THE OVICIDAL ACTIVITY OF TRACER* NATURALYTE* INSECT CONTROL AGAINST HELIOTHINE SPECIES IN CONVENTIONAL COTTON

I. G. Peterson
Dow AgroSciences
Tallahassee, FL
G. A. Herzog
Department of Entomology
University of Georgia,
Coastal Plain Experiment Station
Tifton, GA
J. A. Durant
Clemson University Pee Dee Research and Education Center
Florence, SC
P. F. Pilsner
Coastal Ag. Research, Inc.
East Bernard, TX
S. Micinski
Louisiana State University Agricultural Center
Baton Rouge, LA
L. L. Larson and B. A. Nead-Nylander
Dow AgroSciences
Indianapolis, IN
R. M. Huckaba
Dow AgroSciences
Ferrum, VA
D. J. Porteous
Dow AgroSciences
Georgetown, TX

Abstract

The ovicidal and ova-larvicidal activity of Tracer Naturalyte insect control was compared to that of the commercial standards, Ovasyn (amitraz, AgrEvo), Larvin (thiodicarb, Rhone-Poulenc) and Lannate (methomyl, DuPont). Three laboratory studies and three field treated trials demonstrated that Tracer will provide both ovicidal and ova-larvicidal activity to freshly lain eggs of *Heliothis virescens* and *Helicoverpa zea* in cotton. The labeled rate of 0.06 lb ai/A of Tracer, foliar applied to Heliothine eggs less than 24 hours old, gave ovicidal activity equivalent to the standards at their published ovicidal rates, and ova-larvicidal activity to the hatching and newly hatched larvae that was superior to the standards. As an added IPM benefit, Tracer, Ovasyn and Larvin allowed natural parasitism by *Trichogramma* sp. to occur at a level equal to the non-treated control. Levels of parasitism in the Lannate treated plots were significantly reduced.

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Introduction

Tracer Naturalyte insect control is a newly registered system for managing lepidopteran larvae pests in cotton. Tracer received Federal registration in 1997 and is applied in cotton when the economic threshold level has been reached and the majority of the pest population is from blackhead egg to one-quarter inch larval length. Economic thresholds for recommending treatment of lepidopterous pests in cotton have been established by researchers largely based on the percent infestation of larvae. During periods of prolonged moth flights, resulting in extended heavy egg laying, it is possible that when appropriate treatment thresholds are reported, damaging numbers of larvae could be beyond the optimum treatment size. Being able to lengthen the treatment window by demonstrating ovicidal activity with Tracer, would give the grower greater flexibility in determining the best time to make an application, without worrying about the need to tank-mix with an ovicidal product. The objective of this study was to determine the ovicidal activity and the ova-larvicidal activity of Tracer natural insect control relative to known commercial standards.

Methods

The target pests selected for these studies were the tobacco budworm, *Heliothis virescens*, and the corn earworm, *Helicoverpa zea*. The host crop was conventional cotton, *Gossypium hirsutum*.. Tracer insect control (spinosad, Dow AgroSciences) was compared to the commercial standards, Ovasyn (amitraz, AgrEvo), Larvin (thiodicarb, Rhone-Poulenc) and Lannate (methomyl, DuPont).

The first of three laboratory studies was one using both *H. virescens* and *H. zea* colonized adults laying eggs on sheets of gauze. The gauze, with eggs attached, was cut into strips and dipped into a selection of concentrations of test chemical. The eggs were maintained in moist chambers for 3-5 days and mortality was observed. Both LC50's and LC90's were recorded.

A second laboratory study used *H. virescens* females from a Dow AgroSciences colony that were allowed to lay eggs on greenhouse grown cotton plants. The plants were then treated in a spray hood with a selection of concentrations of the chemicals and then moved to moist chambers. After 3-5 days of observation, the LC50's were determined and recorded.

A third laboratory study was designed as a rate definition trial. Newly deposited eggs on greenhouse grown cotton were sprayed in a spray tower with field concentrations of Tracer, ranging from 0.063 lb ai/A down to 0.01 lb ai/A. The treated eggs were kept in paper bags in the laboratory for 4 days and observed for mortality. The commercial standard for this trial was Lannate at 0.1 lb ai/A. The study was repeated 10 days later.

The field study was designed to confirm the laboratory findings. Selected fields of cotton in Louisiana, South Carolina and Texas were scouted following moderate to heavy moth flights. Pre-application collections of 15 Heliothine egg bearing terminals or leaves were made in each of the 4 replicated plots and brought into the laboratory and placed in individual diet cups or petri dishes. Attempts were made to collect only white eggs less than 24 hours old. A second set of 15 egg bearing terminals in each of the 4 replicated plots (white eggs less than 24 hours old) were flagged and left in the field. The prescribed chemical treatments (Table 1) were then applied to the cotton in as close to a commercial manner as possible. After the treatments were dry (approximately 1 hour), the flagged terminals were collected, placed in individual diet cups or petri dishes and brought into the laboratory for observation.

The diet cups or petri dishes were kept at room temperature and observed 3-6 days later, noting the following: (1) percent egg kill - eggs desiccated and obviously dead; (2) percent larval emergence kill - egg hatch had occurred but the larvae died in the process or immediately thereafter; (3) percent live larvae - egg hatch had occurred and the larvae survived; (4) percent egg parasitism - definite evidence of parasitism had occurred.

Discussion

In the laboratory dipped egg sheet study, the LC50's for *H. zea* and *H. virescens* were similar for both Tracer and Ovasyn, with an LC50 activity between 43 and 100 ppm for both compounds (Figure 1).

There was more variation with the LC90 values (Figure 1). For *H. zea*, the LC90 for the 2 compounds was between 140 and 200 ppm , whereas for *H. virescens* Tracer had an LC90 of *ca*. 350 ppm and Ovasyn had a highly variable LC90 of 1300 ppm. There may have been other factors at work here as the variability in mortality could not be readily explained.

In the laboratory study using sprayed greenhouse cotton (Figure 2), the LC50 values for Tracer and Ovasyn against laboratory based *H. virescens* eggs were similar when observed 5-6 days after treatment. On eggs that were treated immediately after deposition, the LC50's were 187 ppm for Tracer and 232 ppm for Ovasyn. For eggs that were treated 1 day after deposition, the LC50 for Tracer was 125 ppm and that of Ovasyn was 162 ppm.

These data were similar to the laboratory dipped egg sheet values but were less variable. They also suggest that newly laid eggs may be slightly less susceptible to chemical action than the 1 day old egg. An alternate suggestion is that a little more chemical remains on the egg surface and surrounding leaf at hatching time with the later treatment such that there is slightly more larva-emergent activity.

The field studies were quite uniform across the 3 southeast locations and the data are reported in Figure 3. The pure ovicidal activity of the 4 compounds tested was not significantly different from each other but was different than the non-treated control. The 4 treatments provided an average egg mortality ranging from 40.6% to 44.2% when measured 3 to 6 days after treatment across the 3 trial sites.

The activity against the emerging larvae ("ova-larvacidal activity") was similar for Ovasyn, Larvin, Lannate and the non-treated control with a range of 20.9% to 28.2% mortality. Tracer was significantly more active providing 47.1% ova-larvacidal control (Figure 3).

Some parasitism by *Trichogramma* sp. occurred in 2 of the 3 trials, and amounted to 6.7% to 10.8% for Tracer, Ovasyn, Larvin and the non-treated control. These were significantly different from the Lannate plot which recorded only 2.5% parasitism. This suggests that Tracer, Ovasyn and Larvin were less harsh than Lannate on the parasitic wasps that were active at the test sites.

Total mortality of the Heliothine eggs and newly hatched larvae as an average across the 3 test sites was 94.4% for Tracer, 67.1% to 79% for Ovasyn, Larvin and Lannate and approximately 48% for the non-treated control. These figures include the naturally occurring parasitism as well (Figure 3).

The third laboratory study was designed to look at the effective rate related ovicidal activity of Tracer. There was some difficulty with the survivorship of the non-treated controls in the laboratory, but two dates provided some useful Tracer rate response information when compared to the percent survival of the associated non-treated controls (Figure 4).

There appeared to be a rate related ovicidal response with Tracer in these two studies. For practical purposes, the mortality due to true ovicidal activity and that due to ova-larvacidal action was not differentiated here, but was grouped together as total mortality at 4 days after treatment. Tracer at 0.01 lb ai/A was highly variable, whereas, Tracer at 0.063 lb ai/A provided excellent control with a mean of 93.3% over the two studies, equivalent to Lannate at 0.1 lb ai/A. Tracer at 0.03 lb ai/A was only slightly less active with a mean activity of 83.4%.

Summary

Tracer has been shown to be an effective ovicide against both *Heliothis virescens* and *Helicoverpa zea* in cotton using both laboratory and field study techniques. Tracer remains active on the chorion and plant and acts as an "ova-larvicide" as the neonate larvae chews its way out of the egg and moves on to the leaf. Tracer demonstrates strong IPM characteristics as it does not interfere with natural parasitism by *Trichogramma* sp. in the field. Tracer as an

ovicide or ova-larvicide treatment is rate related with the general recommended rate for cotton of 0.063 lb ai/A being very effective. Tracer performs equal to the established cotton ovicide products Lannate, Larvin and Ovasyn. As an ova-larvacidal product, Tracer at 0.063 lb ai/A was superior to Lannate, Larvin and Ovasyn at their recommended ovicidal rates.

Table 1. Product name and rate of compounds used in field studies to evaluate Heliothine ovicidal activity in cotton. 1997.

Treatment	Common name	Rate lb ai/A
Lannate	Methomyl	0.1
Larvin	Thiodicarb	0.1
Ovasyn	Amitraz	0.1
Tracer	Spinosad	0.06

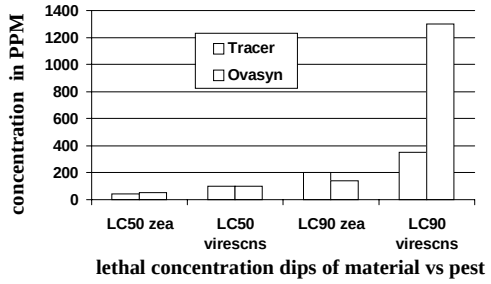

Figure 1. Laboratory ovicidal activity against *H. zea* and *H. virescens* via dipped egg sheet method. 1995.

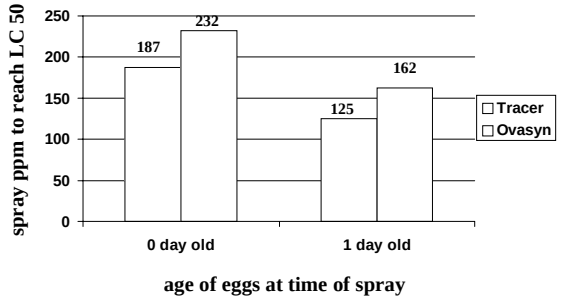

Figure 2. Laboratory ovicidal activity against *H. virescens* eggs on cotton in PPM of spray solution to reach LC50. 1995.

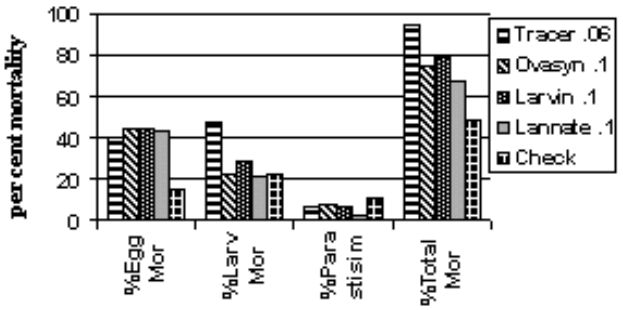

Figure 3. Heliothine egg/neonate larval mortality and parasitism in 3 S.E. cotton field trials. 3-6 DAA. 1997.

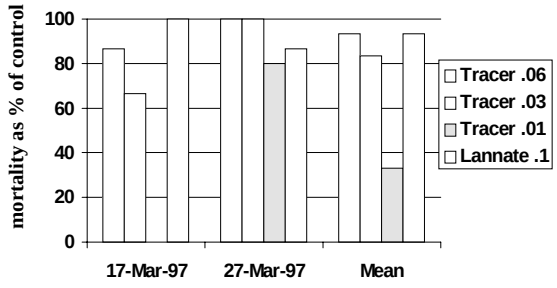

Figure 4. Percent mortality *H. virescens* eggs/neonate larvae in a laboratory rate definition study, 4DAA. 1997.
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