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On-Farm Sweetpotato Summer Oriental Beetle Surveys for the Development of an IPM Action Threshold for the Prevention of Juvenile White Grub Damage to Mature Roots

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Abstract

In 1997 Southern Maryland sweet potato growers reported up to 60% culls due to damaged roots from the juvenile white grub of the Oriental beetle *Anomala orientalis* (Waterhouse). No treatment threshold existed for the control of adult Oriental beetles at egg laying, and for their subsequent fall juvenile white grub feeding. Therefore, adult beetle counts at egg laying in the sweet potato canopy were conducted in 1998, 1999, 2000, and 2001. This on farm study was spawned from a farmer sweet potato "round-table" extension meeting. Five farmers cooperated in the study to directly solve this specific production problem, which promoted confidence in this IPM approach. In Southern Maryland an insecticide treatment threshold at egg laying was determined to be the capture of three or more Oriental beetle adults in a single bucket trap during the period from June 10th to July 10th.

Introduction/Situation

In 1997 Maryland sweet potato growers suffered economic losses due to at harvest damage to roots from the Oriental beetle white grub. The white grub feeding rapidly devaluates the crop aesthetically as well as its ability to remain disease free in storage. The Oriental beetle white grub has a distinguishing feeding habit of spiraling around the root. In Severn, Maryland five neighboring farmers produce 75 acres of sweet potatoes. The farms produce an average sweet potato yield of 10 tons/acre with a wholesale value of $240 per ton. The resulting yearly gross revenue for the five farmers is $180,000 and the 60% loss in 1997 due to Oriental beetle damage in some fields represented a significant income loss. No treatment thresholds exist for the control of adult Oriental beetles at egg laying, and for the subsequent juvenile white grub damage. The Oriental beetles have an affinity for the open soil conditions of the sweet potato fields at egg laying time. The white grub larvae upon hatching have ready access to the developing roots. Generally sweetpotato growers have large fields that are in a close rotation further amplifying the white grub destruction potential.

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Sweet Potato "Round Table"

On March 5, 1998 the sweet potato "Round Table" convened with five farmers, and nine Cooperative Extension members. The hot topic of discussion was the 60% crop loss in 1997 to the culling root damage cased by the white grub of the Oriental beetle. During the meeting a conference telephone link was made from the "Round Table" to the office of Ken Sorenson, North Carolina State Entomologist to discuss similar damage seen in the sweet potato fields of North Carolina. The group recognized that the Oriental beetle is a relatively new pest with pockets of heavy populations randomly dispersed (see the Oriental beetle history highlight). Ken recommended that the growers utilize white buckets placed in the sweet potato fields as an adult beetle monitoring tool to assess the population at individual locations, possibly enabling the prediction of heaviest white grub damage areas. Treatment threshold development for the adult Oriental beetle at egg laying would hopefully be a possible outcome of the monitoring. In subsequent "Round Table" discussions control strategies were developed. The farmers also participated in the study by placing white buckets in their fields to assess the value of this monitoring tool.

Objectives

In order to predict and appropriately respond to the Oriental beetle white grub damage to sweet potato roots, beetle counts at egg laying in the open soil of the recently transplanted sweet potato fields were to be conducted. The correlation of beetle counts to the number of feeding juvenile white grubs at sweetpotato harvest were to be made. Beetle surveys were to be made by using beetle traps since the highest beetle flight and egg-laying activity occurs at dusk. Once beetle action thresholds are developed beetles may be sprayed with insecticides over the sweet potato canopy at the proper time for optimum efficacy.

This study was on-farm in cooperation with area farmers in order to promote confidence in IPM and directly solve this specific production problem. All five farmers involved monitored their fields with the white bucket trapping method; although, the four-year replicated study was conducted only at the Schillinger farm site.

Project Plan

A four year replicated study was conducted at the Schillinger farm site for the years 1998, 1999, 2000, and 2001. The project's experimental design was a randomized complete block, examining two treatment options, with four replications, and a plot size of 30' by 50'. The soil was a Rumford deep loamy sand with 0% slope located three miles from the Baltimore Washington International Airport weather station. The two treatments compared were a canopy application of insecticides for control of the adult egg laying Oriental beetles at the spraying triggers of 3 beetles captured/trap and 6 beetles captured/trap in a single day. Neither of the two treatments received granular insecticide at planting, or the root swell application of insecticide. Also randomly flagged in the sweet potato field were control areas where no canopy applications of insecticides or soil insecticide applications were made either at planting or at root swell. The remainder of the field received a pre-plant incorporated application of 13.5 lbs Lorsban® 15G/acre and an application of 2.5 qts Mocap® 6EC/acre banded over the row and incorporated with the last cultivation. Oriental beetle numbers were recorded daily for the bucket trap, and upright beetle trap catches during the adult oriental beetle egg laying activity period of June 5th

through July 15th for all the treatment areas. Incidence of root damage and beetle larvae discovery was monitored from August 10th (corresponding to root swell) through harvest.

Oriental Beetle History

The Oriental beetle *Anomala orientalis* (Waterhouse) is most likely a native pest of the Philippine Islands, and was introduced to the Hawaiian Island Oahu sometime before 1908 (Tashiro 1987). It quickly became an established pest of sugarcane throughout the Hawaiian Islands. In the continental United States, the beetle was first reported to have reached New Haven, Connecticut, in 1920 in baled nursery stock from Japan. It is currently known to be present in Connecticut, Maryland, Massachusetts, New Jersey, New York, North Carolina, Ohio, Pennsylvania, Rhode Island, and Virginia (Alm, Villani, and Klein 1996).

Oriental beetle Observation Highlights

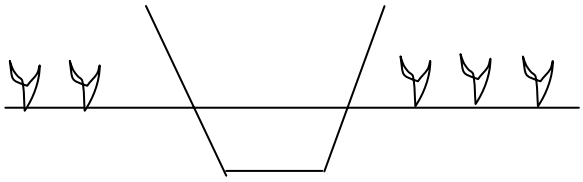
The following observations of the behavior of the Oriental beetle were recorded during the four-year study:

1. Adult Oriental beetles exhibit no gregarious behavior, and can easily go undetected. They do not feed on vegetation. They are very secretive, and will hide quickly in loose soil when disturbed or fly away.
2. The beetles seem to be most active at dusk or in the late afternoon on cloudy low light days. They have an interesting habit of direct fast flight at 5-6 foot off of the ground in a straight-line fashion.
3. Adult oriental beetle emergence typically begins one week after the May beetle initial emergence, and one to two weeks prior to the emergence of the Japanese beetle. The first Oriental beetle emergence appears synchronous with the emergence of the first fireflies.
4. The C-shaped white grub is nearly identical in size and shape to the Japanese beetle; however, they can easily be distinguished by their raster pattern of two parallel lines of fine hairs.

Oriental Beetle IPM Bucket & Trap Method

Place a one-gallon <u>white</u> bucket in the sweet potato row, and bury the bucket 4-5 inches deep. Add and maintain in the bucket 2 inches of soapy water during the entire monitoring period.

Monitor daily, and record capture.

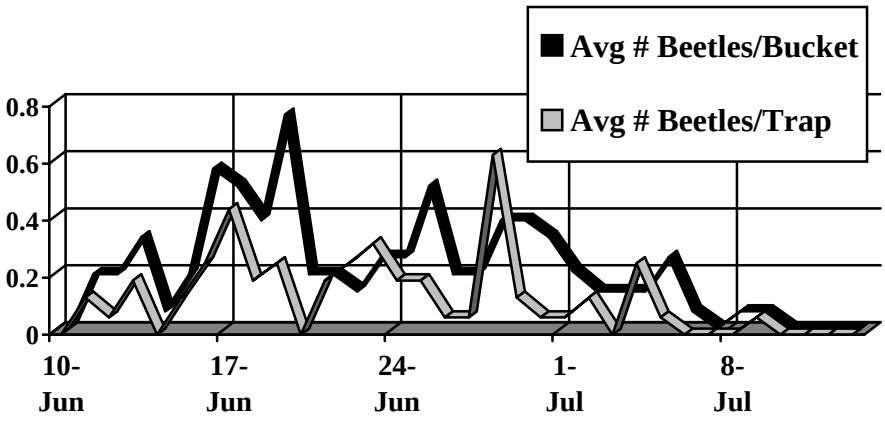


Date: _____

<u>REP/Location</u> <u>#OB/Bucket</u> <u>#OB/Trap</u>

Weather & Comments:

Sweet Potato Oriental Beetle
IPM Survey Results
1998, 1999, 2000 & 2001



IPM White Grub Survey

Although there were heavy populations of Oriental beetle white grubs (>12 Grubs/ft^2) found during the late Winter field digs every year adult beetle activity was light in all four years of the study. There appears to be a naturally occurring high mortality rate of the white grub stage. The use of soil insecticides at sweet potato transplanting was discouraged, because the white grubs were already undergoing pupation. These early field dig surveys aid in the site location of the monitoring buckets and upright trap stations.

IPM Adult Beetle Survey

The sweet potato Oriental beetle IPM survey results for 1998 – 2001 revealed an active adult beetle egg-laying period from June 10th to July 10th. The peak adult beetle activity averaged over the four-year monitoring period was a two-week period from June 15th to July 1st (see the graph). The graphed results shows a beetle capture advantage for the white bucket monitoring station verses the standard up-right beetle trap stations. However, both trap devices are extremely synchronized in ability to represent active beetle periods.

An interesting bi-modal Oriental beetle population is revealed during the four-year monitoring period with two distinct adult beetle activity periods. The first adult activity period occurs from June 15th to June 22nd and the second period occurs from June 24th to July 1st.

The total average number of adult Oriental beetles per trap device never exceeded 1.0 (the highest level was 0.8 average # of beetles per bucket), however, the threshold for insecticide spray treatment was exceeded when any single trap device captured three or more adult beetles in a single day. This occurred three times during the four year monitoring project. In 1998 and 2001 the spray threshold of three or more adult beetles in a single trap device never occurred. In 1999 an above threshold capture occurred on June 23rd and again on June 28th, while in 2000 an above threshold capture occurred on June 19th. The highest number of adult beetles captured in one-bucket trap for a single day was five. The treatment threshold of 6 beetles capture/trap for a single day never occurred; therefore, this treatment essentially became a no spray area. Insecticide sprays were not made in the non-treatment areas during the above threshold beetle activity periods for damage comparison.

At Harvest White Grub Damage Survey

At harvest white grub damage surveys were conducted in 1998, 1999, 2000, and 2001. The only Oriental beetle white grub damage that was discovered during the fall surveys was in 1998, where one plot had a 20% damage level. This damage occurred in the spray treatment area, and was compared to the control area, which had received the application of soil insecticides at root swell. In 1999, 2000, and 2001 no damage was discovered in any of the treatment plots.

The growers involved in the study did however discover pockets of Oriental beetle white grub damage every year, and it was noted that the fields that did not receive the application of the granular insecticide at root swell suffered the most damage; however, this was not revealed in any randomized sampling of monitoring or treatment areas. Damage did not exceed 20% in field any location during the entire monitoring project.

Oriental Beetle Thresholds

1. Any day that three or more adult Oriental beetles are discovered in a single bucket trap, make an evening insecticide spray application of Thiodan® or Sevin® . Repeat spray weekly until Oriental beetle capture falls below three beetles in any single bucket trap station.
2. Two optional cover sprays of Thiodan® or Sevin® applied at weekly intervals, during the period from June 15th to July 1st in Southern Maryland, may provide control of egg laying adults if monitoring efforts are compromised.
3. At early root-swell, corresponding to the final cultivation, look for Oriental beetle white grub feeding, if damage is evident or immature white grubs are present on the lower tubers apply Mocap® and incorporate. Also apply Mocap® to fields where adult Oriental beetle activity was above the three-beetle threshold for an extended period. Always be sure to avoid harvest delays to reduce the level of damaged sweet potato roots from maturing Oriental beetle white grubs.

Economic Impact

1. The sweet potato root loss was held at a 0 to 20% cull rate during the four-year monitoring cycle. Thus a possible crop loss savings for the five farmers involved in the project of 20% to 40%, representing a gross income savings of $36,000 to $72,000 per year, respectively.
2. The growers involved in this on-farm study have developed a much better understanding of utilizing IPM as a management tool, and now posses an improved ability to sense and respond to pest activity appropriately**.**