# RATE OF DICHLORVOS RELEASED FROM KILL STRIPS USED IN BOLL WEEVIL ERADICATION PROGRAMS

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## Abstract

Two types of kill strips, Hercon Vaportape™ II and Plato Insecticide Strip), are used in boll weevil, *Anthonomus grandis* (Boheman), eradication programs. Both types contain dichlorvos (DDVP) as the active ingredient and are typically replaced in traps on a four-week interval. However, published information regarding the duration of effectiveness of kill strips is not available and there is concern that kill strips may not be effective for 4 weeks, particularly during the warmer summer months. We evaluated the weekly quantities of DDVP released from Hercon and Plato kill strips aged in pheromone traps under differing environmental conditions in Texas. Based on the average initial content of DDVP in kill strips, the Plato kill strips contained substantially more DDVP (~101 mg) than the Hercon kill strips (~64 mg), but both contained their respective labeled % active ingredient for DDVP. Overall, the Hercon kill strips released 33, 10, 5, and 3 mg of DDVP during the 1$^{st}$, 2$^{nd}$, 3$^{rd}$, and 4$^{th}$ weeks of aging, respectively. Comparatively, the Plato kill strips released 35, 16, 10, and 8 mg of DDVP during the respective weeks of aging. Given the relatively low amounts of DDVP released during the third and fourth weeks of aging, it is likely that the benefits of using kill strips are reduced during the 3$^{rd}$ and 4$^{th}$ weeks of use. As such, our findings suggest programs should consider reducing the replacement interval of kill strips in traps to maintain the benefits of their use.

## Introduction

Eradication programs against the boll weevil, *Anthonomus grandis* (Boheman), use pheromone traps to monitor boll weevil populations and to determine when pest management efforts are required. These traps are typically placed adjacent to cotton fields and are serviced weekly to every three weeks, depending on the stage of eradication. Additionally, pheromone traps are typically equipped with a plastic insecticide-impregnated kill strip. The kill strips are intended to deter predation of captured weevils and to kill weevils soon after capture, thereby simplifying servicing of traps and reducing the incidence of weevil escapes. Currently, two types of kill strips are used in boll weevil eradication programs, Hercon Vaportape™ II and Plato Insecticide Strip. Both kill strip types contain dichlorvos (DDVP) as the active insecticidal ingredient. Several studies have evaluated the effectiveness of these kill strips on weevil capture, mortality, and escape within pheromone traps, as well as the servicing of traps (Armstrong et al. 2008, Suh et al. 2003, 2009); however, there is no published information in regards to the duration of efficacy of these kill strips under field conditions. Although both kill strip types are marketed to last up to four weeks in traps, there is concern these strips may not be effective for four weeks in subtropical areas such as the Lower Rio Grande Valley production area of Texas. In this study, we aged kill strips in pheromone traps under various environmental conditions and quantified the weekly amounts of DDVP released over a 4-week period.

## Materials and Methods

Hercon Vaportape™ II (10% AI, ~ 74 mg DDVP) and Plato Insecticide Strips (6.96% AI, ~ 92 mg DDVP) were placed individually in boll weevil pheromone traps for aging. Ten kill strips of each type and for each age group (0, 1, 2, 3, and 4 weeks of aging) were removed weekly and analyzed. The study was replicated over three trials in 2014 (May 28 – June 28; Sept. 11 – Oct.7; and Oct. 20 – Nov. 17). A weather station was established next to traps to monitor environmental conditions during the study.

DDVP was extracted from kill strips for 24 hours in acetone on a mechanical shaker. A 1-µl extract from each sample was analyzed by gas chromatography on a Shimadzu GC-2010 (Shimadzu Scientific Instruments, Columbia, MD) equipped with a flame ionization detector and a DB-5 column (60m x 0.32mm i.d. x 0.25µm thickness).

Helium was used as a carrier gas using a column flow rate of 2.6 mL/min and a split ratio of 50:1. The injector temperature was set at 250˚C and the detector temperature at 300˚C. The initial column temperature was set at 125˚C and maintained at that temperature for 14.5 min. Thereafter, the temperature was raised to 300˚C at a rate of 50˚C/min and maintained at that temperature for 20 min. Gamma-terpinene was used as an internal standard.

## Results and Discussion

On average, Plato kill strips had a higher initial content of DDVP (~101 mg) than Hercon kill strips (~64 mg); however, both kill strip types showed similar decreasing trends in the release of DDVP (Fig. 1, Table 1).

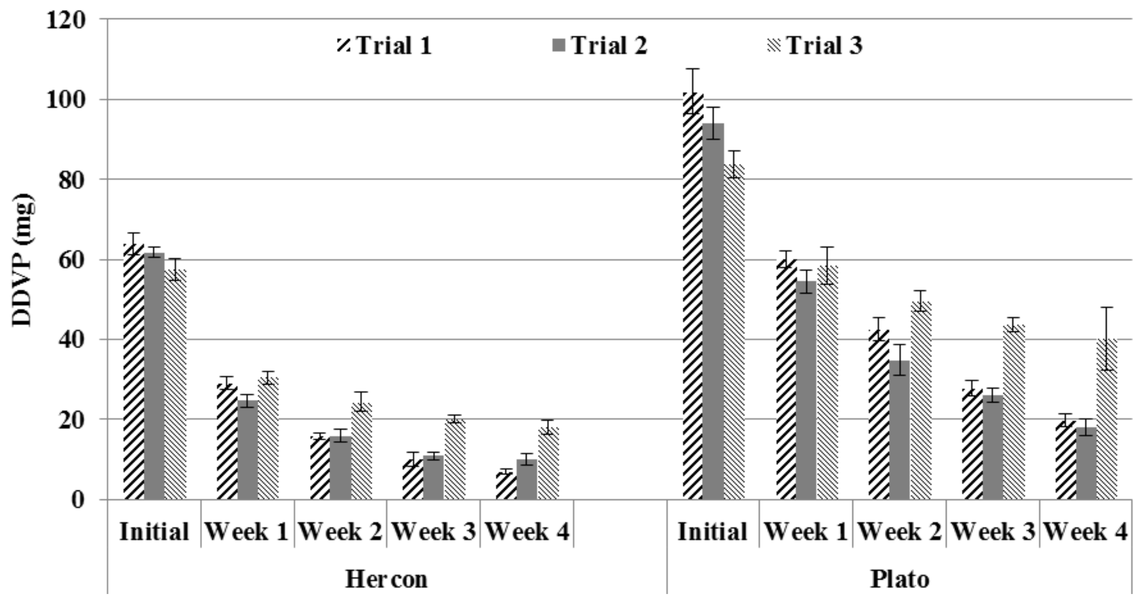


Figure 1. Initial and weekly residual content of dichlorvos (DDVP) in Hercon Vaportape™ II and Plato Insecticide Strips aged in pheromone traps for four weeks during three trials (May 28 – June 28; Sept. 11 – Oct.7; and Oct. 20 – Nov. 17) in 2014, College Station, TX.

Table 1. Mean amount of dichlorvos (DDVP) released (mg) from Hercon Vaportape™ II and Plato Insecticide Strips aged in traps during three four-week trials in 2014, College Station, TX.

| Trial | Kill Strip | Week 1 | Week 2 | Week 3 | Week 4 |
|---|---|---|---|---|---|
| 1 (May 28-June 28) | Hercon | 34.9 | 13.3 | 5.8 | 3.0 |
| | Plato | 41.9 | 17.4 | 14.8 | 8.0 |
| 2 (Sept. 11-Oct. 7) | Hercon | 36.3 | 9.2 | 4.5 | 3.1 |
| | Plato | 37.8 | 20.6 | 7.9 | 12.3 |
| 3 (Oct. 20-Nov. 17) | Hercon | 27.0 | 6.1 | 4.3 | 2.0 |
| | Plato | 25.4 | 8.8 | 5.9 | 3.5 |

Because the initial DDVP content varied considerably between kill strip types, the weekly percentages of DDVP released relative to the initial DDVP contents of kill strips were calculated (Table 2). On average, the Hercon kill strips released 54, 15, 8, and 3% of its initial DDVP content during 1st, 2nd, 3rd, and 4th weeks of aging, respectively. Similarly, the Plato kill strips released 42, 16, 10, and 7% during the respective weeks of aging.

Table 2. Average weekly percentage of dichlorvos (DDVP) released (relative to the initial DDVP content) from kill strips aged in pheromone traps during three trials in 2014, College Station, TX.

| Trial | Kill Strip | Week 1 | Week 2 | Week 3 | Week 4 |
|---|---|---|---|---|---|
| 1 (May 28-June 28) | Hercon | 55 | 21 | 9 | 5 |
| | Plato | 41 | 17 | 15 | 8 |
| 2 (Sept. 11-Oct. 7) | Hercon | 60 | 14 | 8 | 1 |
| | Plato | 42 | 21 | 9 | 8 |
| 3 (Oct. 20-Nov. 17) | Hercon | 47 | 11 | 7 | 3 |
| | Plato | 42 | 11 | 7 | 4 |

In comparison to the first two trials, the amount of DDVP released from both kill strip types during the third trial was reduced (Table 1). During the first two trials, approximately 80 to 90% of the total DDVP content of kill strips was released by the end of the fourth week of aging. In comparison, 64 to 68% of the total DDVP content of kill strips was released in the third trial. The average daily temperature during the third trial was substantially cooler than those observed during the first two trials (Table 3), which is likely responsible for the reduced release of DDVP from kill strips during the third trial.

Table 3. Ambient temperature profile during the three field aging trials of kill strips in 2014, College Station, TX.

| Trial | Avg. daily temp. (°F) | Range (Min - Max) |
|---|---|---|
| 1 (May 28-June 28) | 80.6 | 73.0 - 83.4 |
| 2 (Sept. 11-Oct. 7) | 77.4 | 67.8 - 86.1 |
| 3 (Oct. 20-Nov. 17) | 59.0 | 32.0 - 72.9 |

## Conclusions

In general, Plato kill strips contained and released more DDVP than Hercon kill strips. However, both types released the majority of DDVP during the first two weeks of aging. Given the relatively small amounts of DDVP released during the 3rd and 4th weeks of aging, kill strip replacement schedules should be re-evaluated in order to examine the benefits of their use under current practices.

## References

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