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# Studies on Different Types of Threshold Levels for Controlling *Earias vittella* Fb. on Cotton in South Gujarat

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**ABSTRACT**

**Field trials were conducted at Main Cotton Research Station, Gujarat Agricultural University, Surat during 1983-84 and 1984-85 cotton seasons for testing various threshold levels for control of spotted bollworms (*Earias vittella* Fb.). The threshold tested were 5 and 10 per cent damage to squares, 10 larval units, 10, 15 and 20 larvae of spotted bollworms per 10 m² area and 8 eggs of spotted bollworms per 24 plants. The results indicated that the thresholds based on percentage damage and egg count required more insecticidal applications and yielded high. The studies on economics and incremental cost benefit ratio (I.C.B.R.) indicated that for getting optimum yield at high net profit with moderate I.C.B.R., the threshold of 10 per cent damage can be adopted, while for getting moderate yield and net profit with high I.C.B.R. the threshold of 10 larval units per 10 m² area should be adopted. It was also observed that 15 larvae per 10 m² area can also be adopted to avoid the cumbersome method for counting larval units as this thershold has also given moderate yield and net profit at high I.C.B.R.**

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## INTRODUCTION

Cotton which consumes greater amount of inputs for pest control, the use of insecticides at economical threshold level is most reliable tool as a part of integrated pest management and hence it became a call of the day to work out most economical threshold level for pest like spotted bollworms which cause heaviest damage among all pests (Patel *et al.*, 1954; Kulkarni *et al.*, 1958 and Anonymous, 1983). Many workers have suggested different threshold levels. Mulchandani *et al.* (1980) have advocated the first spray at 25 per cent damage to squares and subsquent applications at 15 days interval, while Vyahalkar (1978) has suggested to initiate the first spray at 5 per cent damage level and subsequent applications at 11 days interval. Sidhu *et al.* (1981) have suggested to start the first spray two weeks after flowering and subsequent insecticidal applications at 10 days interval. Rote *et al.* (1983) have recommended to spray at 2 per cent damage

level. The threshold based on larval count was suggested for the first time in India by Shah and Mehta (1979) wherein 10 larval units for spotted bollworms and 7 larval units for American bollworm (Heliothis) per 20 plants as threshold levels. They have also described the methodology for working out the larval units for these two bollworms. Menon (1979) suggested I larva per 10 plants at 10 per cent damage to fruiting parts as threshold level, while Thangavelu and Ramamoorthy (1984) claimed that 10 per cent damage level was better than 3 larval units per 10 plants. The threshold suggested by Shah and Mehta (1979) were experimented by Sherasia and Chari (1983), Chari *et al.* (1983). Maisuria *et al.* (1983) and Rote *et al.* (1984). These workers reported that this was the most economical threshold levels for control of spotted and American bollworms. The threshold levels based on egg count as suggested for African bollworms by Matthew and Tunstall (1968) are on an average of 0.5 eggs per plant, while Beeden (1972) reported as 8 eggs of American bollworm per 24 plants.

This threshold levels suggested by different workers varied from place to place. Moreover majority of workers have suggested collective threshold levels for bollworms which includes spotted bollworms as well as American bollworms, and hence it was felt necessary to study different types of threshold levels only for spotted bollworms i.e. *Earias vittella* Fb. which is most predominant pest of cotton in South Gujarat. The experiments were conducted on G. Cot. Hybrid-6 cotton which is extensively grown in South Gujarat area of Gujarat State.

## MATERIALS AND METHODS

The field trials in three replications were laid out at Main Cotton Research Station, Surat during 1983-84 and 1984-85. The threshold levels tested were 5 and 10 per cent damage to squares by spotted bollworms; 10, 15 and 20 larvae and 10 larval units of spotted bollworms per 10 $m^2$ area and 8 eggs of spotted bollworms per 24 plants. Untreated control was also kept in all replications. Fourteen plants which covered 10 $m^2$ area were selected at random from three replications (5+5+4) for each of the threshold treatment based on per cent damage to squares, larval population as well as larval count, while 8 plants from each replication were selected for egg count. The observations were recorded twice in a week. The larval units were worked out as per methodology suggested by Shah and Mehta (1979). The threshold levels were maintained by spraying monocrotophos @ 600 a i/ha as soon as the damage/count reached/crossed the level fixed for respective treatment. The incidence of African bollworms was kept under control by blanket application of DDT. The yield of seed cotton was recorded separately from all plots and additional yield over control was worked out separately for each threshold treatment.

The economics including the Incremental Cost Benefit Ratio (I.C.B.R.) were worked out separately for individual threshold on the basis of gross income, cost of insecticides including the expenditure on its application and net profit. The results on basis of two years pooled data are presented in Table 1 and also depicted in figure 1.

## RESULTS AND DISCUSSION

### 3.1 Number of Insecticidal Applications and Yield

The results regarding yield presented in Table 1 indicated that the highest yield (2998 kg/ha) was obtained from the threshold of 8 eggs which required on an average 13 applications and beyond 13 applications the increase in yield was not observed as can be seen from the treatment of 5 per cent damage level which required 15 applications and yielded 2994 kg/ha. The treatment 10 per cent damage level required 9 applications and yielded 81 kg less than that was obtained from treatment of 8 eggs which required 13 applications. Thus after 9 applications there was no substaintial increase in yield and after 13 applications there was reduction in yield.

Among thresholds based on larval population and larval units the yield was decreasing with decrease in number of applications. Comparing the additional yield at additional applications the threshold of 10 larvae per 10 $m^2$ area gave moderate yield with 6 applications. Thus it can be said that optimum yield was obtained in the threshold of 10 per cent damage level with 9 applications and moderate yield was obtained from the treatment of 10 larvae with an average 6 applications.

### 3.2 Gross Income v|s Net Profit

The gross income and net profit as presented in Table 1 and also depicted in figure 1 indicate that the highest gross income was obtained from the treatment of 8 eggs while highest net profit was obtained from the treatment of 10 per cent damage level. The comparison of additional gross income and additional net profit between the threshold of 5 and 10 per cent damage levels indicates that there was gain in gross income of Rs. 537/ha in the farmer threshold but there was loss of Rs. 1119/ha in net profit. So the threshold of 10 per cent damage level can be said better than the threshold of 5 per cent damage level. Similar comparison between thresholds of 8 eggs and 10 per cent damage level showed that the farmer threshold was better than the later. Thus the threshold of 8 eggs can be said better than the threshold of 5 and 10 per cent damage levels.

Among thresholds based on larval population and larval units, the threshold of 10 larvae had given highest gross income and highest net profit.

### 3.3 Cost of Treatments v/s Net Profit

The data showed that among thresholds based on per cent damage and egg count, the threshold of 10 per cent damage level gave the highest net profit and lowest expenditure. while among remaining thresholds the lowest expenditure was in the threshold of 10 larval units but the highest net profit was realised from the threshold of 10 larvae. Comparing the threshold of 10 larvae with 10 larval units, the former threshold gave additional profit of Rs. 600/ha at an additional expenditure of Rs. 690/ha. Thus additional profit was less than the additional expenditure and hence the threshold of 10 larval units can be considered better than the threshold of 10 larvae. Similar comparison between 15 larvae with 10 larval units, 20 larvae with 10 larval units, 20 larvae with 10 larvae, 10 per cent damage level with 15 larvae and 10

*TABLE* 1

**Economics of different thresholds.**

| *Treatments* | *No. of insecticidal applications* | *Yield (kg/ha)* | *Increased yield over control (kg/ha)* | *Gross income (Rs/ha)* | *Cost of treatment (Rs/ha)* | *Net profit (Rs/ha)* | *I.C.B.R.* |
|---|---|---|---|---|---|---|---|
| 5% damage level to squares | 15 | 2994 | 1432 | 9981 | 4172 | 5809 | 1:1.39 |
| 10% damage level to squares | 9 | 2917 | 1355 | 9444 | 2516 | 6928 | 1:2.75 |
| 10 larval units per 10 $m^2$ area | 3.5 | 2458 | 896 | 6245 | 998 | 5247 | 1:5.26 |
| 10 larvae per 10 $m^2$ area | 6 | 2643 | 1081 | 7535 | 1688 | 5847 | 1:3.46 |
| 15 larvae per 10 $m^2$ area | 4.5 | 2569 | 1007 | 7019 | 1274 | 5745 | 1:4.51 |
| 20 larvae per 10 $m^2$ area | 4 | 2488 | 926 | 6454 | 1125 | 5329 | 1:4.74 |
| 8 eggs per 24 plants | 13 | 2998 | 1436 | 10009 | 3620 | 6389 | 1:1.76 |
| Control (No treatment) | — | 1562 | — | — | — | — | |

Note : Average price of seed cotton Rs. 6.97/kg.

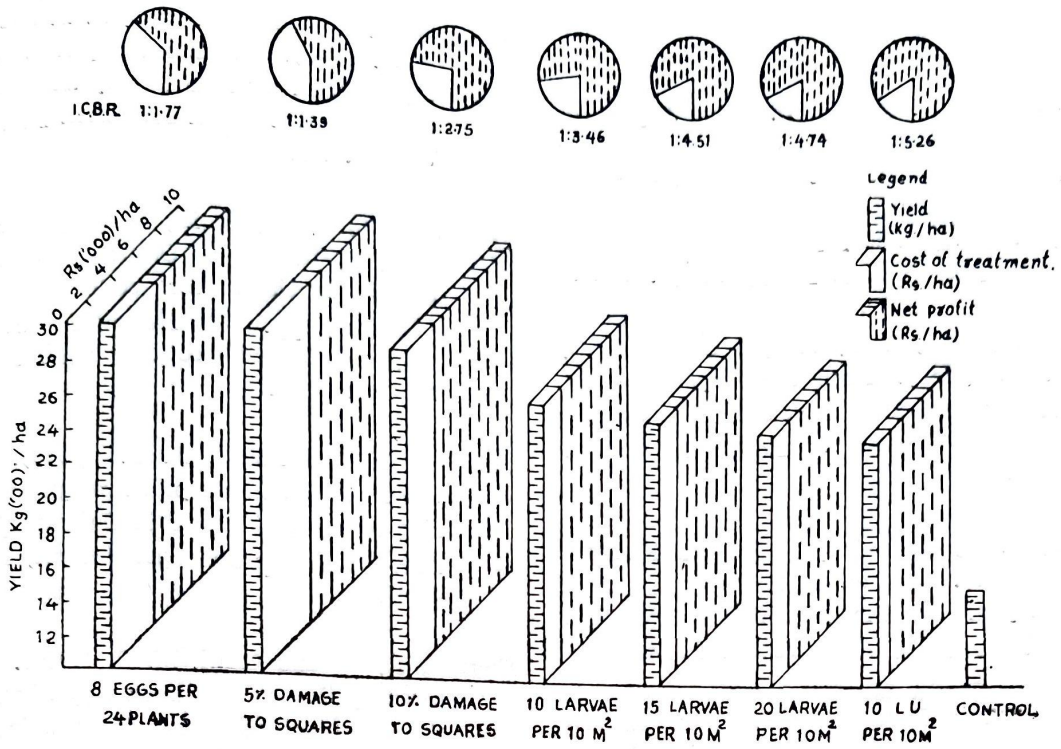



**Figure 1 : Yield and economics of different thresholds treatments.**

larval units showed that 15 larvae < more than 10 per cent damage level < 10 larval units < 20 larvae < 10 larvae.

### 3.4 Incremental Cost Benefit Ratio

The data presented in Table 1 indicate that as number of insecticidal application are decreasing, the I.C.B.R. was increasing. The treatment of 10 per cent level which gave the optimum yield (2917 kg/ha) required 9 application gave the I.C.B.R. as 1:2.75, while the threshold of 10 larval units which required lowest number of applications i.e. on an average 3.5 gave the moderate yield with the highest I.C.B.R. i.e. 1:5.26. The threshold of 15 larvae with on an average 4.5 applications gave the I.C.B.R. as 1:4.51.

The studies on testing of different thresholds indicated that for getting optimum yield (2917 kg/ha), highest net profit (Rs. 6928|ha) with moderate I.C.B.R. (1:2.75) with 9 applications the threshold of 10 per cent damage to squares by spotted bollworms should be adopted, while for getting moderate yield (2458 kg/ha), moderate net profit (Rs. 5247|ha) with highest I.C.B.R. (1:5.25) with minimum number of insecticidal applications i.e. on an average 3.5, the threshold of 10 larval units of spotted bollworms per 10 $m^2$ area should be adopted. Further, it can also be concluded that the threshold of 15 larvae of spotted bollworms per 10 $m^2$ area can also be adopted for those finding difficulty in calculating the larval units as this threshold has also given moderate yield (2569 kg|ha) with higher net profit (Rs. 5745|ha) and I.C.B.R. of 1:4.51 with on an average 4.5 appliactions. It can be further concluded that there was no substantial increase in yield after 9 applications as also the net profit and I.C.B.R. was decreasing with the increase in number of application beyond 9.

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