

Applied aspects of pales weevil control

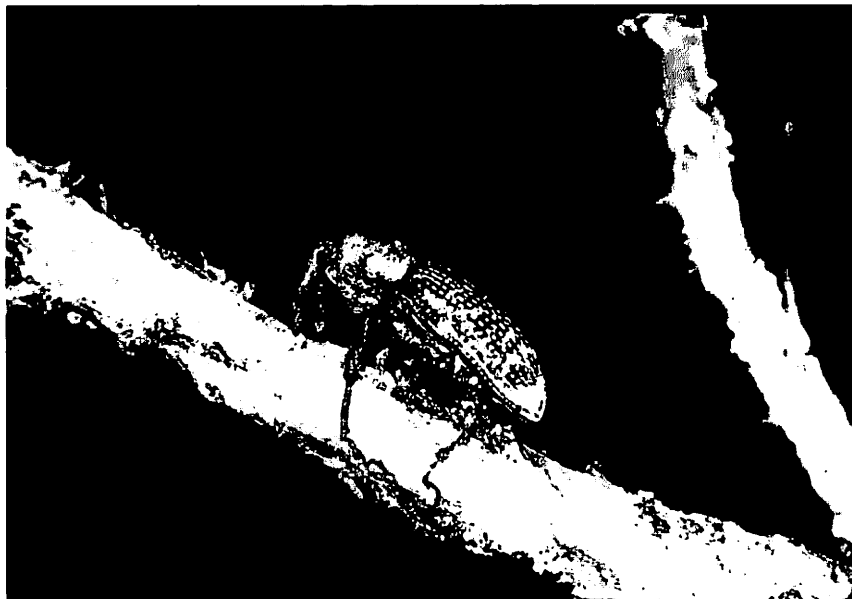


Figure 1. Up to 90% of the seedlings in a loblolly pine plantation can be killed by the feeding of the pales weevil.

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INTRODUCTION

The pales weevil, (*Hylobius pales* Herbst), together with its ally the pitch-eating weevil, (*Pachylobius picivorus* Germar), can cost the owner of new southern pine plantations \$20 or more per acre. It is not uncommon for weevils to kill 40-90 percent of the loblolly pine (*Pinus taeda* L.) seedlings planted in recently logged areas (Figure 1). Mortality in this range necessitates at least partial replanting the following year. On the other hand, if planting is delayed until the weevils have left the area, one or more year's potential growth is lost. Also, delay allows increased weed competition, and another year elapses before the area becomes aesthetically pleasing again.

Fortunately, three chemical treatments have recently been approved by the Environmental Protection Agency to help remedy this situation (Figure 2). They are: (1) a clay slurry root dip containing 1% carbofuran, the active ingredient in Furadan 4F; (2) a post-planting surface application of 1.0 grams ai of Furadan 10G per seedling; (3) a post-planting foliar spray of 2% chlorpyrifos, the active ingredient in DURSIBAN[®] M insecticide.

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Furadan insecticide is systemic and is manufactured by FMC Corporation and Chemagro Corporation. DURSIBAN M insecticide, a contact insecticide, is a product of The Dow Chemical Company. These chemicals have proved to be safe and effective substitutes for aldrin and DDT which are no longer permitted for pales weevil control.¹

The purpose of this article is to summarize the three years of experience that we have had with these products and discuss various strategies for using them.

Situations Requiring Weevil Control

Although present in natural pine forests, the pales weevil is principally a problem in managed plantations. Weevils are attracted into freshly cut areas where they breed in the roots of pine stumps and weakened trees, and in buried slash (Speers and Rauschenberger 1971). New plantations in or near large, contiguous clearcuts are especially vulnerable (R. F. Anderson, personal communication).

Not every new pine plantation is attacked by weevils, however. Areas logged in the winter and early spring months are usually safe for planting the following winter (Speers and Rauschenberger 1971), particularly if controlled burning is the only method of site preparation used (Fox and Hill 1973).

With the advent of intensive site preparation, however, this rule does not always hold. The disturbance created by mechanical equipment used to remove the slash and brush frequently prolongs the attractiveness of the area to weevils (Speers 1971, 1973).

To identify problem areas, we picked sites in Arkansas and Oklahoma that had been logged and mechanically site prepared at various times of the year. We then planted untreated seedlings in those areas the following winter and determined the subsequent weevil-caused mortality.

Only areas logged in the spring and site prepared in the spring or summer were safe from weevil attack (Table 1). Apparently, enough time elapsed for weevils to leave

¹Our use of trade and firm names is for the information and convenience of the reader and does not constitute official endorsement or approval of the product by the United States Department of Agriculture to the exclusion of others which may be suitable.

Soil samples taken at harvest time from the various treatments and bioassayed for herbicide residue (Table 5) indicated that very low levels remained in the soil by that time. Considering that a 1 oz ai/A application is equivalent to 62.5 ppb, the breakdown was in the range of 96% or 4% residue. This would appear to be an ideal situation as far as herbicide breakdown is concerned.

In 1974, a crop tolerance study indicated that oats were completely tolerant up to the highest rate of DOWCO 290 used, which was 16 oz/A. Barley was a little less tolerant, in that the neck strength appeared to be slightly reduced and allowed greater head bending. This effect was not reflected in any yield loss.

With wheat, tolerance appeared to be excellent at all levels of application until the flowering and filling stage. At this point it was noted that flowering and filling were reduced at the 8 oz/A rate of application, and severely reduced at the 16 oz/A rate. In terms of yield (Table 6), it meant a 35% and 60% reduction, respectively. Weed control ratings from these plots indicated that the higher rates of DOWCO 290 alone were not as effective as the low rate in combination with 2,4-D or MCPA.

Bioassay of the soil from the plots (Table 7) showed that there was a more rapid breakdown in oats than wheat. In wheat, the residue at harvest time was 15% of the amount applied, while in oats it was 8.6% of the applied material. The residue was proportional to the rates applied in both crops. It is assumed that the difference in tolerance of these two crops to DOWCO 290 had a bearing on the uptake of the herbicide in the plants. The plant materials have not been subjected to analysis.

Applying DOWCO 290 herbicide in combination with 2,4-D or MCPA at different growth stages (Table 8) indicated that weed control was more effective when the treatments were applied at the three-leaf stage rather than the five-leaf stage. Differences in weed control due to stage of application was greater when MCPA was used in the combination than when 2,4-D was used. At the later stage of application, DOWCO 290 + MCPA at 1 + 4 and 1.5 + 6 oz/A did not control wild buck-

wheat or Russian thistle effectively. Stinkweed and lamb's-quarters were well controlled at all rates and stages of application. Crop tolerance was not really affected at any stage or rate. Crop yield was not significantly different due to the treatments.

Rapeseed appeared to be quite tolerant to DOWCO 290; however, as the rates increased, the yields of both varieties decreased (Table 9). The decrease in the yield of Torch between the 2 and 4 oz rates of application was statistically significant but not with the Midas variety. In the Midas variety, frost had more of an influence as the treatments delayed maturity by several days.

Weed control was not consistent, but this is not unusual in rapeseed as crop cover has a marked effect on weed control. Due to adverse spraying conditions, the Midas variety was sprayed one week after Torch. The weeds had developed considerably during this time, and consequently, poorer results were obtained. None of the treatments with DOWCO 290 were any better than TOK/RM (niclofen).

The control of Canada thistle in wheat with DOWCO 290 in combination with 2,4-D at 3 + 6 and 4 + 4 oz ai/A was more effective than 2,4-D alone at 12 oz/A but not as effective as 2,4-DB at 24 oz/A.

When DOWCO 290 herbicide was used during the fallow year in combination with 2,4-D at 12 to 18 oz/A of the 1:4 ratio of DOWCO 290:2,4-D, the control in the crop year rated at 5 - 6 on a 0 - 9 scale of rating. When 2 oz/A of DOWCO 290 was combined with 16 oz/A of Glyphosate, the control rating was 6.5.

CONCLUSIONS

In view of the crop tolerance shown in the 1974 tests, it would seem that higher rates of DOWCO 290 could safely be used as a summer fallow treatment without any danger to wheat. In barley or oats, relatively high rates might be tried for the control of Canada thistle in crop land. Since DOWCO 290 herbicide seems to be quite compatible in cereal grains, particularly oats and barley, the narrowing of its ratio with phenoxy herbicides might be considered to reduce the total herbicide applied without losing the ability to control tough weeds. ◀

these areas prior to planting. The later in the year that logging or site preparation was performed, the greater the weevil damage to the new plantation. The worst damage occurred in plantations established immediately after fall logging and site preparation. Fully 35% to 78% of the seedlings were lost in those situations. Thatcher (1960) found that plantations in east Texas were especially vulnerable to pitch-eating weevil attack if planted soon after fall or winter logging.

Most of the weevil-caused seedling mortality occurs in late winter and spring, apparently due to the feeding of over-wintering adults (Thatcher 1960; and C. A. Doggett, C. R. Grady, and H. F. Layman, unpublished data). Their broods, which emerge in the late spring and late summer, also contribute to seedling losses.

Results of Insecticide Screening Trials

In 1972 we began to screen a number of insecticides to replace the banned chlorinated hydrocarbons for control of pales weevil. Laboratory tests indicated that chlorpyrifos and carbofuran were promising candidates for field testing (Robertson et al. 1975). Our field tests covered a period of three years and encompassed southeastern Oklahoma, southwestern Arkansas, and southeastern North Carolina*. The tests were arranged in standard experimental designs with a minimum of four replications and 20 seedlings per replicate. Several different insecticides, rates, and application techniques were tested (Nord et al. 1975; J. D. Walstad, unpublished data), but only the registered uses are discussed here.

Both DURSBAN M and Furadan insecticides afforded significant protection to loblolly pine seedlings from weevil attack (Table 2). In most cases, the chlorpyrifos foliar spray (as DURSBAN M) provided the best control, followed by the Furadan 10G treatment and the Furadan clay slurry root dip. However, due to the variability in weevil damage, statistically significant differences among treatments only occurred at four locations. It should also be mentioned that the chlorpyrifos spray was applied about a month later than the other treatments, and this may have accounted for its superiority. None of the treatments was phytotoxic.

* The field tests in North Carolina were cooperative studies involving the U.S. Forest Service, North Carolina Forest Service, Federal Paper Board Co., Inc., and Weyerhaeuser Co. The tests in Arkansas and Oklahoma were conducted by Weyerhaeuser Co.

TABLE 1. Relationship of logging and site preparation dates to pales weevil attack on planted loblolly pine seedlings.

Logging/Site preparation	SW. Arkansas	SE. Oklahoma
	% weevil-caused seedling mortality	
Spring/Spring	5.0	7.5
Spring/Summer	2.5	0
Spring/Fall	30.0	5.0
Summer/Summer	22.5	15.0
Summer/Fall	12.5	57.5
Fall/Fall	35.0	77.5

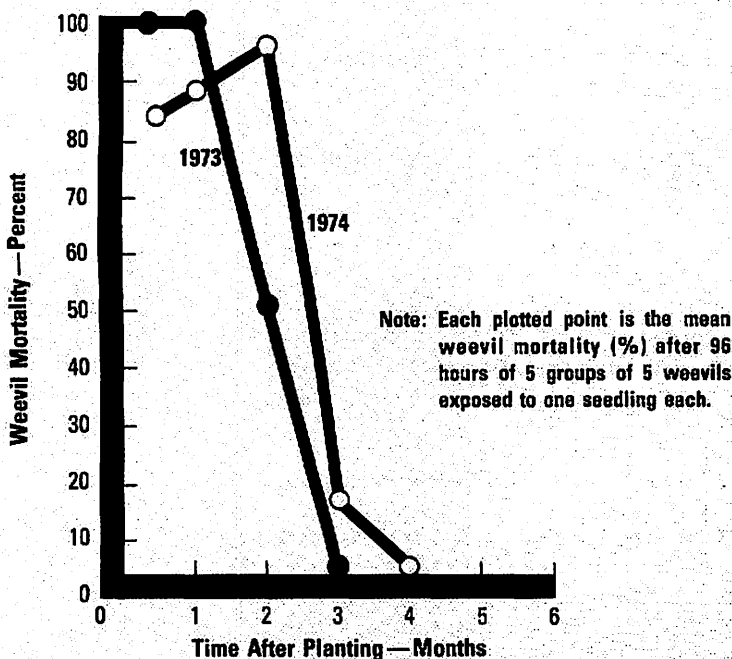
While the degree of protection given by these treatments was not adequate in some instances, it should be mentioned that these tests were situated in the midst of large, freshly-logged areas and were exposed to intense feeding pressures. In many instances the only above ground food source within several ^{acres} ~~areas~~ was the small plot of seedlings in our test. Our experience from operational tests indicates that when the whole area is treated the damage is reduced to a tolerable level.

The considerable variation in the effectiveness of the carbofuran clay slurry root dip was due to its short residual life and the intensity and duration of weevil attack. Bioassays of slurry-dipped seedlings indicated that the treatment was only effective for a period of 2-3 months (Figure 3). Since the heaviest feeding period lasts from February through June, delaying the planting of slurry-dipped trees until March will maximize the effectiveness of this treatment (Walstad et al. 1973). Also, this treatment should be restricted to areas of moderate weevil activity. Otherwise a follow-up treatment of DURSBAN M or Furadan 10G may be necessary. If the weevils are actively feeding, the chlorpyrifos spray should be used to obtain instantaneous protection. Furadan 10G insecticide requires a good rainfall before it is effective.

Figure 2. This loblolly pine seedling was protected with an insecticide. Nineteen dead weevils were found at the base of this seedling and yet it continued to grow.



Figure 3. Duration of protection from pales weevil attack provided by the 1% ai Furadan clay slurry root dip.



Operational Strategies for Pales Weevil Control

Table 3 prescribes the various treatments which can be used to reduce weevil damage following various logging and site preparation activities.

Planting sites are classified according to weevil hazard based on logging and site preparation dates. "Cold" areas, where hazard is low due to early logging and site preparation, require no treatment. Since hazard is low, planting of "cold" areas is scheduled in the winter ahead of the more hazardous "warm" and "hot" areas, which are planted later to minimize the time the seedlings are exposed to weevil feeding.

Seedlings in "hot" areas require maximum protection so they are treated with Furadan granules or sprays of chlorpyrifos. Because of the longer residual life of these treatments, "hot" areas can be planted in February or early March. "Warm" areas are planted in March with seedlings treated by the Furadan clay slurry root dip method. Unanticipated outbreaks, resulting from adjacent logging or other disturbances, can be controlled with DURSBAN M insecticide.

Weyerhaeuser Company foresters have used these prescriptions to protect millions of seedlings in Arkansas and Oklahoma. We have developed a "dribble bar" for applying Furadan 10G as the seedlings are planted (Figure 4), and we use a conventional backpack sprayer for applying the foliar sprays of chlorpyrifos (Figure 5). The carbofuran clay slurry root dip is applied at Weyerhaeuser Company nurseries. Detailed safety precautions and periodic training sessions help prevent any accidents in handling these materials.

Treatment costs vary from less than \$1 per acre for the carbofuran clay slurry root dip to \$5-\$10 per acre for the Furadan 10G and chlorpyrifos spray techniques. All of these treatments are considerably cheaper than either replanting or losing a year's potential growth.

Summary

Proper scheduling of silvicultural activities both in time and place will help minimize the pales weevil problem in southern pine plantations (Thomas 1971). However, in areas which must be planted within a year after logging, there are three chemical treatments which will protect the seedlings. A 1% ai

TABLE 2. Results of insecticide screening trials for pales weevil control:

Location	DURSBAN® M insecticide foliar spray (2% ai)	Furadan 10G granules (1 gram ai/sdlg) ¹	Furadan clay slurry root dip (1% ai)	Check
% weevil-caused seedling mortality ²				
Arkansas:				
Crows	9.8a	13.4a	2.1a	60.5b
DeQueen	—	3.8a	35.0a	60.0b
Dierks	5.8a	13.1a	22.7b	69.1c
Hot Springs	—	21.3a	71.3b	92.5c
Howard Mt.	2.5a	16.3a	5.0a	55.0b
Puckett Hollow	2.5a	11.3a	15.0a	63.8b
North Carolina:				
Bolton	—	0.0a	—	53.3b
Burgaw	—	3.3a	34.0b	58.9c
Oklahoma:				
Eagletown	1.1a	0.0a	4.5a	37.7b
Wright City	5.0a	35.0b	45.0bc	58.8c
Overall mean	4.5	11.8	26.1	61.0

¹ 2g ai/sdlg in field tests at Crows, Dierks, and Eagletown.

² Means at each location followed by the same letter are not significantly different at the 0.05 level of probability.

TABLE 3. Strategies for reducing damage to loblolly pine seedlings by pales weevil.

Setting Classification	Logging Date	Site Prep Date	Planting Date	Treatment
Cold	Spring	Spring-Summer	Winter	None
Warm	Summer	Summer-Fall	March	1% ai Furadan clay slurry root dip
Hot	Fall	Fall	February March	1 gram ai Furadan 10G or 2% ai DURSBAN M insecticide spray
Surprise!	—	—	—	2% ai DURSBAN M insecticide spray

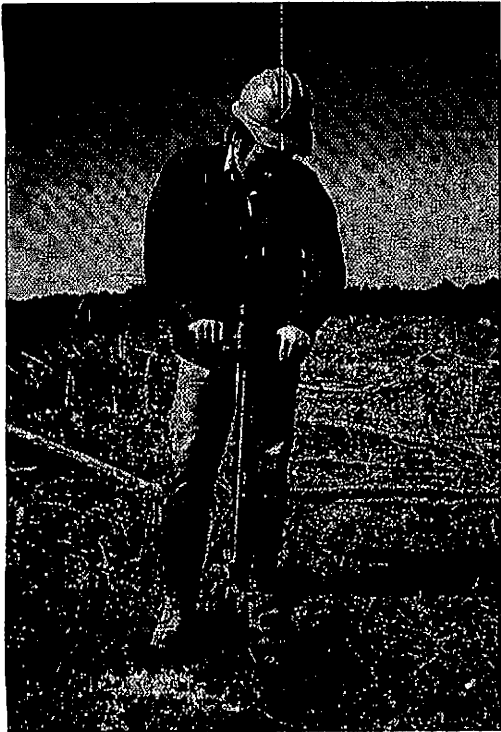


Figure 4. The "dribble bar," developed by Weyerhaeuser foresters, automatically dispenses 5-10 grams of Furadan 10G at the base of each seedling.

Figure 5. A back-pack spray is used to treat individual seedlings with 2% ai DURSBAN. (Photo by Norm Spray).



carbofuran clay slurry root dip will prevent weevil damage for two to three months after planting. If longer protection is needed, then a post-planting application of Furadan 10G (1 gram ai per seedling) or a 2% chlorpyrifos spray of DURSBAN M will suffice. Three years of experience on an operational scale indicate that these treatments are safe, effective, and economical if properly used.

Pesticide Precautionary Statement

Pesticides used improperly can be injurious to man, animals and plants. Follow the directions and heed all precautions on pesticide labels. Since registration is under constant review by the Federal Environmental Protection Agency as well as state agencies, consult County Agricultural Agents or State Extension Specialists to be sure that the uses mentioned here are currently registered.

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