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RESEARCH **P**APER

Economics of treatments for management of mustard aphid (*Lipaphis erysimi* Kalt) on mustard (*Brassica compestris* L.)

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The experiment were conducted on efficacy of biopesticides and certain chemical insecticides against mustard aphid (*Lipaphis erysimi* Kalt) at research farm Department of Entomology, SHIATS Allahabad during *Rabi* season of 2012-2015. Result showed that significantly higher seed yield and net return were recorded with spraying of dimethoate 30 EC followed by malathion 50 EC and neem oil (0.5%), respectively. The cost benefit ratio descending order was dimethoate 30 EC > malathion 50 EC > NSKE > *Bacillus thuringiensis* > neem oil > *Beauveria bassiana*> *Metarhizium anisopliae*> *Verticillium lecanii*> tobacco leaf extract.

Key words : Aphid, Cost benefit (C: B) ratio, Dimethoate, *Lipaphis erysimi*, Malathion, Neem oil, NSKE

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INTRODUCTION

Rapeseed and mustard are one of the most important oilseed crop of India belong to genus *Brassica* of family Cruciferae. The oilseeds *Brassicas* comprises of four species*: B. compestris* (*B. rape*), *B.* juncea (Indian mustard), *B. napus* (winter and spring rape) and *B. carinata* (Ethiopian mustard). Rapeseed or mustard oil is the most important edible oil in north India which is difficult to be replaced by any other oils. Aphids are also under these pests causing tremendous losses to the agriculture yield. Different species of aphids are known to cause yield reduction differently for example, 10-90 per cent of losses were reported for the oilseed crops in India by the species of aphids *viz.*, *Brevicoryne brassicae* and *Lipaphis erysimi* Kalt. alone that reached 70-80 per cent in Pakistan (Rana, 2005). However, 48 per cent of soybean yield reduction was reported by the soybean aphid, *Aphis glycines* alone in the united states in year 2008 (Catangui *et al*., 2009) aphids, also known as plant lice are small sap sucking insects, and members of the super family Aphidoidea (McGavin, 1993). Aphid sucks the cell sap from the stems, twigs buds, flowers and developing pods causing a significant loss in yield. Aphid population and rate of infestation are very much dependent on sowing time (Islam *et al.*, 1991). Aphids remain active in North India on rapeseed mustard crop from November-March with higher population during mid February to mid March. Mustard aphid cause 65 to 96 per cent loss in seed yield (Bakhetia, 1984) and loss in oil content up to 15 per cent (Verma and Singh, 1987). Different control measure is recommended to control of this pest. The botanicals and bio-agents are more compatible with the environmental components, eco-friendly with plant health and non-hazardous to human being. The present investigation was conducted to determine the economic feasibility in term of cost benefit ratio.

RESEARCH METHODOLOGY

The study on the efficacy of biopesticides and certain

chemical insecticides against mustard aphid (*Lipaphis erysimi* Kalt)" was undertaken during *Rabi* season 2012-15 at the Entomology Research Farm, SHIATS, Allahabad. The experiment was laid out in the assessment of economics and effect of treatments on marketable yield of mustard in a R.B.D. with ten treatments replicated thrice. Total two sprays were applied to protect crop from aphid (*Lipaphis erysimi* Kalt.) infestation. The treatments: neem oil (0.5%), NSKE (5.0%), tobacco leaf extract, *Beauveria bassiana*, *Metarhizium anisoplia*, *Verticillium lecanii, Bacillus thuringiensis*, dimethoate 30 EC (0.05%), malathion 50 EC (0.1%) and untreated control. To know the significance of difference among various treatments, yield data were subjected to statistical analysis. The benefit cost ratio was found out for all the treatment by taking into account the market price of biopesticides, chemical and market price of mustard. The yield grained cost of treatment were worked out for each treatment to find out the benefit cost ratio and the net profit for each treatment. Value of yield grain over control was calculated on the basis of prevailing market price in Allahabad at the time of harvesting.

RESEARCH FINDINGS AND ANALYSIS

The yield data presented in Table 1 and Fig. 1 and 2 indicate that all the insecticidal treatments and bioagents were significantly superior. Maximum grain yield was recorded in dimethoate 30 EC. but it was statistically at par with malathion 50 EC and neem oil. While the minimum grain yield was found from control. Based on the highest

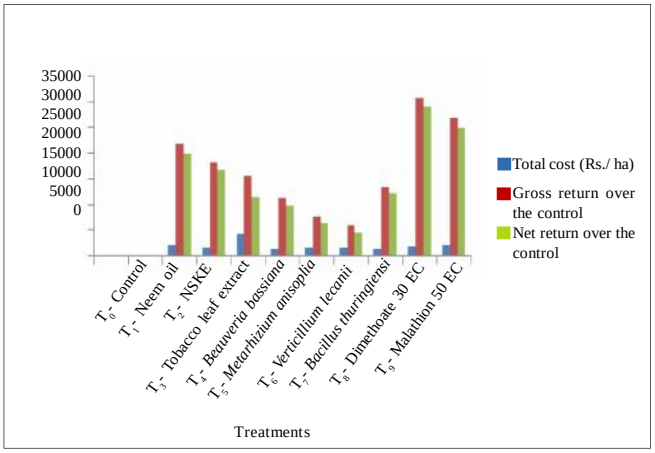

Fig 1: Incremental economics of different treatments during the *Rabi* season of 2012-15 (pooled data)

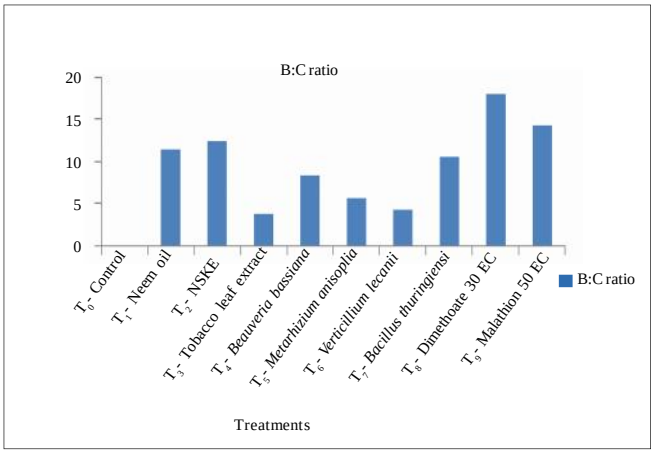

Fig 2: Incremental B:C ratio of different treatments during the *Rabi* season of 2012-15 (pooled data)

Table 1: Incremental economics of different treatment during the *Rabi* season of 2012-15 (pooled data)

Treatments	Unit (per ha)	Price (Rs./ha)	Labour charge	cost (Rs./ha)	Total cost (Rs./ha) •	Increase yield over the control		Gross return over the control	Net return over the control	BCR
						Grain yield	Straw yield			
T_0- Control	0	0	0	0	0	0	0	0	0	0
T_1-Neem oil	3 L	398.61	553.34	951.95	1903.9	5.94	12.50	21710.68	19806.78	1:11.40
T_2- NSKE	3 kg	174.99	553.34	728.33	1456.66	4.97	10.16	18131.97	16675.31	1:12.45
T_3- Tobacco leaf extract	6 kg	1530.0	553.34	2083.34	4166.68	4.25	8.67	15503.18	11336.5	1:03.72
T_4-*Beauveria bassiana*	1.5 kg	108.5	553.34	661.84	1323.68	3.04	6.24	11093.62	9769.94	1:08.38
T_5-*Metarhizium anisoplia*	1.5 kg	116	553.34	669.34	1338.68	2.08	4.08	7569.21	6230.53	1:05.65
T_6- *Verticillium lecanii*	1.5 kg	115	553.34	668.34	1336.68	1.56	3.39	5713.76	4377.08	1:04.27
T_7-*Bacillus thuringiensis*	1.2 kg	70.8	553.34	624.14	1248.28	3.66	7.31	13333.51	12085.23	1:10.68
T_8- Dimethoate 30 EC	1.2 L	291.6	553.34	844.94	1689.88	8.43	15.54	30565.95	28876.07	1:18.09
T_9- Malathion 50 EC	1.5 L	377.1	553.34	930.44	1860.88	7.37	14.39	26812.33	24951.45	1:14.41

• Spray two times, Neem oil Rs. 132.87/lit, NSKE Rs. 58.33/kg, Tobacco leaf extract Rs. 255.0/kg, *Beauveria bassiana* Rs. 72.33/kg *Metarhizium anisopliae* Rs. 77.33/kg, *Verticillium lecanii* Rs. 76.67/ kg, *Bacillus thuringiensis* Rs. 59/kg, Dimethoate 30 EC Rs. 243/lit., Malathion 50 EC Rs. 251.4/lit., Grain Rs. 3420.0/q, Straw Rs. 111.67/q One labour Rs. 276.67/day

cost benefit ratio was recorded with dimethoate 30 EC sprayed followed by spraying of malathion 50 EC and NSKE. Higher seed yield and cost benefit ratio in dimethoate 30 EC treated crop was also reported by Gour and Pareek (2003) the result of present investigation in seed yield of rapeseed is based the degree of interaction of insecticides with the activity of mustard aphid (Gupta and Rai, 2006).

Spraying of dimethoate 30 EC recorded the highest gross income (Rs. 30565.95 ha^{-1}) followed by spraying of malathion 50 EC recorded the highest gross income (Rs. 26812.33 ha^{-1}). While, spraying of *Verticillium lecanii* recorded the lowest (Rs. 4377.08 ha^{-1}). Spraying of dimethoate 30 EC in mustard accrued highest incremental net benefit of Rs. 28876.07 ha^{-1} followed by malathion 50 EC spraying gave net benefit of Rs. 24951.45 ha^{-1}. Hence, the superior to neem oil, NSKE, *Bacillus thuringiensis*, Tobacco leaf extract, *Beauveria bassiana* and *Metarhizium anisopliae* spraying gave net benefit of Rs. 19806.78, 16675.31, 12085.23, 11336.5, 9769.94 and 6230.53 ha^{-1}, respectively. However, the *Verticillium lecanii* spraying gave minimum net benefit of Rs.4377.08 ha^{-1}.

The highest benefit cost ratio (18.09) was recorded with dimethoate 30 EC spraying followed by spraying of malathion 50 EC (14.41). Hence, the superior to NSKE, neem oil, *Bacillus thuringiensis, Beauveria bassiana*, *Metarhizium anisopliae* and *Verticillium lecanii* spraying gave benefit cost ratio of Rs. 12.45, 11.40, 10.68, 8.38, 5.65, and 4.27 ha^{-1}, respectively. While the lower benefit cost ratio was recorded with tobacco leaf extract (3.72). These results are in agreement with the finding of Gupta and Rai (2006) and also Singh and Singh (2009).

It is concluded that spraying of dimethoate 30 EC, malathion 50 EC and neem oil gave benefited seed yield and plant biomass, which was presumably due to reduction of aphid numbers; protection of crops from pest pressure has frequently been found to result in yield and net return increases, which is very important in the context of the socio-economic conditions of Allahabad.

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