and registering a mean reduction of 50.74% in larval population over control . In treatment T3 where foliar spraying of NSKE 5% was only applied, shows highest larval population (0.62 larvae/plant) and registering a mean reduction of 7.46% in larval population over the control. Our results are in conformity with the following findings, Misra (2003) reportedthat all the insecticides significantly reduced the larval population up to 14th DAS. The reduction in larval population was 90% at 1st day after spraying and 44.8% to 52.5% at 14th days after spraying , Panday(2017) also reported that seed treatment with imidacloprid plus foliar spray of profenofos recorded lowest larval population (0.15 larvae per plant) and showed a highest reduction in mean larval population (93.03%). Afzal(2002) reported that curacron 500 EC (Profenofos) applied @ 1500 ml/ha was effectively reduced the population of leaf webber and pod borer.This result were also corroborated with our results Similar results were obtained by Tripathi(2007) .

The result presented in (Table: 4) revealed that all the treatment were found significantly superior over the untreated control (T6) among the treatment T5 (seed treatmentimidacloprid

600 FS (5g/kg seed)+Intercropping with black bram(3:3) NSKE 5% at 30 DAS and Profenofos 0.1% @ 2ml/liter at 45 DAS) lowest percent damage plant flower and capsule of *Antigastra percentage reduction over control 50.09%* (84.12%) and capsule percentage reduction over control 88.09 % damage /5 plant at 30 and 45 DAS respectively) compare to other treatment and a mean percentage reduction of 54.54% ,69.36& and 87.91% in reduction percent in over control treatment T4 (Seed treatment with imidacloprid 600 FS @ 5g/kg seed + Intercropping with black gram (3:3) followed by foliar spray of Profenofos 0.1% @ 2ml/liter at 30 DAS and NSKE 5 % at 45 DAS)was next better treatment with respect to lowestpercent damage at 30 and 45 DAS our result are in conformity with the result of Ahirwar (2010), they reported that incidence of both nymph and adult of leaf hopper decresd significantly by natural and indigenous product like neem oil neem seed karnel extract ,neem leaf extract ,garlic +red papper extract ,cow urine and cow butter milk as compared to control.

The result presented in (Table: 3b and table 4) revealed that all the treatment were found significantly superior over the untreated control (T6) among the the treatment T5(seed treatmentwithimidacloprid 600 FS (5g/kg seed)+Intercropping with black bram(3:3) NSKE 5% at 30 DAS and Profenofos 0.1% @ 2ml/liter at 45 DAS) lowest population of *Dasinurasesame*mean population (0.45) 5/plant and percentage reduction over control 89.41 %andmean flower damage (5.30/plant and percentage reduction over control 57.25 % ,45 DAS respectively) compare to other treatment and a mean percentage reduction % damge 6.50 in n percent reduction in over control treatment T4 (Seed treatment with imidacloprid 600 FS @ 5g/kg seed + Intercropping with black gram (3:3) followed by foliar spray of Profenofos 0.1% @ 2ml/liter at 30 DAS and NSKE 5 % at 45 DAS) (47.58%) was next better treatment with respect to lowestpercent damage at 45 DAS.The present finding corroborates with the results Nayak *et al* 2019 ,Pandey et al 2017, Gupta *et al* 2002)

The presented in (Table 5) of minimum mean population of jassid, mired bug and whitefly (0.16 jassid/three leaf, 0.24 mirid bug/three leaf and 0.48 whitefly/three leaf at 30 and 45 DAS respectively) percentage reduction over control 76.47 %, 72.41% and 44.42% T5 (with seed treatmentimidacloprid 600 FS (5g/kg seed)+Intercropping with black gram(3:3) NSKE 5% at 30 DAS and Profenofos 0.1% @ 2ml/liter at 45 DAS) respectively was mean and percent reduction in control recorded in module T_4(Seed treatment with imidacloprid 600 FS @ 5g/kg seed + Intercropping with black gram (3:3) followed by foliar spray of Profenofos0.1% @ 2ml/liter at 30 DAS and NSKE 5 % at 45 DAS). our result are in

conformity with the results of Ahirwar*et al* 2010, Nayak *et al*2019 ,Pandey et al 2017,Gupta*et al* 2002).

The Seed equivalent yield was significantly increased in all the IPM module T1 ,T2 ,T3 .T4.and T5 compare untreated control module T6 (Table 6).The plot in which only seed treatment was applied recorded less seed yield than those recivingseedtreatment and folior spray of NSKE % and profenofo0.1% higher than the control percentage increase in seed yield in each treatment was calculated based control. As indicate the (Table 6) ,The higher seed equivalent yield (1176kg/ha) with (57.00%)higher increment in seed yield (over the control and higher B:C ratio (5.11) was recorded T 5 was applied. this was followed by treatment T4(1075 kg/ha)with(43.52%) increment in seed in seed yield over control was applied . this was followed by seed equivalent yield T1 (982 kg /ha) with(31.11%) increment in seed yield %over control but the BC ratio (4.23) in case of neem based insecticide and chemical insecticide ,foliar spray of NSKE5% gave maximum increase in seed equivalent yield (75%) over the control. it was maximum in T5 (1176 kg/ha), and T4 (1075kg/ha)compared with untreated control (749kg /ha) .The maxi additional profit (Rs 94080/ha) net profit (78667 Rs/ha) and Incremental cost: Benefit ratio(5.11) were recorded in T_5 (Seed treatment with Imidacloropid 600 FS + intercropping with black gram (3:3) followed by foliar spray of NSKE 5% at 30 DAS and Profenofos 0.1% at 45 DAS) followed by of addition profit (Rs 86000 /ha)net profit (Rs 70337/ha) and Incremental cost: Benefit ratio (4.49) T_4 (Seed treatment with Imidacloropid 600 FS + intercropping with black gram (3:3) followed by foliar spray of Profenofos 0.1% at 30 DAS and NSKE 5% at 45 DAS).consideration the effective and economics, NSKE5%can be sprayed for the management concerned insect pests for the of export purpose sesame .they are reported present finding corroborates with the results (Nayak *et al* 2019 ,Pandey *et al* 2017, Gupta *et al* 2002 and Ahirwar*et al* 2010)

5. Conclusion

In case of two foliar spraying of insecticides, the foliar spraying of profenofos 50 EC 0.1% and NSKE5% was found most effective in reducing the insect pest population than by using botanical insecticide like NSKE 5% in controlling shoot webber and capsule borer**,** leaf hopper and Bud fly , leaf hopper , mirid bug.and white fly . For the management of leaf roller/capsule borer, Bud fly, leaf hopper, mirid bug and white fly the maximum protection treatment T5 was found most effective followed by the treatment T4. In respect to percent, flower and capsule damage by *Antigastra*, the treatment T5 was found most effective in

reducing the flower damage by (84.12%) over control. In case of capsule damage treatment T was found best in (88.09%) reduction over control.The present finding corroborates with the results Nayak *et al* 2019 ,Pandey et al 2017, Gupta *et al* 2002)

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