# THE INFLUENCE OF WITHIN-PLANT DISTRIBUTION OF *HELIOTHIS* (LEPIDOPTERA: NOCTUIDAE) EGGS ON OVICIDE EFFICACY IN COTTON[1]

Robert R. Farrar, Jr., and J. R. Bradley, Jr.
Department of Entomology
N. C. State University
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## ABSTRACT

The influence of within-plant distribution of *Heliothis zea* (Boddie) eggs on ovicide efficacy in cotton was investigated. Eggs were placed on different parts of cotton plants in the field, and an ovicide was applied as a broadcast spray. Eggs in more sheltered sites and lower on the plants suffered significantly lower mortality. Similar results were obtained using both methomyl and chlordimeform.

Key Words: *Heliothis zea,* eggs, ovicides, distribution, cotton.

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## INTRODUCTION

*Heliothis* spp., primarily *H. zea* (Boddie), are major pests of cotton in North Carolina. One of the control tactics currently employed against this insect is the use of chemical ovicides, such as methomyl and chloridimeform (Drake et al. 1982). As with all insecticides, successful use of these compounds depends on reaching the target site with the chemical.

In North Carolina, the distribution of *Heliothis* eggs on cotton has been found to be quite variable from year to year (Farrar 1984). Eggs were laid on terminals, leaves, or both, and either concentrated in the upper third of the plants or scattered in all levels of the plant. Farrar (1984) further found that larvae hatching from eggs on leaves had establishment rates comparable to those on terminals. The purpose of this test was to determine what effect site of egg placement might have on egg mortality under ovicide treatment. Reduced efficacy of the chemical in certain sites could result in higher egg survival when large percentages of eggs are laid in such sites.

## MATERIALS AND METHODS

This test was conducted in early to middle August of 1982 and 1983 near Clayton, Johnston Co., North Carolina. The cotton cultivar Coker 310, planted the second week of May, was used both years. At the time of the test, it was 1.0 to 1.5 m (3 - 4.5 ft) tall and flowering.

*Heliothis zea* moths were collected from black-light traps (voucher specimens were deposited in the North Carolina State University Insect Collection). These were held in a paper-sided cage similar to that described by Knott et al. (1966).

[1] Use of trade names does not imply endorsement of products named nor criticisms of similar ones not mentioned.

The paper sides, bearing eggs, were removed after 24 hr and held for another 24 hr at 27°C to allow fertile eggs to develop a characteristic brown ring. Groups of 10 fertile eggs, on 1 to 2 $cm^2$ of paper, were cut out.

The cotton plants used were in the middle two rows of a plot four rows wide and about 5 m long, surrounded on all sides by unused cotton. Each egg-bearing paper was attached to the plant with a straight pin inserted through the paper into the plant. Ten papers, plus one or two extras, were placed on each of four types of plant parts, in the upper half (by linear measurement) of the plants. The same number of papers were also placed on the same kinds of plant parts in the lower half of the same plants. Plant parts included: upper sides of leaves, lower sides of leaves, terminals, and bracts of fruiting structures (squares and small bolls). The plot was then sprayed with the ovicide.

The following day, the papers were collected, taken to the lab, and held at 27°C to allow surviving eggs to hatch. Unhatched eggs were then counted. Percent mortality was calculated for each group of 10 eggs and a factorial analysis of variance performed on the data with site and height on the plant as independent variables. Data from papers on which eggs had been attacked by predators were excluded from the analysis. An arcsine transformation was performed on the 1983 data prior to analysis since mean percentage mortality was low.

This test was done once in 1982 using methomyl (Lannate®) at a rate of 0.56 kg AI/ha. It was repeated twice in 1983 using chlordimeform (Galecron®) at 0.14 kg AI/ha. These rates were chosen to give moderate levels of mortality that would reflect subtle effects of site of egg placement. Both chemicals were applied with a back-pack sprayer ($CO_2$ propellant), pressurized at 3.51 kg/$cm^2$ with one hollow cone nozzle (Spraying Systems Co. Teejet ® TX-8) per row, calibrated to deliver 73.5 l/ha. Chloridimeform was chosen because it has some fumigant action which might reduce the effect of site of egg placement. In the first trial of 1983, considerable predation of eggs occurred, resulting in a smaller sample size than desired. It was therefore necessary to repeat the test again, using a plot which had been sprayed two days previously with methyl parathion (0.56 kg AI/ha) to reduce arthropod predator populations. Data from both 1983 trials were pooled for analysis.

## RESULTS AND DISCUSSION

Egg mortality data are summarized in Table 1 for methomyl and Table 2 for chlordimeform. Results of the experiment were significant for both site and height on the plant and similar for both compounds. Eggs on the upper sides of leaves suffered the greatest mortality; those on the undersides of leaves, the least. Mortality was also signficantly lower ($P \leq 0.001$) in the lower halves of the plants. As one might expect, mortality was lower in the more sheltered sites. Under the procedures used here, fumigant action of the chlordimeform was apparently not sufficient to overcome this effect. Increased egg mortality by fumigant activity of chlordimeform might have occurred had *H. zea* eggs been left on cotton plants longer than 24 hr.

These data are not intended for comparison of the relative efficacy of the two ovicides since each was used during a different year under contrasting environmental conditions.

Table 1. Effects of *H. zea* egg distribution on cotton on the ovicidal efficacy of methomyl (0.56 kg AI/ha), Clayton, NC, 1982.

| Variable | Treatment | Mean percent mortality | N | Group |
|---|---|---|---|---|
| Height | Upper | 69.5 | 38 | * |
| | Lower | 47.4 | 43 | |
| Plant Part | Leaf, Upper side | 78.6 | 22 | A† |
| | Terminal | 65.3 | 19 | AB |
| | Fruit | 59.0 | 19 | B |
| | Leaf, Lower side | 28.1 | 21 | C |

* Significant at 0.0008.
† Duncan's Multiple Range Test; means with the same letter are not signficantly different at the 0.05 level.

Table 2. Effects of *H. zea* egg distribution on cotton on ovicide efficacy, chlordimeform (0.14 kg AI/ha), Clayton, NC, 1983.

| Variable | Treament | Mean* percent mortality | N | Group |
|---|---|---|---|---|
| Height | Upper | 28.4 | 68 | † |
| | Lower | 13.2 | 65 | |
| Plant Part | Leaf, Upper side | 34.3 | 35 | A‡ |
| | Fruit | 20.9 | 33 | B |
| | Terminal | 16.2 | 34 | BC |
| | Leaf, Lower side | 11.3 | 31 | C |

* Figures show untransformed means.
† Significant at 0.0001.
‡ Duncan's Multiple Range Test with arcsine transformation; means with the same letter are not signficantly different at the 0.05 level.

## CONCLUSION

The distribution of *Heliothis* eggs on cotton plants was found to influence ovicide efficacy. Because the egg distribution was observed to vary from year to year depending on weather patterns that influence plant structure, ovicide efficacy may be expected to vary as well. If eggs are not laid on upper terminals, efficacy can be reduced. In such cases, other control tactics should be considered.

## LITERATURE CITED

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