A REPORT ON TESTING FIVE INSECTICIDE FORMULATIONS FOR CONTROLING CODLING MOTH (*CARPOCAPSA POMONELLA* L.) IN IRAN

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INTRODUCTION

Codling moth is a cosmpolitan insect and is the most destructive pest of apple, pear and quince in Iran. In almost any part of the country where apple is grown, the characteristic injury of the insect can be easily detected. The amount of injury varies from 20 to 80% in various localities. To overcome this problem, several insecticide formulations were tested for control of the pest. This report is the result of these trials.

GENERAL CONDITIONS OF THE ORCHARD

The experiment has been conducted on 10-12 years old apple trees in an orchard located at Ainestan, 22 Km. north of Karaj. The trees were mainly from two late varieties of local apples named SANGANI and SHEMIRANY. They were planted five meters apart and in a diagonal pattern. The trees were irrigated every 10 days during the summer. The apple trees were apparently over irrigated considering the soil type and the moisture needed.

Design of experiment

For this purpose the orchard was first divided in two sections and the experiment was designed independantly in each section.

1 . Northern section : In this section 48 plots of at least 8 homogenous trees were selected and numbered. Five insecsicide formulations were used as follow :

A) D. D. T. + Diazinon (2 kg. D. D. T. 75% W. P. + 1 kg. Diazinon 40% W. P. per 1000 lit. of water)

B) D. D. T. + Guthion (1.5 kg. D. D. T. 75% W. P. + 1.5 kg. Guthion 20% W. P. per 1000 lit. of water)

C) Guthion (2 kg. Guthion 20% W. P. per 1000 lit. of water)

D) Guthion & Sevin (0.2% W. P. in first application and Sevin 0.125% of 80% W. P. for other applications)

E) Cidial (2 kg. Cidial 50% E. C. per 1000 lit. of water)

Three different spraying intervals adopted for each formulation (15-20-30 days). Each treatment had three replicates which were selected randomly among the numbered plots and three plots were considered as checks,

so the experimental unit is a plot of at least 8 homogenous trees, number of replicates R=3, and n=5×3×3+3=48, type of design: split plot design with whole plots of insecticides and sub-plots of intervals.

Sampling methods

Four trees of equal size were marked for collection of dropped apples from a month after first spray up to the harvesting period. The fruits were examined to calculate average number of wormy fruits in each plot. At harvesting time the average number of healthy and wormy fruits of each plot was calculated.

In order to estimate the total weight of crop per tree, the average weight of an apple was determined for each variety.

Analysis of variance

For analysis of data, the percentage of wormy apples of droped and harvested fruits were calculated. Analysis of variance based on percentage of wormy apples in each plot indicates that:

1. For treatments F=6.5 which is highly significant ($\alpha = 1\%$)

2. For insecticide versus check, F=77.30. This indicates that the low percentage of wormy apples is chiefly due to insecticide application.

3. The F for intrevals indicates that the available data is not sufficient to show the difference among intervals.

4. F for replicates is significant with $\alpha = 5\%$.

So there is difference among different plots in percentage of wormy apples and they are not homogenous in this respect.

II. Southern section: In this section design was the same as in the north but the number of replications was reduced to two due to low number of plots, and an additional spray application has been made in each plot. In other words, the plots with a 15 day interval were sprayed 5 times and those with 20 day and 30 day intervals, 4 and 3 times respectively. The analysis of data indicates that:

1. The insecticides used in this experiment lower the number of wormy apples considerably.

2. There is a difference among insecticides in their effect on codling moth.

3. The replicates show no significant difference.

4. The available data is not enough to show the difference between the plots treated with different spraying intervals.

5. The additional spray increased the efficiency of the chemicals in reducing the number of wormy apples.

Results and conclusions

The difference between the means in check and treated plots is 64.13−17.28=46.85

In the southern section with an additional spray, the difference is still higher 69.24−8.85=60.39

Fig. 8 shows this differences.

The average number of fruits per tree was about 1000. So 62.39 percent of this number is 603.9 apples which were saved due to insecticide applications. The average weight of an apple at harvesting time was about 120 gr. The price of fruit was about 20 Rials per kg. at this period, so the amount gained by insecticide application is:

$$\frac{623.9 \times 120 \times 20}{1000} = 1449.8 \text{ Rials.}$$

The maximum expense per tree due to insecticide, labor and transportaion is not more than 100 Rials, so the net income per tree is about 1349.8 Rials. A comparison between the none wormy apples shows that the difference between checks and the treated plots is still higher. The average number of fruits per tree in treated plots was 809.06 and only 57.41 in the check. Apparently the insecticides will keep some other injurious pests away from the trees besides the codling moth. If we base our economic evaluations on the number of healthy apples, the amount of net income per tree will be close to 1769.69 Rials. The comparison of means among the insecitides indicates that, in the northern section Guthion & Sevin is top in controlling codling moth. Guthion, D. D. T. + Guthion, Cidial and D D. T. + Diazinon follow respectively. It is note worthy that the difference between these four insecticides is not highly significant (fig. 6).

The number of fruits per tree more or less confirms the above results. Except for plots treated with Guthion & Sevin which had the least number of fruits per tree, more investigation is necessary to show whether this difference is due to the thining effect of Sevin.

As far as the spraying intervals are concerned D. D. T. + Diazinon at 15 day intervals gave the same results as for 30 day intervals. Probably this is due to the long residual effect of D D. T. in this formulation. However the number of fruits per tree shows preference in 15, 20, 30 days interval respectivily. In formulations B, C, and D, there is more or less a direct relation between application intervals and the number of wormy apples. However the number of fruits per tree shows contradictory results. Fig. 7 Shows some differences among the plots treated at different intervals. Thei shorter the spraying intervals, the lower the wormy apple percentage. The length of columns in Fig. 8 shows the difference in number of applications.

The most inportant point in controlling codling moth is the exact time of spraying in the first application. In the orchard used for this experiment,

the first instar larvae of first generation emerged when the fruits were about 15-18 mm. in diameter. It is clear that spraying prior to this period is a waste of time and effort.

As far as the spider mites are concerned the clover mite *(Bryobia paetiosa)* was the dominant species in this apple orchard. All insecticides used in this experiment except D. D. T. + Guthion, have retarded the population growth of this pest. In the Guthion group, D. D. T. + Guthion has the maximum number of winter eggs per 1 cm^2.

As a general conclusion D. D. T.+ Diazinon and Guthion are both good formulations for codling moth control, but if clover mite infestations are to be considered the D. D. T. + Diazinon formulation at present time, seems to be the most advisable. Moreover, this formulation could be applied at longer intervals than any other. More investigation is necessary to give final judgment on the other formulations used in this experiment.

1. Insecticides used in this experiment reduce overall the clover mite population or at least prevents their population increase.

2. Although the interval shows no significance, the interaction among the insecticides and interval is significant.

It seems that the sampling method used to determine the clover mite population was not accurate enough to obtain a dependable result.

More investigation is needed to give more precise results.

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