DETERMINATION OF ECONOMIC INJURY LEVEL FOR MUSTARD APHID, LIPAPHIS ERYSIMI (KALTENBACH) ON BRASSICA NAPUS

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INTRODUCTION

The mustard aphid, Lipaphis erysimi is the most serious pest of Brassica crops in India. Its nymphs and adults suck sap from leaves, flowers, pods and stem, resulting in poor pod formation and reduced oil content in grains. Depending upon various conditions such as date of sowing, species, variety, weather conditioins etc. the crop may altogether escape its attack (Bakhetia et al. 1986) or may suffer very heavy damage resulting in losses upto even 96 per cent in seed yield (Phadke 1980). Thus the number of sprays required to protect the crop varies under different circumstances. The use of economic levels helps in reducing the number of unnecessary insecticide sprays without any economic losses. Earlier, efforts have been made to establish economic injury level (EIL) for mustard aphid in Brassica juncea (Bakhetia et al.1979,1988; Singh et al. 1985). As the infestation and damage of the pest is different in different species, these studies were made to know the EIL of the pest in Brassica napus.

MATERIAL AND METHODS

The studies were conducted at RegionalResearch Stations Faridkot and Bathinda of Punjab Agricultural University. Two trials one each during 1983-84 and 1984-85 were conducted at Faridkot and the rest three trials were laid out at Bathinda from 1985-86 to 1989-90. The crop was raised under normal recommended agronomic practices. The experiments were sown in a randomized block design with 3 to 4 replications. The variety GSL-1 of Brassica napus was sown in the experiments and the plot size was kept at 5m x 4.5m. Seed yield was recorded at harvest. Different levels of aphid population were maintained by the use of insecticides. The aphid population was recorded weekly from 10 cm terminal portion of central shoot. In each plot 5-10 randomly selected plants were observed. When the mean aphid population reached or exceeded the desired level, all the plots of that treatment were sprayed with insecticide.

For determining the degree of association of aphid population and crop yield, the coefficeint of correlation and

linear regression were worked out between the mean observed population of aphid in different treatments and corresponding yield. Though every effort was made to keep the aphid population at the desired level in different plots, but due to its aggregated nature some differences remained. Keeping in view the highly significant coefficient of correlation and to make different parameters more reliable the latter were based on expected yield, which were calculated from linear regression equations. The economic injury level was worked out by following method of Stone and Pedigo (1972).

RESULTS AND DISCUSSION

The results of the experiments are given in the Table 1. The number of sprays required to keep the crop free from aphid ranged from 2-4 in different years. The other treatments always required less number of sprays. The coefficient of correlation between aphid population and corresponding yield was always very high (0.812 to 0.955) showing the very high damaging potential of the pest and its direct bearing on the seed yield. The linear coefficient of regression showing damage inflicted by one aphid in kg of produce per hectare varied from 2.2 kg to 6.6 kg. The variation in the damage per aphid may be due to the differences in the time of initiation of infestation. If the aphid population starts building early in the season or the peak population coincides with the peak flowering, the damage is more than the late infestation and peaks coinciding with pod formation stages of the plant.

The maximum yield was always gained in completely protected plots. The net gain over control was also always the highest in the completely protected plots except during 1985-86, when it was slightly less than the plots in which the aphid populatioin was kept at around 25 aphids/10 cm central shoot. The net profits were calculated after deducting the cost of insecticide application in terms of produce(kg/ha) i.e. Gain Threshold of Stone and Pedigo (1972) from the gain over control. This indicates that the economic injury level of mustard aphid on *B. napus* should be less than or equal to 25 aphids per 10 cm shoot of a plant.

The concept of cost benefit ratio is being normally used in deciding the better treatments in determining EIL, but sometimes it may lead to misleading interpretations. It is the net result of interaction of the net profits from the protection versus the cost of protection measures. The reduction of costs may dramatically increase the benefits per unit of cost even when the net profits are decreasing. If the figures of net profits and cost: benefits corresponding to complete protection and 50 aphids are compared, in all the years, the benefits per unit of investment was more in the

latter even though there was quite significant loss in terms of net profit. The net profits decreased from 512 to 401, 482 to 379, 349 to 301, 931 to 632 and 800 to 626 kg/ha in different years while the corresponding benefits per unit of cost increased from 7.64 to 12.15, 7.19 to 11.48, 3.63 to 9.12, 14.1 to 19.2 and 7.21 to 10.98. Thus the ratios are not giving proper base for interpretation of results.

The economic injury levels for L. erysimi on B. napus calculated following the procedure of Stone and Pedigo (1972) are also included in the table. These in simper terms are the number of aphids that will inflict the damage equal to the cost of applying insecticides for protecting the crop. The EIL thus calculated varied from 5 to 43 in different years under different treatments. The variation in EIL within a year was due to the differential number of sprays required in various treatments. However, the cost of one spray was equalled by the damage of 5 to 15 aphids/10 cm central shoot in different years. Taking the mean of all the years the average figure comes to 10 aphids for 10 cm central shoot of a plant.

Reviewing all the various above mentioned parameters it can be concluded that the control measures for the protection of B. napus crop from mustard aphid should be started when the mean population of the aphid reaches 10-25 aphids/10 cm central shoot of the plants. Some earlier workers have given the EIL/ETH values on Raya (Brassica juncea) as below 50 aphids/plant (Singh et al 1983), 9.42 to 30.60 aphids/10 cm terminal shoot (Misra and Singh 1986), 54 to 71 (Bakhetia et al 1988). These are slightly higher than the value calculated for B. napus which may be due to its comparatively more susceptibility to the pest.

CONCLUSION

The Lipaphis erysimi has a high damage potential and its population has significant negative correlation with yield. An average infestation of a single aphid per 10 cm central shoot per plant causes 2.2 to 6.6 kg of loss in B. napus per hectare. The cost benefit ratio does not always provide sound basis for identificatioin of better treatments in aphid control. The value of EIL for mustard aphid on B. napus was 10-25 aphids per top 10 cm central shoot per plant.

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Table 1. Population of Lipaphis erysimi and yield of Brassica napus Var.GSL I in different years

Aphid population per plant	Expected yield (Kg/ha)	Gain over control (Kg/ha)	No. of sprays	Gain Threshold (GT)	Net profit (Kg/ha)	Cost: Benefit	Coefficient of Correlation (r)	Coefficient of Regression (b)	Economic Threshold (x = GT/b)
1	2	3	4	5	6	7	8	9	10
				1983-84					
0	1782	579	2	67	512	1:7.64	-0.812	-2.89	23
25	1710	507	1	33	474	1:14:36			11
50	1637	434	1	33	401	1:12.15			11
100	1493	290	1	33	257	1:7.78			11
200	1203	-	0	0	0	-			-
				1984-85					
0	2551	549	2	67	482	1:7.19	-0.893	-2.70	25
25	2482	480	1	33	447	1:13.54			12
50	2414	412	1	33	379	1:11.48			12
100	2277	275	1	33	242	1:7.33			12
200	2002	-	0	0	0	-			-
				1985-86					
0	2276	445	3	96	349	1:3.63	-0.899	-2.22	43
25	2220	389	1	33	356	1:10.79			15
50	2165	334	1	33	301	1:9.12			15
100	2053	222	1	33	189	1:5.73			15
150	1943	112	1	33	79	1:2.39			15
200	1831	-	0	0	0	-			-

Continued

1	2	3	4	5	6	7	8	9	10
					1987-88				
0	1918	997	2	67	930	1:30.7	-0.955	-6.65	10
25	1752	831	1	33	796	1:24.1			5
50	1586	665	1	33	632	1:19.2			5
100	1253	332	1	33	299	1:9.1			5
150	921	-	0	0	0	-			-
					1989-90				
0	1308	911	4	111	800	1:7.21	-0.933	4.556	24
25	1194	797	3	81	716	1:8.84			17
50	1080	683	2	57	626	1:10.98			13
100	853	456	1	30	426	1:14.20			7
150	625	228	1	30	198	1:6.60			7
200	397	-	0	0	0	-			-

$$\text{Gain Threshold} = \frac{\text{Cost of plant protection measures (Rs./ha)}}{\text{Market price of produce (Rs./kg)}}$$

EIL based on cost of insecticide at the rate of Rs.84/liter; Three labourers for spraying one ha @ Rs.20/- per day; Price of produce Rs.4/- kg except for 1989-90, when corresponding values were Rs.84/- per liter, Rs.20/- per day and Rs.6.25 per kg.