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THE ECONOMIC VIABILITY OF THREE INSECTICIDES IN THE CONTROL OF 'POLLU' BEETLE (*LONGITARSUS NIGRIPENNIS* MOTS.) IN BLACK PEPPER

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ABSTRACT

A suitable choice of insecticides for different levels of infestation by 'pollu' beetle (*Longitarsus nigripennis* Mots.) in black pepper has been worked out based on a multilocation trial involving three insecticides namely, endosulfan, quinalphos and methyl parathion.

INTRODUCTION

'Pollu' beetle (*Longitarsus nigripennis* Mots.) is the most important pest of black pepper (*Piper nigrum*L.) in India, causing extensive damage to the berries and vines in certain endemic localities. Based on a series of experiments conducted at the Central Plantation Crops Research Institute, to control the pest, large variation in extent of damage under natural conditions and reduction in damage through insecticidal application were observed. In the present study, an attempt has been made to assess the net returns through application of three insecticides namely, endosulfan, quinalphos and methyl parathion and the level of infestation beyond which it would be economical to adopt plant protection measures.

MATERIALS AND METHODS

Experiments were carried out for a period of three years (1981–1983) at three locations (two in Calicut district and one in Kottayam district of Kerala state) to test the efficacy of various insecticides, in reducing the damage due to 'pollu' beetle. Three insecticides namely, endosulfan (Thiodan), methyl parathion (Metacid) and quinalphos (Ekalux) were found effective in controlling the pest (Anonymous, 1984). However, it was also found that the mean percentage of damaged berries per spike varied from 1 to 22 in the control plots over the places, and that the estimated gain by application of insecticides varied from 0.5 kg/quintal to 17.0 kg/quintal of harvested pepper. Hence, the relationship between the percentage of damage under control conditions and the corresponding gain through application of insecticides was studied for the three insecticides. About forty data-pairs were used for this purpose for each insecticide. In addition, taking into consideration the

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cost of insecticides, cost of labour, size of the plantation and yield, an inequality was derived to determine whether spraying for a particular level of damage by the pest was economical or not.

The regression of gain of pepper on percentage damage in control conditions is of the form:

Gain in kg/quintal = b × percentage damage in control conditions where b is the regression coefficient, different for different insecticides. Let n be the number of plants in a garden, d be the mean percentage of damage per spike and y be the total yield in quintals. Information on the value of y is always possible from previous years' yield for any garden.

Therefore, the actual gain by spraying (in kg)=b d y.

Let p be the price of pepper per kilogram.

Then, the monetary value of pepper gained by spraying=b d y p (Rupees). Let c be the cost of spraying per plant (the cost of spraying per plant arrived at under the present study should be reasonable for sufficiently large number of plants).

Then, the total cost of spraying=n c (Rupees).

Now, we can fix up a criteria for spraying schedule, by specifying that the farmer should gain atleast 50 per cent more than what he has invested in undertaking the spraying work.

In other words, the monetary value of pepper salvaged by spraying should be atleast 1.5 times the cost of spraying.

That is, $b\ d\ y\ p \geqslant 1.5\ nc$

$$\text{or} \quad d \geqslant 1.5\, b^{-1} c \left(\frac{n}{py}\right)$$

$$\text{or} \quad d \geqslant k \left(\frac{n}{py}\right) \text{where } k = 1.5\, b^{-1} c$$

$$\text{or} \quad d \geqslant 100\, k \left(\frac{1}{p.\ y/n}\right), \quad \text{where}$$

y/n is the mean yield per plant in kilograms For any particular insecticide, the values of b and c can be evaluated in advance by knowing the regression coefficient and the cost of spraying per plant, and therefore k may be treated as known constant. By this method, for any plantation of given size and yield potential, the insecticide which is economically viable in controlling the pest could be chosen.

RESULTS AND DISCUSSION

Linear regression equation, passing through the origin were fitted to express the relationship between the mean percentage of damaged berries and the gain of pepper (expressed as kg per quintal of total harvest) through insecticidal applications. The correlation coefficients were sufficiently high indicating a reasonably good fit. The results are presented in Table I.

The cost of application of insecticides (for two sprayings) were also worked out and the average cost of application per plant were Rs. 0.70, 0.95 and 0.67 respectively for endosulfan, quinalphos and methyl parathion. These costs will hold good for sufficiently large number of plants. The results are presented in Table II.

By substituting for the regression coefficients and cost of application per plant in the inequality, expressions of the following form for the three insecticides were obtained.

In the following expressions,d represents the minimum value of the mean percentage of damage beyond which insecticidal application would be

$$\text{i)} \quad d \geqslant 1.31 \left(\frac{n}{py}\right) \text{ or } d \geqslant 131 \left(p\bar{y}\right)^{-1} \quad \text{– for endosulfan}$$

$$\text{ii)} \quad d \geqslant 2.00 \left(\frac{n}{py}\right) \text{ or } d \geqslant 200 \left(p\bar{y}\right)^{-1} \quad \text{– for quinalphos}$$

$$\text{iii)} \quad d \geqslant 1.62 \left(\frac{n}{py}\right) \text{ or } d \geqslant 162 \left(p\bar{y}\right)^{-1} \quad \text{– for methyl parathion}$$

Table I. *Relationship between mean percentage of damage and the estimated gain of pepper through insecticidal spray*

Insecticide	Regression equation	Correlation*
Endosulfan	y=0.8 x	0.96
Quinalphos	y=0.71 x	0.89
Methyl parathion	y=0.62 x	0.81

* Correlation coefficients significant at 1 per cent level.

y is the estimated gain of pepper in kg per quintal of total yield.

x is the mean percentage of damaged berries per spike.

Table II. *Average cost of spraying per plant for three insecticides*

Insecticide	Dilution	Insecticide		Cost of labour per hectare**	Average cost*** of spraying per plant
		Quantity	Cost*		
Endosulfan	1.5 ml/litre of water	1.65 litre	132.00	260.00	0.70
Quinalphos	2.0 ml/litre of water	2.20 litre	264.00	260.00	0.95
Methyl parathion	1.0 ml/litre of water	1.10 litre	106.00	260.00	0.67

* Market prices for insecticides are Rs. 80, Rs. 120 and Rs. 96 per litre respectively. The cost is for a single spray.

** Cost based on 13 man days per hectare per spraying @ Rs. 20 per man day.

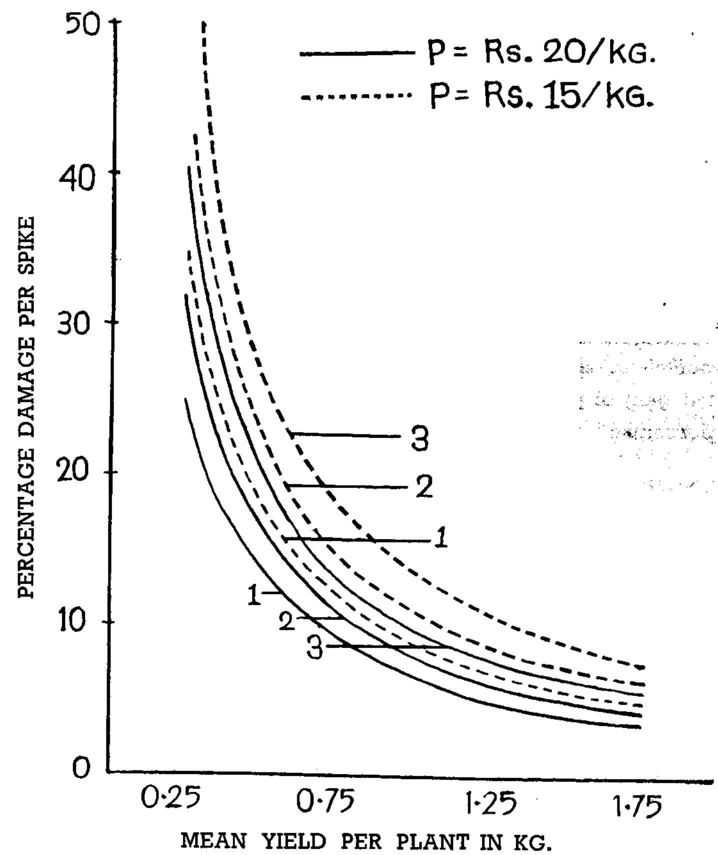
*** The cost is for two sprayings. The number of plants per hectare assumed to be 1100. The cost per plant should be reasonable for sufficiently large number of plants.

economical n represents the total number of plants, p the price of pepper per kg and y the total yield of the plantation in quintals, $\bar{y}$ is the mean yield per plant in kilograms. The value of y, *i. e.*, total yield can be ascertained from previous year's yields.

As an illustration, for a plantation having 200 plants and yield potential of 1.5 quintals and for a market price of Rs. 20 per kg of pepper, by substituting the above expression we find that application of endosulfan would have been economical if the mean percentage of damaged berries exceeded 8.73; application of quinalphos would have been economical if the percentage damage exceeded 13.33 and in case of methyl parathion, the corresponding damage should have exceeded 10.80 per cent.

Figure 1 represents graphically, the behaviour of the inequalities for varying levels of mean yield per plant, for the

FIG. 1. CRITICAL LEVELS FOR APPLICATION OF INSECTICIDES AGAINST 'POLLU' BEETLE



1–Endosulfan 2–Methyl parathion 3–Quinalphos three insecticides and for two price levels of pepper namely, Rs. 15 per kg and Rs. 20 per kg.

It is seen from Fig. 1 that at low levels of yield per plant, there is a considerable difference in the minimum level of percentage of damaged berries at which stage, it would be economical to apply the different insecticides. For example, when the mean yield per plant is 250 grams, it would be economical to apply endosulfan, if the percentage of damage exceeds only 35 whereas it would be uneconomical to apply quinalphos or methyl parathion, for the same level of damage. For this yield level, it would be economical to apply quinalphos and methyl parathion with a minimum damage of 53 and 43% respectively. For mean yield of more than 1 kg/vine the differences narrow down.

From the analysis of results of the experiments it was found that, the three insecticides were equally effective in controlling the pest. But the present investigation throws more light on the likely monetary loss that would have occurred if the levels of infestation and the levels of yield potential of a plantation were not taken into consideration.

CONCLUSION

The results of the study indicated that the net returns through application of insecticides would depend on the cost of application as well as on the levels of infestation. The present results are based on the values of percentage of damage observed at the time of harvest. Studies are underway to study the relationship between the population count of insects at early stages of spike development and the final damage, so that it would be possible to determine the economic threshold of infestation.

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