A New Approach to Pine Root Weevil Management

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Root weevils are a major problem affecting Christmas tree production in Wisconsin, especially on Scotch pine.

Four separate species are involved. The most difficult species to control is the root collar weevil. The larvae mine the below-ground portion of the main stem, thereby disrupting the tree's vascular system. The foliage discolors, and eventually the tree dies. The adults feed at night on twigs.

The pales and pitch-eating weevils are two closely related species, with slightly different habits. These larvae feed on the root of cut stumps or dead trees, which in itself is not damaging, but the developing adults emerge and feed on twigs and stems. Girdling of seedlings can completely devastate new plantings, and twig-feeding can cause limb dieback on larger trees.

Finally, the root tip weevil breeds in the lateral roots of living trees. Attacks by all of these weevils are almost always accompanied by fungal infection.

The biggest problem in dealing with root weevils is that you usually don't know they're present until it's too late to prevent a significant loss of your crop. Because the adults feed at night and the larvae feed below ground.

Controls of the root weevil
Some cultural controls are available against the pales and pitch-eating weevils. For example, if you delay planting for two years after harvest the emerging weevils have nothing to eat and so must either leave or die.

Although usually effective, this does not protect growers from weevils that migrate from someone else's field. It also allows pales and pitch-eating weevils to breed in trees that were killed by the root color weevil. The emerging adults can then cause the problems described above. Delaying replanting does not protect trees from the root collar weevil, because they breed in the live roots and build up over the next few years.

Natural control agents, such as nematodes, parasitic wasps, checkered beetles, and insect-infesting fungi, seem to help somewhat. The weather can help too. During the very rainy fall of 1986, for example, many late-season adults were drowned. Conversely, the severe drought of 1988 killed a large proportion of the early season adults. However, these weevils have overlapping life stages that enable some members always to survive bad conditions.

Although weevils that overwintered in 1987-88 as adults dried out as they sought new trees to attack, for example, the overwintering larval population was protected within the pine roots. They have since matured and begun attacking trees in 1989. The same sort of split enabled populations to rebound quickly after the 1986 floods.

The most effective control measure to date has been preventive spray with insecticides. Preventive control has a big disadvantage, however, in that it can waste money by spraying areas that do not need treatment.

Some highly residual materials, such as lindane, can provide long-term protection. Accordingly, this is the most commonly used insecticide against root weevils in our region. However, any chemical that provides "long-term protection" is by definition "environmental persistent." This is exactly the kind of trait you do not want if you are concerned about groundwater contamination and protecting our streams and soils.

To make matters worse, lindane has a very high acute toxicity, and is a potent carcinogen in tests with laboratory mammals. Lindane has been banned from most commercial uses because of the hazard it poses to both applicators and the environment. It is currently registered in Christmas tree farms under an annual emergency permit.

The problem is aggravated further by the ability of root weevils to thrive in sandy soils, which unfortunately are also the areas most threatened by groundwater contamination. Moreover, insecticides kill both predacious and pest insects. This reduces the natural controls currently in effect and can also cause flaring of secondary pests that weren't even a problem before you sprayed.

So root weevils have put Christmas tree growers in a bind. If growers delay controls until damage is apparent, it may be too late. On the other hand, the most effective preventive measure has some severe disadvantages, can incur unnecessary expenses, and is of uncertain future availability.

Locating the weevil
If there were some way of sampling weevil populations, it would be possible to spray only fields that were actually threatened. Also, the continued performance of sprays could be monitored for several years to see if control was still holding up. If sprays could be targeted effectively, it might not even be necessary to use such persistent insecticides. Something that knocked the weevil populations down and then decomposed

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The first step was to design a trap. We tried several designs, but were most successful with a "pitfall" trap, a sunken cup into which walking weevils fall. The trap consists simply of an 8" section of 4" diameter PVC pipe into which holes are drilled around the perimeter near one end. The pipe section is capped at both ends with removable plastic lids.

The trap is placed vertically into the ground so that the holes are even with the soil surface. Weevils enter the holes, fall to the bottom and become trapped. We apply a thin layer of liquid teflon to the inside walls with a cotton swab to keep weevils from climbing out. Two smaller holes are also drilled through the pipe, so that a stiff wire can pass through them and support the baits. The materials are quite cheap, coming to around $0.38 per trap. The expected longevity is around two years for the lids and almost indefinite for the PVC pipe. They're easily placed in the ground using a post hole digger. We and our friends at Kirk have set up hundreds in a single day.

But how can you sample root insects? Well, if you can't easily and economically find them by direct search or scouting for symptoms, perhaps weevils could be lured into a trap and counted. One way to do this is to exploit the fact that most insects find their food through smell. For example, mosquitoes find us by homing in on the carbon dioxide we exhale. Likewise, each plant has a particular order to which certain insects are attracted.

Traps are Simply Devised

In 1987, we set out to determine if we could devise a simple, inexpensive, easily examined trap for pine root weevils. We were funded by the Christmas Tree Producers Associations of Wisconsin, Michigan, Illinois and Minnesota. We've been doing most of our work in Waushara County on farms owned by the The Kirk Co., whose employees have been fantastic cooperator.

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Next step was to find good bait. We found that a combination of ethanol and turpentine attracts all four species of pine root weevils. Neither chemical is attractive by itself. These inexpensive baits are squirted into small glass vials that hang from the brace wire. We reported the success of this method at the 1988 winter convention of the Wisconsin Christmas Tree Producers Association in Oshkosh.

Once we had demonstration that our trap and bait work, we needed to calculate the relationship between weevil capture and tree damage. In other words, how many weevils in a trap indicates that an economic loss to the farm is imminent? It requires a lot of work to demonstrate such a relationship, and fortunately the Wisconsin Department of Agriculture, Trade and Consumer Protection's sustainable Agriculture Program was willing to lend their support to the continuing growers' funding.

Sustainable agriculture is a philosophy that is gaining growing appreciation in both academic and agricultural circles, and is aimed at economically reducing energy and chemical inputs into production systems. When it's based on sound biology and economics, it can save energy costs, reduce pesticide impacts, and improve yield.

**Report Planned for Winter Conference**

We set up a series of plots in 1988 that provided a range of weevil damage levels. The traps were monitored throughout the 1988 and 1989 growing seasons, and damage ratings were taken periodically. We are conducting a profitability analysis on how traditional preventive sprays, sprays based on trap catch, and nonspray treatments compare. So far the results are encouraging.

So far the results are encouraging. Our trap catches predicted the low level of new attacked during the 1988 drought season, and we can safely say that some sprays were simply a waste of money. One year certainly doesn't prove a method's worthiness of course, and we're hoping the 1989 data will help us fine tune our system better. We'll be reporting our results in early 1990 at the winter conventions of the Wisconsin and Illinois Christmas Tree Producers Associations in Stevens Point and Springfield, respectively. We plan to do a field demonstration at the Wisconsin summer convention in 1990.

In the meantime, we are studying ways to improve trap performance before we finalize our recommendations to growers. We have found, for (continued on page 22)

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Below are some further details that will hopefully answer some questions that you have. If any growers are interested in participating in such a trial, we'd love to hear from you. We'll send you the traps and you can mail us the weevils. We'll have to make at least one on-site visit to survey tree injury.

Next year we'd like to try a sample monitoring system throughout the Lake States. So far, we have concentrated our efforts in Waushara County, and we'd like to get a broader geographic base for our final round of trouble-shooting. Also, to incorporate our new improvements, such as high ethanol to turpentine ratios and white traps, we'll need to update our capture vs damage relationship.

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