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Using Pheromone Traps to Monitor Pests in Tomatoes and Cucurbits

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Overview

Insect monitoring is a key component of successful integrated pest management (IPM) programs in vegetable production. Understanding what insect species are present is necessary to make treatment decisions and protect both yield and profitability. Monitoring for insect pests is often time-consuming, but there are time-efficient options that can predict pest issues before they damage the crop. Pheromone-baited traps are an effective means of monitoring for insect pests and can be used to determine when pests are first moving into a crop[1]. Additionally, trapping systems can give an early indication of pest pressure, help capture pests that can be hard to observe on plants and give an idea of the relative pest pressure at a given location. However, pheromone-baited traps can be tricky to use correctly and may give a false sense of security when trap catches come up empty. Also, traps should not be relied on for total pest removal or as a substitution for crop scouting. There are many different kinds of traps on the market that give varying degrees of helpful information. See below for information on a few pheromone traps that are commonly recommended for monitoring various caterpillar pest species in tomatoes and cucurbits.

Trap Types and Materials

- **Bucket Trap**
- **Heliothis Trap**
- **Hartstack Trap**

Bucket Trap

The bucket trap design (Figure 1) is commercially available from many different sources and retails for about $25-$30, depending on the brand. The design is relatively straightforward and generally comprised of:

- Trap base or bucket
- Trap top or lid
- Lure basket or cage
- Funnel
- Wire hanger

Trap pieces are easily assembled and a pest lure or a pheromone should be added in the cage. This

Figure 1. Bucket trap hanging from a rebar post. (Photo by Ryan Keiffer)

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trap should be hung from a branch, stake, or a stand within 30-60 feet of the crop. Place an insecticide strip, such as the Hercon Vaportape II, inside the collection bucket to improve efficacy[2]. The bucket trap can be used for many different pests and is usually the cheapest option outside of sticky traps for monitoring pests. The bucket trap is often recommended for monitoring for squash vine borer (*Melittia cucurbitae*) in cucurbit crops[3], but in our experience it is the least effective at catching adult moths, such as squash vine borer, that are important in vegetable crops.

Heliothis Trap

The Heliothis trap is a larger funnel trap that is very effective for trapping adult moths (Figure 2). It is commercially available and normally retails for about $85-$120. This trap is constructed with a durable fine fabric mesh and encompasses a large bottom mesh funnel and a smaller, removable mesh collection top. The materials required, in addition to the trap, for setup include:

- Heliothis trap and pole (rebar, t-post, etc.)
- Stake to secure ground anchor strap
- Post pounder or small sledgehammer to drive pole into ground
- Paper clip or binder clip for attaching pheromone or lure

Figure 2. Heliothis trap attached to a t-post with proper placement of ground anchor. (Photo by Ryan Keiffer)

This trap should be attached to a pole (rebar, t-post, etc.) using the mounting straps included with the trap. It is useful to drive the pole into the ground before installing the mesh trap. Use the ground anchor mounting strap as shown in Figure 2 to prevent the wind from blowing the trap around. A pest lure or pheromone will attach at the large opening of the bottom mesh with a paper clip or binder clip (Figure 3). The Heliothis trap can then be placed about 30-60 feet away from fields, with the opening of the trap about two feet above the ground. Make sure to maintain this height throughout the season to allow for the entry of adult moths into the trap.

Figure 3. Pheromone hanging on a Heliothis trap, secured with a binder clip. (Photo by Ryan Keiffer)

The Heliothis trap is an effective tool for capturing many moth species and is most commonly utilized for corn earworm (*Helicoverpa zea*) in sweet corn and tomato, but can also be used for cabbage looper (*Trichoplusia ni*), squash vine borer (*Melittia cucurbitae*), armyworms and other important moth species. This trap is easy to buy online and is a cheap alternative to the Hartstack trap. We have found it to be slightly less effective at estimating moth populations compared to the Hartstack trap, and typically the mesh deteriorates after only a couple of seasons.

Hartstack Trap

The Hartstack trap (Figure 4), also known as a Texas style cone trap, is a metal funnel trap that is commonly used in row crops to estimate corn earworm populations[4]. This trap design can be hard to purchase commercially, however, this trap can be custom-built by a local metal

Figure 4. Hartstack trap attached on top of a pole with flagging tape. (Photo by Ryan Keiffer)

fabricator or on farm using blueprints that are publicly available online (https://entomology.ca.uky.edu/ef010)[5]. These traps usually cost about $250-$275 each. These traps are sturdy in construction and generally last for many years. The materials needed for setup include:

- Hartstack trap and pole or a piece of rebar
- Post pounder or small sledgehammer to drive pole into the ground
- Paper clip or binder clip for attaching pheromone or lure

Place traps within 30-60 feet of a corn, tomato, or cucurbit field, out of the way from tractors and other implements but accessible enough to check the trap catch often. Drive the base pole into the ground with a post pounder or a small sledgehammer to ensure the trap is placed at a proper height. The bottom of the Hartstack trap should be approximately four feet off the ground. The area under the trap should be kept weed-free throughout the season.

After attaching the trap to the pole make sure the collection top is attached correctly and securely to the top of the funnel. Consider using a piece of baling wire to secure the collection top and keep it from blowing off. Attach the lure to the trap using a paper clip, binder clip or alligator clip (Figure 5). This allows for easy changing of the lure when the lure's efficacy diminishes. Our experiences have shown that the Hartstack trap worked the best out of all traps for tomato fruitworm, squash vine borer and cabbage looper (Figure 6).

Figure 5. Close-up view of rubber septa pheromone placed at the base of a Hartstack trap using an alligator clip for quick replacement. (Photo by Ryan Keiffer)

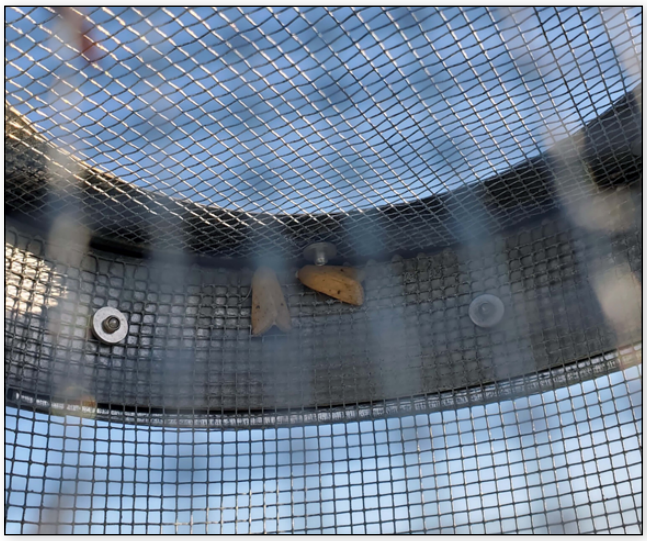

Figure 6. Two corn earworm/tomato fruitworm moths *(Helicoverpa zea)* caught in the collection top of a Hartstack trap in Clarksville, Arkansas. (Photo by Mike Brown)

Trap Placement

Trap placement depends on many factors including trap type, pest species targeted for monitoring, degree day modeling, prevailing wind direction and more. Select a site in or near plantings that is out of the way from tractor operators, but accessible enough to check the contents often. Place traps within 30-60 feet of your crop. Hartstack and Heliothis traps are often placed next to utility poles because they're usually weed-free and out of the way of tractors. Flagging tape can increase the visibility of the traps for tractor operators and other employees. Bucket traps can easily be placed in or near fields, orchards or vineyards due to their small size and convenient wire hanger. If monitoring for tomato fruitworm/corn earworm (*Helicoverpa zea*), place the trap on the upwind side of the field to catch adult moths that get blown into Arkansas on prevailing springtime winds, normally coming from the Southwest. For other specific placement recommendations, consult your local Cooperative Extension Service agent. It is a good idea to remove traps from the field when monitoring efforts are complete to reduce incidental damage and wear to the traps.

Lures and Pheromones

Insect lures may utilize synthetic sex pheromones, aggregation pheromones, alarm pheromones or plant-based kairomones and can be impregnated into rubber septa or other convent products for pest monitoring needs[6]. Insect lures are generally pest specific and have limited effect on non-target pest species. Purchase insect lures before the arrival of the target pest and make sure to purchase enough lures to last throughout the season. Insect lures lose their efficacy over time, with many needing to be replaced every 2-4 weeks. Remove old lures from the field and store any new, unused, lures in the freezer (unless the product specifically says otherwise) to prolong shelf-life. Be sure to wear disposable gloves when attaching lures to the trap and to change gloves between each trap type to minimize pheromone carry-over between species. Insect lures are commercially available from many sources online.

Checking Traps for Pests

It is recommended to check pheromone traps twice a week to maximize early pest detection. If checking the bucket trap in combination with an insecticide strip, make sure to wear disposable gloves. The top of the bucket trap can rotate a few degrees and will come off enabling a quick count in the field. To check the Heliothis and Hartstack traps, remove the collection tops, place in a plastic garbage bag and hold under vehicle exhaust for a few minutes or place in a freezer for two hours to knock down the moths. It is recommended to record catch numbers throughout the season to look for year-to-year trends. After recording weekly trap catches, make sure to return the collection top to the trap and "zero out" the count (remove all caught pests) so next week's totals can be tallied. To compare your trap catches to counts from statewide specialty crop trapping efforts in real time, visit the URL at the bottom of the threshold section.

Thresholds

Pheromone traps should be used in conjunction with field scouting. Trapping can inform scouting efforts and indicate when crops are at increased risk of infestations of known pest species. Pheromone trap catches of greater than seven adult tomato fruitworm moths per week indicate the start of infestations in nearby fields, and catches of more than 100 moths on average per week indicate economically significant populations may be present. Monitoring of tomato fruitworm moths is a way to get an early indication of what is coming to the field and should not be used in the place of weekly field scouting. Tomato fruitworm field-based scouting thresholds of eggs observed on 10 percent of plants (1 egg/10 plants) or 3 larvae/100 fruit indicate an insecticide application is necessary. Consult the MP144 for insecticide recommendations for Arkansas.

Pheromone traps can give a good indication of when squash vine borer is beginning to infest cucurbit crops. Squash vine borer can have two generations per year in Arkansas and emerge from the ground when growing degree days hit

750-1000 (base 50F model with Jan. 1 biofix). If one or more squash vine borer adults are found in traps, this is a good indication that egg-lay is occurring in plantings. Begin field scouting when growing degree days hit 1,000, regardless of pheromone trap catches. If eggs are observed, make two insecticide applications seven days apart. Consult the MP144 for specific product recommendations and visit https://uaex.uada.edu/hort-ipm to compare catch efforts with traps placed across the state of Arkansas.

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