Tuber Moth Information: Spring 2005

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Everyone in the potato industry in Washington and Oregon should be thinking about potato tuber moth during the 2005 season. This pest should concern you as much as late blight did in the mid 1990s. Tuber moth damage left unchecked can reduce the value of a potato field more drastically than any other pest. Below is some of the information we have to offer you to help get you through the 2005 season. We will be conducting extensive research trials this season to gather more information for 2006.

Description and Damage

Tuber moth caterpillars are about ½ inch long when full grown, have a pale body with a dark brown to black head. Adult moths are narrow, about ¼ inch long, light brown, with various darker spots on the wings. See the potato commission web site for pictures of the larva and adult: http://www.potatoes.com/Research.cfm.

Tuber moth causes both foliar and tuber damage. While plants are lush and green, almost all tuber moth larvae will choose to live in the leaves and small stems of the plants. Note that we said **in** the leaves and stems. These larvae are called "miners" because they live out their lives inside leaves and stems, unlike most caterpillars. In most cases, foliar damage will not limit yield or otherwise cause much trouble. Tuber damage is a different story. While plants are green and growing, very little tuber damage will occur except in exposed (green) tubers. Extensive tuber invasion begins as the canopy declines, dies, or dries due to defoliants. Tuber moth larvae can invade tubers after abandoning drying foliage, or adults may lay eggs on tubers or on soil, allowing newborn larvae to locate and invade tubers. Larvae usually tunnel just under the skin of tubers, but sometimes also go deep inside the tuber flesh. Tunnels in tubers are usually littered with the caterpillar's droppings. In contrast, wireworm tunnels are usually straight and clean.

Biology

Host plants. Tuber moth larvae can develop on many plants in the same family as potatoes (Solanaceae), such as tomatoes, egg plant, and nightshade. They prefer potato, however, and in our area potato is probably the only important host. Adult tuber moths, like most moths and butterflies, are nectar feeders. Therefore, tuber moth adults may be found in weeds or flowering crops as they search for nectar.

Life cycle. Tuber moths have four life stages: egg, larva, pupa, and adult. Eggs are laid on or near potato plants. During the growing season, most larvae live inside leaves and small stems, and also construct nests by tying neighboring leaves together. The full grown larva emerges from the plant and pupates in a dirty-looking cocoon, normally on plant debris or the soil surface. Adults can be found on the plants and on the ground in infested potato fields. They are rapid fliers, flitting from plant to plant. Adults are more likely to be out near dusk then during bright sun light.

Developmental rate. During the warm summer months, an entire generation (egg to adult) may take 3 weeks. This insect responds to cooler temperatures simply by developing more slowly. Most research reports that below 50˚F there is little or no development. This varies, however, from place to place.

Our tuber moths are likely to be at least partially cold-adapted, or able to tolerate cooler temperatures, but we have not yet been able to complete temperature tolerance studies. One thing we do know is that tuber moths have been consistently trapped in Oregon, sometimes in very high numbers, through December 2004, from the few traps observed through the winter. There is no good information on low temperature exposure required to kill tuber moth. All stages can survive some freezing weather, but we cannot say how much

Overwintering. This is one area that we are sorely short on information. There simply is very little information on tuber moth overwintering in a climate like the Columbia Basin. Most research on this pest has been done in warm climates like southern California, New Zealand, South Africa, Australia, etc., where winter is almost irrelevant. We know from our spring trapping efforts in 2004, due to the widespread occurrence of adults in pheromone traps, that tuber moths successfully overwintered throughout the Oregon side of the Columbia Basin. We also maintained traps in the Hermiston area throughout the winter of 2004-2005, and collected moths in at least one trap all but one week of the winter. As of March of 2005, tuber moths were being found throughout the Oregon side of the Columbia Basin. Possible overwintering sites are in harvested potato fields, in or near storages, in cull or dirt piles outside storages, or in fields that had hosted volunteer potatoes the previous season.

There is not a specific life stage that overwinters in this insect. Work done 80+ years ago in Maryland and Virginia suggests that all life stages of tuber moth enter the winter season, with a very small percentage living long enough to see potatoes emerge in spring. Many species of insects enter a special hibernating state called diapause. Tuber moth does not do this, having instead to wait out the winter. Those that avoid disease, predation, freezing, dehydration, and starvation are able to infest potatoes that emerge in spring. Almost certainly, volunteer potatoes are very important for overwintering, as a food source in harvested fields in the fall and early winter, and as new volunteers emerge in March and April.

Tuber Moth's Current Distribution

During 2004 the Washington and Oregon potato commissions funded a region-wide trapping network to establish the current range of tuber moth, and track its movement. Using pheromone-baited traps, we followed tuber moth numbers from late May through mid-November (see Figure 1). There were almost no tuber moths found in WA for the first few weeks, but the area just across the river from Oregon soon became heavily infested. The areas north of Pasco initially had few tuber moths, but by the end of the season moths were being caught throughout the region. The more severe winters seen in the north Basin may force tuber moth to colonize areas such as Moses Lake from the south each year, but we cannot be certain of this. Even if this were true, infested tubers in storage buildings are a potential source of tuber moth in the spring regardless of outdoor weather. Our tuber moth monitoring started in March 2005 to help answer the question of survival in the mid- to north-Basin.

Monitoring Your Fields

We strongly recommend that every grower in the Columbia Basin place pheromone traps around all potato fields. It is clear that the southern Basin has a greater tuber moth risk, but the potential damage by this pest is too severe to risk having an infestation in your field go undetected. Traps should be checked regularly, and the sticky liner replaced at least every week. At the current time, we do not have appropriate treatment thresholds for our area and for numbers trapped using the delta trap design. Use the traps to detect tuber moth in your field, and to determine the effect of any insecticide treatments on moth populations.

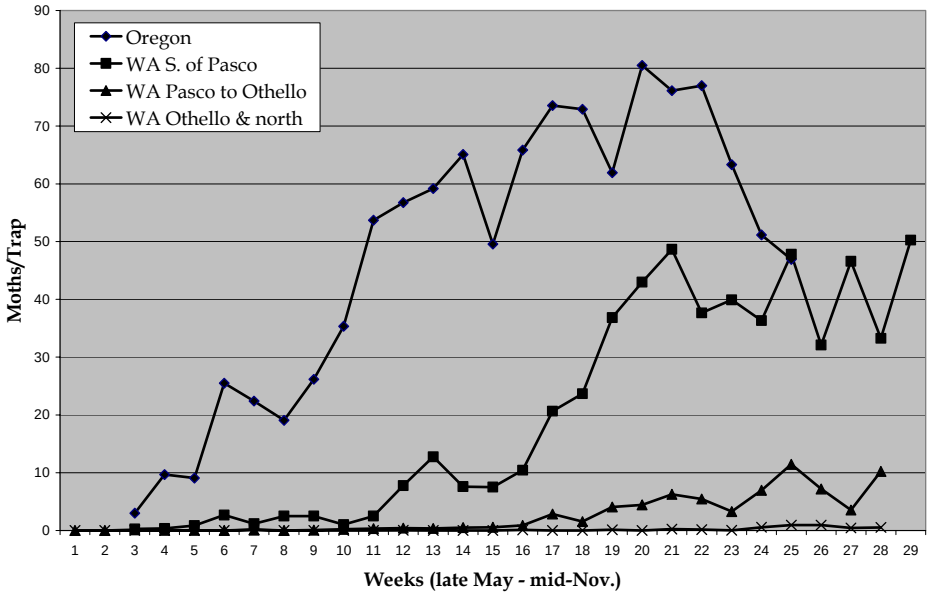

Figure 1. Weekly tuber moth trap catches in four regions of the Columbia Basin, starting mid-May (week 1) to mid-November.

Risk Factors for Tuber Damage

There are a few factors that predispose a field to tuber damage by tuber moth:

1.) Dry Soil. Much previous research shows that dry soil due to furrow irrigation, drought, or ending of irrigation leads to tuber damage. Conversely, wet soil prevents almost all tuber damage.

2.) **Dead Vines.** Tuber moth larvae live in the leaves and stems of potato plants during the growing season, and all evidence suggests that they prefer green foliage over tubers. So, almost all tuber damage occurs after vines begin to die or following chemical defoliation. Dry soil during this time makes tubers especially vulnerable.

3.) **Exposed/Shallow Tubers.** Research around the world has shown that tubers infested by tuber moth larvae are almost always within 2 inches of the soil surface. Tubers deeper than 2 inches are rarely infested.

4.) **Large Moth Populations.** Left unchecked, tuber moth populations can become overwhelmingly huge. It is a good idea to watch tuber moth numbers during the season, and make an effort to keep them in check. Waiting till vine decline or kill to attempt tuber moth control is an invitation to failure.

Figure 2. Tuber moth pheromone trap and stand design used in Washington in 2005.

Management

Cultural methods. There are a few well-known methods to manage tuber damage, which are more or less the reverse of numbers 1-3 in the last section. These methods also have serious drawbacks or limitations for many situations. These methods are: 1.) keep the soil surface moist to the degree possible; 2.) harvest under green vines if at all possible, or as soon after vine death as possible; 3.) increase tuber depth by hilling after vine kill or by achieving deeper tuber set.

Chemical control. There are some insecticides that have good efficacy against tuber moths in potatoes. Published research data show that multiple applications are required for meaningful control of tuber damage in the absence of any cultural controls. Do not expect any at-plant insecticides to give meaningful control of tuber moth. All insecticidal treatment for this pest must be foliar. Choose products with efficacy against moths, with the longest possible period of residual activity (see Table 1 for some guidance). Remember, the larvae are leaf and stem miners and are at least partially protected by the plant from insecticides. Pupae may also be protected. Therefore, adult moths may be found soon after the use of foliar insecticides.

Table 1. Insecticides expected to show tuber moth control, and some insecticides that will not effectively control tuber moth.

Insecticides expected to have efficacy	**Insecticides with little efficacy**
Guthion	Admire, Gaucho, Provado, Genesis
Monitor	Platinum, Cruiser, Actara
Baythroid, Leverage	Temik
Asana	Vydate
Success	Dimethoate
Furadan	Rimon
Imidan	Fulfill
Pounce, Ambush, Permethrin	Methyl Parathion
Lannate	Di-Syston