FIELD EXPERIMENTS IN THE CONTROL OF THE SPINY BOLL WORM *

By

E. RIVNAY AND SHOSHANA YATOM

Soon after the first attempts were made to re-introduce cotton growing in Israel it became apparent that the spiny boll worm, if left uncontrolled, would make cotton cultivation unprofitable. When it was learned, through personal communications**, that Endrin had been successfully used elsewhere against the spiny boll worm, laboratory and field trials were immediately undertaken to test this substance under Israel conditions.

Three field trials were carried out in the coastal plain at the experimental farms of the Agricultural Research Station in Kubeiba (1953), Acre (1954) and Beit Dagan (1955). The results herein reported do not apply to conditions prevalent in the inner valleys where climate, longevity of residual action, and activity of the moth differ. The purposes of these trials were (a) to compare Endrin to Toxaphene and Cryocide — substances which have been used in other countries against the spiny boll worm (1, 2), and (b) to determine the optimum economic concentration, and number of applications with Endrin. Results were essayed on the basis of infestation rate and crop yield.

EXPERIMENTS AND RESULTS

I. KUBEIBA (1953)

In the first set of trials at Kubeiba, Endrin and Toxaphene were compared to see which was the more effective, and to determine how many applications were necessary to obtain satisfactory control.

Five blocks of about half a dunam *** each, in various sections of the farm were sown to cotton towards the end of April. Each block was subdivided into two or three plots to which insecticides were applied as follows: 0.33% Endrin emulsion 19.5% (equal to 40—50 g act. ingr./dn) at 10 or 20 day intervals; Toxaphene 2% W.P. 40% (equal to about 500 g act. ingr./dn), at 10 and 20 day intervals. Dates of applications and results are given in Fig. 1.

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** Dr. Ben-Amotz, Shell Co., Tel Aviv, later appeared in print (5).

*** Approx. 1/4 of an acre.

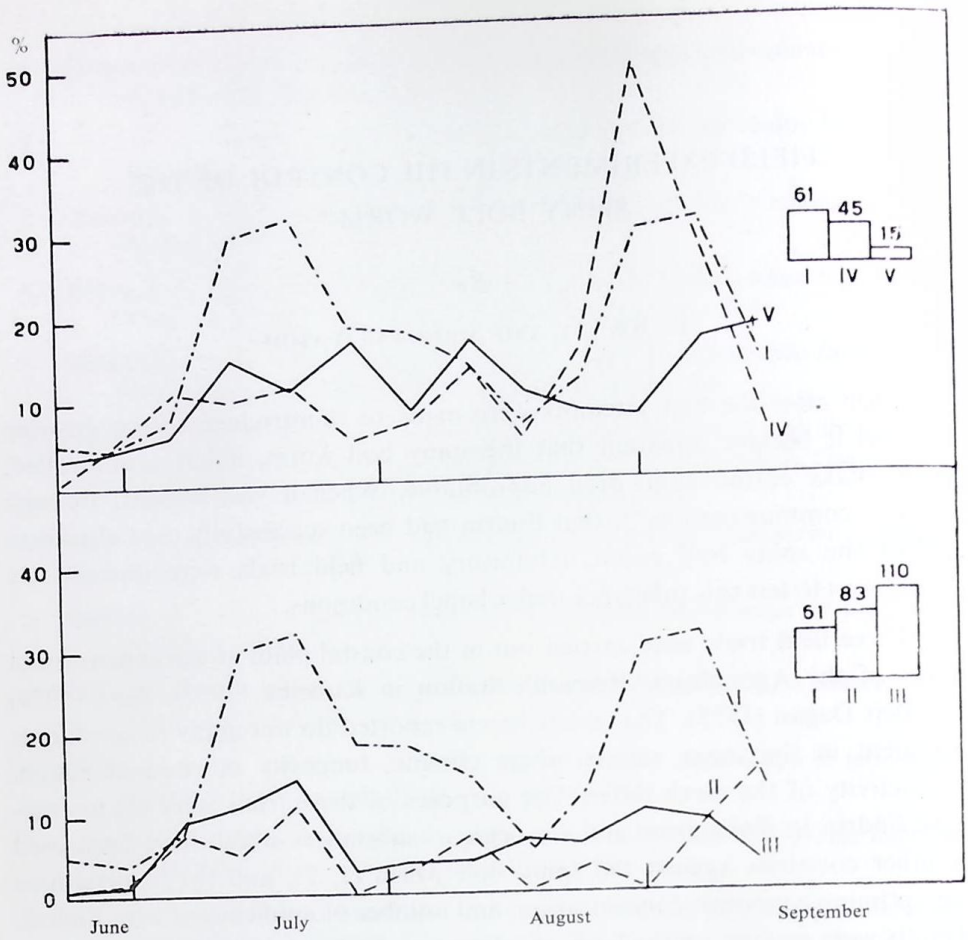

Fig. 1. Kubeiba trials 1953

1. Control
2. Endrin at 20 day intervals
3. Endrin at 10 day intervals
4. Toxaphene at 20 day intervals
5. Toxaphene at 10 day intervals

Yield (kg/dm)

Infestation

Infestation of the bolls was recorded weekly. The Fig. shows that though the infestation rate fluctuated from week to week, there was no apparent effect from either insecticide.

Yield

When the results were evaluated on the basis of cotton yield, Endrin proved far superior to Toxaphene, which indeed, as the tabulation shows, decreased yields as compared with the controls:

	Average Yield (kg/dn)
Control	60
Toxaphene (10 days)	15
Toxaphene (20 days)	45
Endrin (10 days)	110
Endrin (20 days)	83

The reduction of yield in Toxaphene-treated plots as compared with controls requires explanation. In the untreated plot, heavy infestation in July which caused destruction of squares and bolls, probably resulted in the emigration of the population by the end of August. This allowed an increase in the flowers and bolls, which was reflected in the yield results (which however was followed by another increase in pest population in mid-September).

Toxaphene, on the other hand, by causing only partial reduction in pest population, acted to maintain a temporary equilibrium between host and pest such that the squares and bolls were able to develop and support the reduced population, which then rapidly increased and later destroyed them.

In connection with yields, it should be pointed out that for various reasons the experimental plots did not receive optimum fertilization and irrigation, and hence yields were far lower than in subsequent trials.

II. Acre (1954)

In the series of trials at Acre, Endrin was tested to determine whether a concentration of 0.5% Endrin emulsion 19.5% would be sufficient and as effective economically as compared with 1%, and whether applications should be made every two or every three weeks.

A six-dunam field of cotton was divided into 9 equal parts, one of which served as control. In Trial 1, 4 plots were sprayed with 0.5% Endrin emulsion (70 g act. ingr./dn), 2 plots at 14 day, and 2 at 21 day intervals. In Trial 2, the remaining 4 plots were similarly treated with 1% Endrin (140 g act. ingr./dn). Spraying was begun on July 22; the plots sprayed at 14 day intervals received 5 applications ending on September 16, and those sprayed at 21 day intervals received 3 applications, the last being on September 2nd.

Infestation

Results of infestation counts show that there were no marked differences among the various Endrin treatments: infestation-rate during most of the season was 0—6% as compared with 8% in the controls.

Yield

Though there were few differences in yield among the Endrin-treated plots, there was a highly significant difference between them and the untreated control: yield in the latter was only 44 kg/dn as compared with an average of 200 kg/dn in the treated plots.

Since the plots in this experiment were adjacent, it seemed likely that applications in one plot may have influenced the results in neighboring plots. An improved experiment was therefore carried out the following year at Beit Dagan.

III. Beit Dagan (1955)

In order to separate the experimental plots an area of about 22 dunams was divided into 10 strips, each 180 m x 12 m. On April 20, alternate strips were sown with cotton and peanuts (which are not attacked by the spiny boll worm).

Each of the 5 strips sown to cotton was subdivided into 6 equal plots, giving a total of 30 plots to which the following treatments were applied, each in 5 replicates: 0.5% or 1% Endrin (19.5% emulsion), each at 14 and 21 day intervals; 1% Cryocide, at 14 day intervals; and untreated controls. Cryocide was included since it has been officially claimed in some countries (2) that this compound gives good results. Moreover, as a stomach poison it is non-toxic to bees.

Spraying was begun July 11, and completed September 12 for those plots which received 4 treatments at 21 day intervals. Applications on plots receiving 6 treatments at 14 day intervals were continued until September 20.

Infestation

Infestation counts were begun on July 4 and continued at 14 day intervals until September 29 on shoots, flowers and bolls. Results in Fig. 2 show that while both Endrin concentrations reduced infestation in the bolls as is shown in the tabulation, Endrin (either 0.5% or 1%) at 14 day intervals was by far the more effective. There were no significant differences between 0.5% and 1% Endrin.

Average infestation rates during the peak population season (early September)

Controls	60%
Cryocide	45%
Endrin (0.5% or 1%) 14 day intervals	12%
Endrin (0.5% or 1%) 21 day intervals	30%

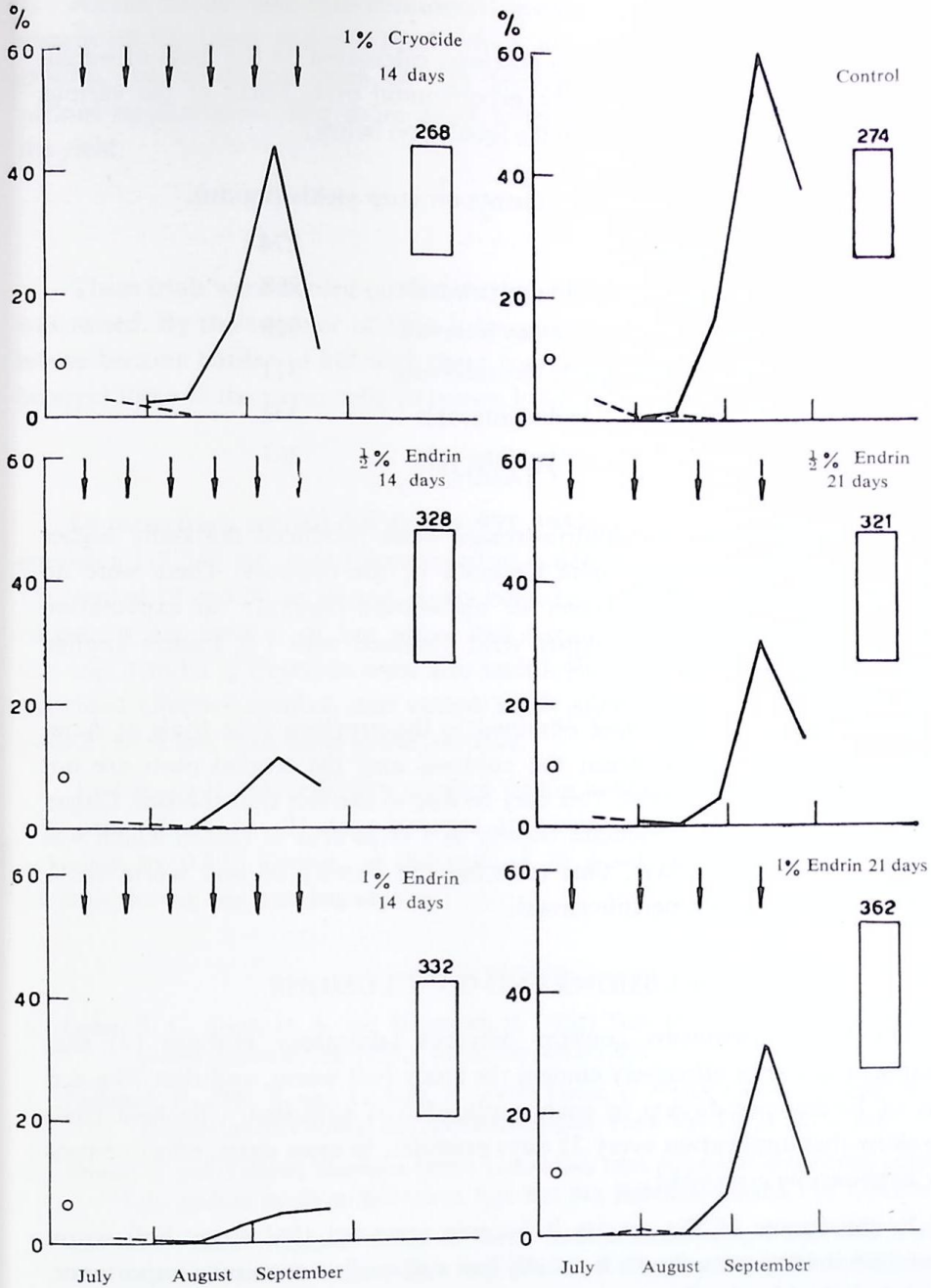

Fig. 2. Beit Dagan Trials 1955

Infestation in heads

Infestation in flowers

Infestation in balls

Spraying dates

Yield (kg/dm)

Yield

Yields are the totals of the two pickings, calculated on the basis of weighings from the center 250 m^2 of the experiemntal plot. Effect of the various treatments on crop yields is given in the tabulation below.

Effect of various treatments on crop yields (kg/dn).

Controls	274
Cryocide (1%) 14 day intervals	268
Endrin (0.5%) 14 day intervals	328
Endrin (0.5%) 21 day intervals	321
Endrin (1%) 14 day intervals	332
Endrin (1%) 21 day intervals	361

As the data show, the Endrin-treated plots produced markedly higher yields than did those treated with Cryocide or the controls. There were no important effects of concentration or application-interval: no explanation was found for the somewhat higher yield obtained with 1% Endrin applied every 21 days.

These results confirm those obtained in the previous field trials at Acre, although the differences between the controls and the treated plots are not as marked as in the Acre trial. This may be due to the fact that the Beit Dagan trials were made in the immediate vicinity of a large area of cotton which was being treated every 14 days, thus reducing the density of boll worm moth population in the entire neighborhood.

DISCUSSIONS AND CONCLUSIONS

The field experiments confirm previous laboratory findings (3) that Toxaphene does not effectively control the spiny boll worm, and that 70 g act. ingr. of Endrin per dunam in each application is sufficient. The field trials also show that application every 21 days provides, in most cases, effective control, as shown by crop yield.

In the course of the counts it became apparent that spiny boll worm infestation in the young shoots is usually low and is of no economic importance. The infestation in the flowers is also low, and cannot serve as a criterion in evaluating the efficiency of the treatments. Population-density is low during July-August; only toward the latter half of August, owing to ecological and biological factors, does infestation reach proportions of economic significance. This accords with previous findings on the biology of the spiny boll worm (7).

As the counts take into consideration only those flowers and bolls which remain on the plant and not those which were attacked and dropped to the ground, the infestation rates do not provide an accurate evaluation of the various applications. The more exact criterion for evaluation is, therefore, the yield.

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These trials were carried out before the problem of resistance to insecticides was raised. By the summer of 1956 it became apparent that Earias moths and larvae became harder to kill with these insecticides (4). The recommendations brought forth in the paper refer to insects before development of any hardiness.

SUMMARY

In three trials carried out during1953, 1954 and 1955, respectively, Endrin emulsion (19.5% act. ingr.) was tested at concentrations of 0.33%, 0.5% and 1%, and at 10 and 20, or 14 and 21 day intervals, to determine the most effective treatment for control of the spiny boll worm. 2% Toxaphene W.P. (40% act. ingr.) and 1% Cryocide were also tested. Neither Toxaphene nor Cryocide provided effective control, and cotton yields after treatment with these compounds were less than those in the controls.

Endrin gave very effective control within concentrations of 0.5% — 1% and intervals of 14—21 days between applications; economic treatment was achieved by 0.5% Endrin, at the rate of 70 g act. ingr./dn, applied every 21 days during the growing season.

CITATIONS

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