# DEVELOPMENT OF KILLING STATIONS FOR CONTROL OF WALNUT HUSK FLY

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## ABSTRACT

Development of an alternative tactic for control of walnut husk fly is under development by IPM Tech Inc. with the help of several cooperators. In summer 2003, we began testing of the components of a proposed innovative killing station for walnut husk fly control. A new type of ammonium carbonate lure proved more effective than the standard Trece Supercharger for attracting husk flies. The addition of a pesticide-impregnated tag did not influence fly capture. Trap shape, however, did significantly affect fly capture rates, with cross-vane and cylindrical traps outperforming the standard yellow panel trap. In the future, we plan to continue development of a killing station using a pesticide-impregnated target baited with an ammonium carbonate lure. The long-term goal of this project is to develop a sustainable alternative to insecticide and/or bait cover sprays for walnut husk fly and other tephritid fruit fly control. An additional goal is development of a husk fly control tactic that is compatible with organic production.

## OBJECTIVES

1. To determine effectiveness of new ammonium carbonate lure (developed by IPM Tech, Portland, OR) in relation to Trece Supercharger in attracting walnut husk flies.
2. To determine if pesticide-impregnated plastic targets are repellant to walnut husk flies.
3. To investigate relative attractiveness of different shaped traps in attracting walnut husk flies.

## PROCEDURES

Field testing took place in two heavily infested English walnut orchards, one located in Fremont at Ardenwood Historic Farm (East Bay Regional Parks), and the other in Winters at Wolfskill Experimental Orchard.

Five experimental blocks of 3 trees each were selected in Ardenwood for lure and pesticide tag testing. Three different lures (with Pherocon AM-NB traps) were tested in each block, one trap per tree, as follows: (1) Supercharger (ammonium carbonate lure, Trece Inc., Salinas, Ca.), (2) IPM Tech ammonium carbonate lure, (3) IPM Tech ammonium carbonate lure with a pesticide-impregnated cattle ear tag hung inside the trap so that the ear tag was not visible. All flies were removed from the traps and counted, and the traps were replaced and location randomized within a block every other day. Lure testing occurred at Ardenwood for approximately four weeks. A general linear model ANOVA was used to test for effects of lure type and trap location on number of flies captured.

Twelve experimental blocks of 2 trees each were selected in Wolfskill. Trees within a block were matched for canopy size and English walnut variety. Two different lures (with Pherocon AM-NB

traps) were tested in each block, one trap per tree. The two lures tested were the Trece Supercharger and the IPM Tech lure. Trapping at Wolfskill occurred for two weeks with flies removed and counted, and traps replaced and location switched twice a week. A two-way ANOVA was used to test for effects of lure type and trap position (north or south tree of a pair) on number of flies captured.

The final trapping experiment was a two-week test of the effects of trap shape conducted at Ardenwood Farm in Fremont. Four different shapes of yellow sticky traps were tested: 1) cross-vane (2 yellow panels oriented perpendicular to each other), 2) flat panel (standard Pherocon AM-NB yellow panel), 3) horizontal cylinder (long axis oriented horizontal to ground), and 4) vertical cylinder (long axis oriented vertical to ground). These traps were set in 5 blocks of 4 trees each. Flies were removed from traps and counted, and traps were changed and location within a block re-randomized 3 times per week. A two-way ANOVA was used to test for the effects trap shape on number of flies captured and to determine if the number of flies captured varied over time.

**RESULTS**

The total number of flies caught per day was significantly affected by the type of lure used ($F= 5.26$, $df= 2$, $p= .006$) (Figure 1). A Tukey comparison test indicated that the Trece Supercharger was significantly less attractive to walnut husk flies than the IPM Tech lure, but no significant differences were detected between the IPM Tech lure alone and the IPM Tech lure with the pesticide tag attached. There was also a significant effect of trap location within the walnut orchard ($F=3.07$, $df= 14$, $p<.005$). That is, blocks differed significantly in the numbers of flies captured, similar to what we have found in previous studies at Ardenwood and other English walnut orchards.

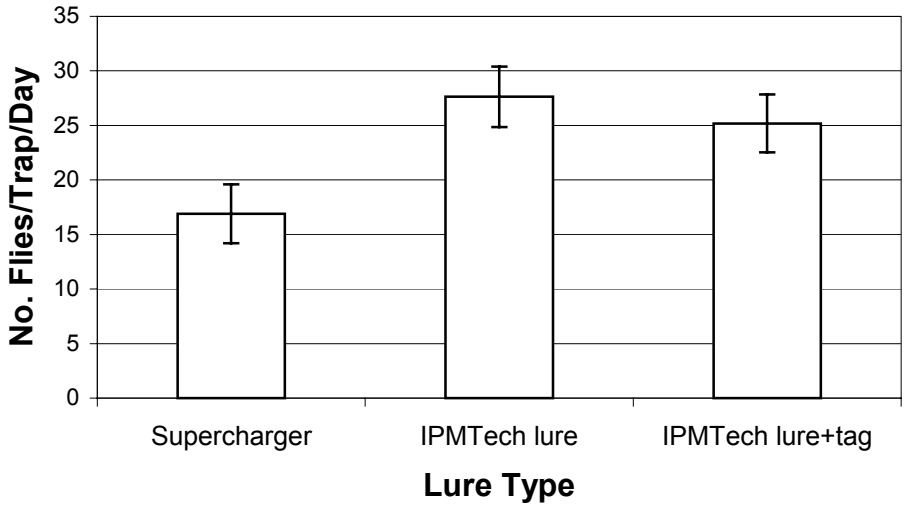


**Figure 1. Ardenwood Historic Farm, Newark, CA – Lure comparison test**

In Wolfskill, there was a significant effect of lure type on the number of flies captured per trap per day ($F= 15.47$, $df= 1.92$, $p< 0.005$), with the IPM Tech lure capturing significantly more flies than the Trece Supercharger (Figure 2). The two-way ANOVA also indicated that there was no significant effect of position within blocks (i.e., north vs. south tree) ($F=0.47$, $df= 1$, $p=.495$).

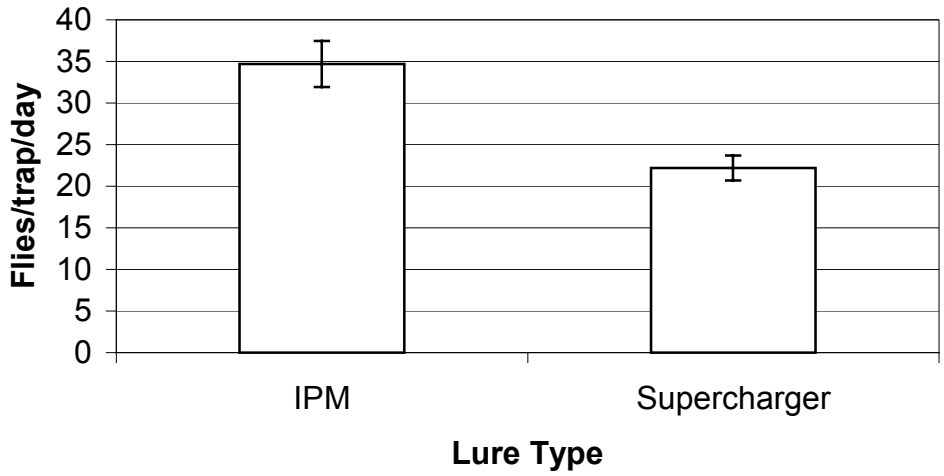


**Figure 2. Wolfskill Experimental Orchard, Winters, CA – Lure comparison test**

The shape of a trap significantly affected the number of flies captured per trap per day ($F= 7.34$, $df= 3,64$, $p<0.005$) (Figure 3). The horizontal cylinder, vertical cylinder and cross-vane traps all caught significantly more walnut husk flies than the flat panel traps. There was also a significant change in the number of flies caught over time ($F= 4.12$, $df= 3,64$, $p<0.005$), with more flies caught in the first week of the study than in the last week. The analysis also indicated that there was a significant interaction between the trap shape and time ($F= 2.82$, $df= 9.64$, $p= 0.007$), meaning that over time, as the numbers of flies captured decreased, the differences in effectiveness between the different trap shapes decreased.

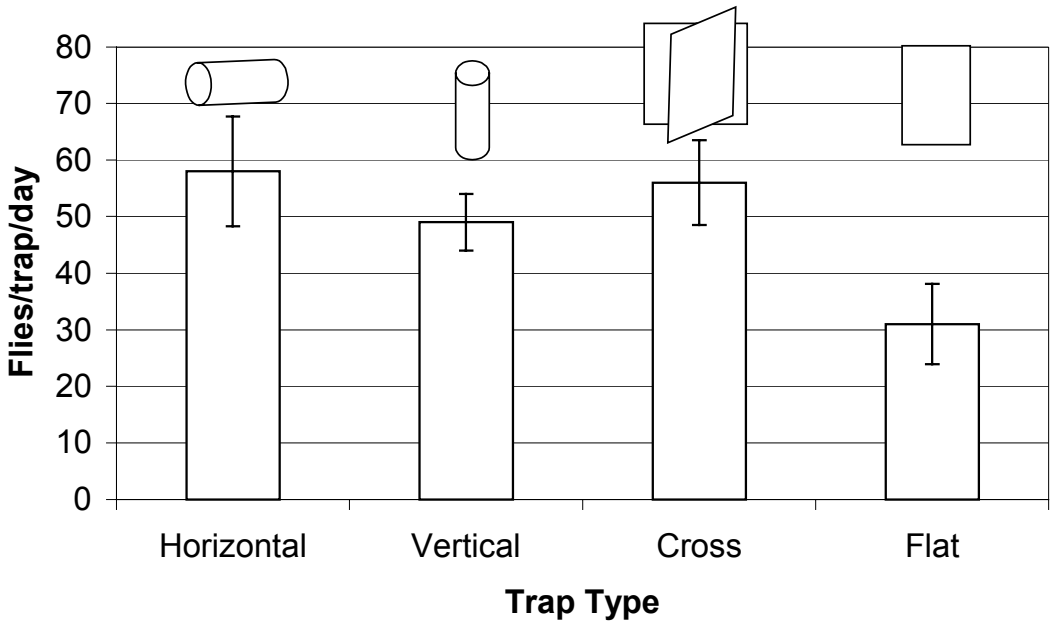


**Figure 3. Ardenwood Historic Farm, Fremont, CA - shape comparison test**

## DISCUSSION

The IPM Tech lure was significantly more attractive to walnut husk flies than the Trece Supercharger. We also concluded that the pesticide-impregnated tag did not have a negative effect on the attraction of flies to traps. Finally, the IPM Tech lure appeared to be equally effective as a lure in both high-density fly populations (Wolfskill) and low-density fly populations (Ardenwood). These three findings indicate that development of an attract-and-kill device using an ammonium carbonate lure coupled with a pesticide-impregnated target is a viable strategy for control of walnut husk fly and should be explored further.

Testing of the different shape of traps also resulted in some interesting outcomes. From the field studies, we determined that certain shapes of traps were more effective than others. In a high density fly population (i.e., earlier in the summer), both cylinders and the cross-vane shape were the most effective, while the flat panel trap, the standard trap used for monitoring populations of walnut husk flies, was the least effective at catching husk flies. In a lower density fly population (i.e., later in the summer), the differences in the effectiveness of the traps were far less pronounced. We conclude that when walnut husk fly populations are sparse, shape may not be an important factor in trapping; however, when populations are dense, trap shape could be a very important factor in the number of flies killed. Thus, optimizing target shape is an important component in development of an effective killing station for walnut husk fly. IPM Tech plans to continue development of the killing station technology for control of walnut husk fly and other pest tephritids.