



Christmas Tree Notes

Control of Root Feeding Insects in Fraser Fir Christmas Trees

CTN-008

Introduction

There are several species of insects that feed on and affect root growth of Fraser fir Christmas trees either in the field or in seed beds. These include:

- ◆ May and June beetle grubs (*Phyllophaga anxia*, *Phyllophaga fusca* and *Polyphylla comes*)
- ◆ Asiatic garden beetle grub (*Maldera castanea*)
- ◆ Masked chafer grub (*Cyclocephala* sp.)
- ◆ Black vine weevil grub (*Otiorhynchus sulcatus*)
- ◆ Root aphids (*Prociphilus americanus*)



Figure 1. Grub feeding on tree roots.

White grubs. White grubs such as May and June beetle grubs, Asiatic garden beetle grubs, and masked chafer grubs are the immature stage of scarab beetles. Depending on the species, they can live in the soil for up to three years before maturing into the adult beetle. Grubs have a white C-shaped body with six legs and a yellow to dark brown head. Size of grubs can vary with species and with age within a species, as all grubs go through several molts before pupating.

Black vine weevils. The black vine weevil grub is similar in appearance to scarab beetle grubs, except they are legless. Occasionally they are also pests of seedlings. The adult black vine weevil is also a pest, feeding on more than 100 different kinds of plants with their preferred hosts being rhododendrons, hemlocks and yews. Adult weevils feed on leaf margins causing a typical crescent-shaped notch.

Root aphids. Root aphids feed on conifer roots for part of their lifecycle, then become woolly aphids that feed on ash trees. They appear as large white aphids on the roots. It is not known how much



Figure 2. Root aphids are seldom a problem unless numbers are high.

damage they cause to their conifer host; however, when numbers exceed one hundred aphids on a single seedling, growth of fine feeder roots appears to be reduced.

Root feeder damage. Grubs and other root feeding pests cause poor growth through loss of roots. Small roots will be absent and larger roots are often stripped of their bark. Young trees will appear stunted with yellow-green color. Mortality will occur especially following periods of moisture stress. Even after grubs have been controlled, seedlings that have suffered severe root loss from grubs often will not recover and grow properly. Seedlings that have had root damage in plant beds should not be planted out into the field.

Identifying pests. Not all grubs will eat Fraser fir roots. Some grubs, such as the Japanese beetle grubs (*Popillia japonica*), only eat grass roots. Others, such as green June beetle grubs (*Cotinus nitida*), only eat dead organic matter on the surface of the soil at night. Green June beetle grubs can be distinguished from other grubs because they “crawl” on their backs when they are laid on the ground.

Another species of grub, the Oriental beetle grub (*Exomala orientalis*), has been found in isolated areas in western North Carolina feeding both on turf and

hemlocks. In other states, it also feeds on Fraser fir. It is extremely difficult to control and any occurrence on Fraser fir should be reported to your County Extension Agent.

Life Cycles

May and June beetle grubs. Adult beetles feed on the leaves of hardwood trees, especially oaks. They mate and lay their eggs in short grass from May through July. Grubs are common in old pastures or where grass is kept short through mowing. During the winter, the grubs burrow several feet deep in the soil to keep from freezing. When the soil warms in the spring, the grubs gradually return to the root zone, feeding throughout the growing season. During the winter of their second year, they pupate and then emerge as adult beetles the following spring to begin the life cycle again.

Asiatic garden beetle. Unlike the May and June beetles, Asiatic garden beetles complete their life cycle in one year. The larvae pupate in late June, with adults emerging in July and August. The females burrow into the soil to lay their eggs (50+). Eggs hatch in about two weeks and the larvae begin feeding. Adults and larvae are found in the soil during the day.

Masked chafer beetle. Masked chafers also complete their life cycle in one year and overwinter as grubs below the frost line. Larval feeding activity will continue in April and May with pupation occurring in late May to early June. Adults emerge in early July. Eggs are laid in the upper 2" of soil and grubs begin to appear by early to mid-August. Larval feeding damage can be observed by late August through October.

Black vine weevil. Black vine weevils overwinter as mature larvae. However, a few adults also survive the winter to feed and deposit eggs during a second season. This weevil is parthenogenetic – there are no males produced and offspring are clones of the mother. Although one female was recorded as laying 863 eggs, the average number of eggs deposited by each female is probably about 200. The adults feed most extensively during the preoviposition period which occurs in late May and June and lasts about 4 weeks. Adults usually live 90 to 100 days. The adults hide during the day and are difficult to find. Eggs, deposited in the soil and leaf litter, hatch in 2 to 3 weeks. Initially, the young larvae feed on rootlets; but after the third molt the larvae move to larger roots. During their development, larvae molt five or six times within earthen cells in the soil. After a

quiescent prepupal stage that lasts from 3 weeks to 8 1/2 months, the larvae pupate. Three weeks later, adults emerge. Adults feed at night and drop from the plant, feigning death when disturbed. These weevils cannot fly; so they must be carried or walk to uninfested areas. Problem areas are often localized.

Root aphids. Root aphids have multiple generations per year, producing live young. A portion of the population appears to remain on the fir host year round. In spring, however, many move onto ash trees, the alternate host, where their feeding distorts developing growth.

Finding Root Feeding Pests

Growers often first become aware of the presence of root pests by above-ground plant symptoms, i.e., poor growth, poor foliage color, and even plant death. Most damage occurs on seedlings and transplants in plant beds, or young plants within the first year or two after planting in the field, though occasionally larger trees will be attacked. These same symptoms can have many causes besides root pests such as Phytophthora root rot, drought, or improper planting. To distinguish white grub damage from other problems, some affected plants should be pulled up and the roots examined. Grubs will eat the feeder roots and bark from primary roots, leaving little of the root system, although what is left may appear healthy. Also look for grubs in the soil where symptoms are found (see below). Root aphids are found feeding on the roots themselves. In addition, black vine weevil grubs have frequently been a problem in Fraser fir seedlings grown in greenhouses.

Identifying Grubs

Proper identification of grubs is important. White grubs are often identified by the raster pattern, which is the pattern of hairs on the tip of the abdomen. With a hand lens, a grower may be able to distinguish between the different types. For positive identification, however, it is best to put the grubs in a small bottle in alcohol and send them to the North Carolina State University Plant Disease and Insect Clinic in Raleigh. Contact your local County Extension Agent to aid in grub identification.

Finding the Adult

The adult form of many of these pests that feed on Fraser fir roots are nocturnal. Finding adult beetles or weevils is difficult. Many are attracted to lights at night and can be trapped in a light trap. Knowing when adults are actively flying can help time

pesticide applications. Black vine weevil adults do not fly and they will hide during the day. They can be observed by placing a board or burlap near the seed bed to determine when adults are active and the size of the population.

Scouting Fields for Grubs

Fields should be scouted for white grubs before trees are set. Grubs are difficult to kill because insecticides are often bound to clay and organic matter in the soil and will not move deep enough into the soil to affect the grubs. Grub control is improved if insecticides can be incorporated into the soil. This can only be done before trees are set. It is especially important to scout old pastures that are to be set in trees, as grubs are almost always present.

It is not possible to adequately assess the prevalence of grubs in the spring since they may not have returned to the root zone. Fields to be planted in the spring should be scouted for grubs the summer or fall before planting.



Figure 3. Young grubs are very small, but are important because they will keep feeding in your trees for a year or more.

To do a pre-plant search for grubs, select five locations in a one to two acre field. Select locations where grubs are suspected because of poor stands of grass (possibly due to grub feeding), wild strawberries (a favorite food of grubs) or where moles, foxes, crows, or other animals have been feeding on grubs. Otherwise, choose locations at random.

At each location, dig a square foot hole that is 6-8 inches deep. Sift the soil through your fingers, looking for grubs and keeping count of the number found. Grub size will vary from the size of your thumb to some no longer than 1/4 of an inch. These small grubs can be easily missed, so look carefully.

Treatment Threshold

Record the number of grubs found in each of the five holes. Add up the total number of grubs found in all the holes and divide by five. This is the average number of grubs. If this number is greater than one, chemical control is recommended.

Pre-Plant Chemical Control

In the fall, incorporate an appropriate insecticide such as Lorsban (chlorpyrifos) in the soil along the strip where trees will be set. Only kill the ground cover in this strip. Leaving ground cover between the rows will provide a food source for grubs so they will be less likely to eat the roots of newly set Fraser fir transplants.

Treating Seedlings Before Setting in Grub Infested Ground

It is easier to tree seedling roots than to get chemicals into the soil to control grubs. Talstar Nursery (bifenthrin) is labeled for root dip at one gallon in 100 gallons (1.3 ounces/gallon). Talstar, which degrades within a few weeks in sunlight, will last for a year or more in the soil, protecting seedling roots. Be sure to wear appropriate personal protective equipment when handling pesticide treated seedlings. This method of control can also be used when re-setting seedlings that have died from grubs.

Ground Cover Management

Proper ground cover management is more important than treating with an insecticide to control grubs and to keep them from returning. Maintain a ground cover with suppressive rates of post-emergent herbicides. Grubs that are already in the ground will have something to eat besides Fraser fir roots. All grubs will mature and leave within two growing seasons. By not mowing from May through August, no eggs will be laid in the field by the adult beetle to produce more grubs. Your County Extension Agent can help you develop a ground cover management program for your trees.

Chemical Treatment after Trees Are Set

Once trees are set, chemical control is much more difficult. Many of the newer materials for grub control such as Flagship (thiamethoxam) and

Marathon (imidacloprid) work best when grubs are small. They should be applied in the late spring. These materials should be applied in 50-100 gallons of water per treated acre. Organophosphates such as Diazinon or Lorsban may give quick knockdown of grub numbers when used when grubs are close to the surface of the soil. This may be in the spring, or more likely in the fall. Apply these materials in the tree row before a soaking rain.

Controlling Soil Pests in Plant Beds

It is easier to treat for grubs in plant beds because the soil is looser and pesticides can be irrigated in. Sites for beds should be scouted for grubs before seeding and planting. When grubs become a problem, apply Flagship or Marathon in the late spring, or one of the organophosphates for quick knockdown. Irrigate into the soil after application as recommended on the label.

To control black vine weevils and Asiatic garden beetles, target adults before they lay eggs rather than larvae in the soil. Materials like Lorsban and Talstar sprayed on the soil surface will control these pests. For the best timing, lay a board or piece of burlap around the edge of the field for these pests to hide under during the day. Black vine weevils are typically active in late May or early June. Asiatic garden beetles are most prevalent in July and August

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Original Christmas Tree Note "White Grub Control in Fraser Fir Christmas Trees" 1982. Rewritten June 1995. Updated and renamed July 2004. Updated December 2009.

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but may be present even into October. Treat one to two weeks after adults are first observed.

Controls for Root Aphids

Many growers in western North Carolina find that root aphids cause few problems. However, in areas where root aphid numbers exceed 100 per plant, and in areas receiving little rainfall or with poor fertility, root aphids may require treatment. Root aphids have been successfully controlled in other states with Flagship (thiamethoxam). If root aphids are found on roots of transplants, consider treating with an insecticide that can be applied as a root drench, such as Talstar Nursery. For current treatment options, and for help in determining if root aphids are indeed a problem, contact your local County Extension Agent.

Scouting after Chemical Control

Several weeks after chemical applications, scout fields to determine if grubs can still be found. If you see dead grubs on the surface of the soil after applying an insecticide, you have only killed the green June beetle grubs which feed on the surface of the soil on dead plant material at night. You may or may not have killed the grubs that are damaging your trees. Dig in the soil in several locations where grubs were previously found to determine if grub numbers have been reduced.