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**PROTECTING PLANTS FROM WEEVIL DAMAGE BY DIPPING OR SPRAYING BEFORE PLANTING USING AQUEOUS INSECTICIDES,**  
**by Stuart Heritage.**

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### Abstract

This Note describes aspects of the use of aqueous insecticides to protect plants from damage from *Hylobius abietis* and species of *Hylastes* beetles. Methods for applying the insecticide are outlined and the active ingredients described. The need to adopt measures which protect operators and the environment is emphasised. Treating plants before planting with aqueous insecticides will reduce damage levels, but damage may still occur on sites which have very high populations of these insects.

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### Background

1. Plants used for restocking ex-conifer plantations are at considerable risk of damage from *Hylobius abietis* and species of *Hylastes* beetles. Damage levels to untreated plants vary unpredictably from site to site, with total losses occurring on some.

### Application methods

2. Treatment with insecticides before planting is currently the most reliable way of ensuring that plants are protected. Only the main stem and upper part of the root system of conifers requires protection because both *Hylobius* and *Hylastes* start their feeding at the root collar. Predicting damage levels is unreliable at present and, therefore, all plants destined for restocking sites should be treated. Dipping or spraying plants at the nursery, or other central facility is the best way to provide safe and cost-effective plant protection. The techniques can be very reliable with little dependence on high technology and capital investment.

#### *Dipping*

3. Conventionally, bare-rooted forest plants are protected by dipping their tops and root collars in a tank containing a high concentration of an insecticide product diluted with water. The main advantage is its simplicity and low technology basis. Experience over many years has shown that dipping provides protection for the first growing season for spring planted plants, provided that care is taken to ensure that the correct concentration is maintained in the dipping tank.
4. The main disadvantage of dipping is that the insecticide deposit must be dried to ensure weather fastness. This drying procedure places the plants at risk from root desiccation during the initial draining stage and involves extra plant handling when plants are temporarily heeled in to allow their tops to dry. This is necessary before the plants can be handled safely by personnel not wearing the full protective clothing necessary for dipping. A further disadvantage is that dipping by hand necessitates staff being in close contact with relatively high concentrations of insecticide and requires high standards of working practice and protective clothing. Mechanical systems for plant handling and treatment have been developed which minimise the exposure of staff to the insecticide and reduce the risk of plant damage from desiccation.

#### *Spraying*

5. Containerised plants may be treated by spraying with insecticide at the same concentration used for dipping. Small numbers of plants can be treated using knapsack spray equipment, but it is difficult to ensure an even and consistent treatment. For larger programmes, various mechanical spray systems with multiple spray nozzles have been developed to ensure a rapid and even treatment.

## Choice of insecticides

6. The use of any insecticide for the protection of plants from insect damage must be approved for this purpose by the Pesticide Safety Directorate (PSD) of the Ministry of Agriculture, Fisheries and Food under the Food and Environment Protection Act 1985 (FEPA) and Control of Pesticides Regulations 1986 (COPR). Their use and storage is governed by the 1994 Control Of Substances Hazardous to Health (COSHH) Regulations. The following insecticides are approved by PSD as pre-planting treatments (see Table 1):

Table 1. The current status of PSD approvals for the use of insecticides before planting against *Hylobius*

Method of application	Active ingredient	Products	Concentration	Approval expiry date
Dip	Permethrin	Permasect and Permit	0.8 per cent	October 2000
	Gamma HCH	Lindane 20	1.6 per cent	*Expired but applied for
	Chlorpyrifos	Dursban 4	2.4 per cent	Full approval
		Lorsban 4	2.4 per cent	Full approval
Pre-planting spray	Permethrin	Permasect and Permit	0.8 per cent	Full approval
	Chlorpyrifos	Dursban 4	2.4 per cent	Full approval
		Lorsban 4	2.4 per cent	Full approval

### *Gamma HCH*

7. This is a persistent organo-chlorine insecticide first described in 1942. The loss of this active ingredient from plants is largely through volatilisation. It was introduced for plant protection against *Hylobius* in the late 1960s as a substitute for DDT. There is no current approval for its use in dipping, but it has been included in many experiments as a known standard for comparison with other insecticides.

### *Permethrin*

8. This insecticide was one of the first synthetic pyrethroids to be developed and its insecticidal properties were described in 1973. It is a broad spectrum persistent insecticide with strong contact action. It has a slight repellent effect so that insects may avoid treated plants. Loss of permethrin from plants is mainly through oxidation and the action of UV light. Once the deposit has dried on the plants there is no detectable loss through rainfall.
9. Dipping bare-rooted stock or spraying container grown plants in 0.8% permethrin has been shown, by a range of experiments, to protect plants during the whole of the first growing season.

### *Chlorpyrifos*

10. This active ingredient was first described in 1965 and has a good contact action with reasonable persistence. It is an anticholinesterase organophosphorus compound and should not be used by anyone under medical advice not to work with such compounds. This insecticide was included in a few experiments during the late 1960s and was found to provide the same level of protection as Gamma HCH.

## Protective clothing

11. It is essential that plant treatment and planting treated plants is carried out by personnel who are fully trained and equipped with the appropriate protective clothing. There are different specifications of protective clothing required for each stage in the plant treatment and planting process (see Figures 1 & 2).
12. Clean gloves must be used at the start of each work period and replaced during use if damaged. Before removal, the outside of the gloves must be washed and surplus moisture wiped off.
13. All protective clothing must be carefully washed down at the end of each period of use and planting suits changed daily in accordance with manufacturers' instructions. Personal clothing must be kept separate from protective clothing which should be stored in ventilated accommodation.
14. Engineering controls may replace personal protective equipment if a COSHH assessment shows that they provide an equal or higher standard of protection. In addition to these requirements, it is necessary to establish a system of operator monitoring throughout the work.

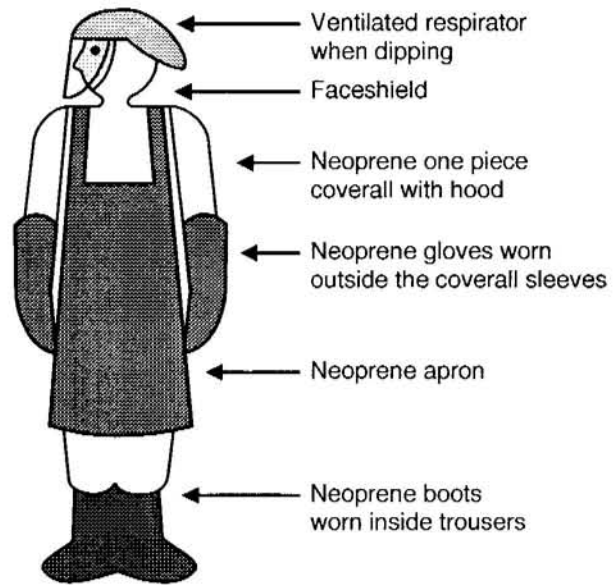


Figure 1. Protective clothing required for dipping.

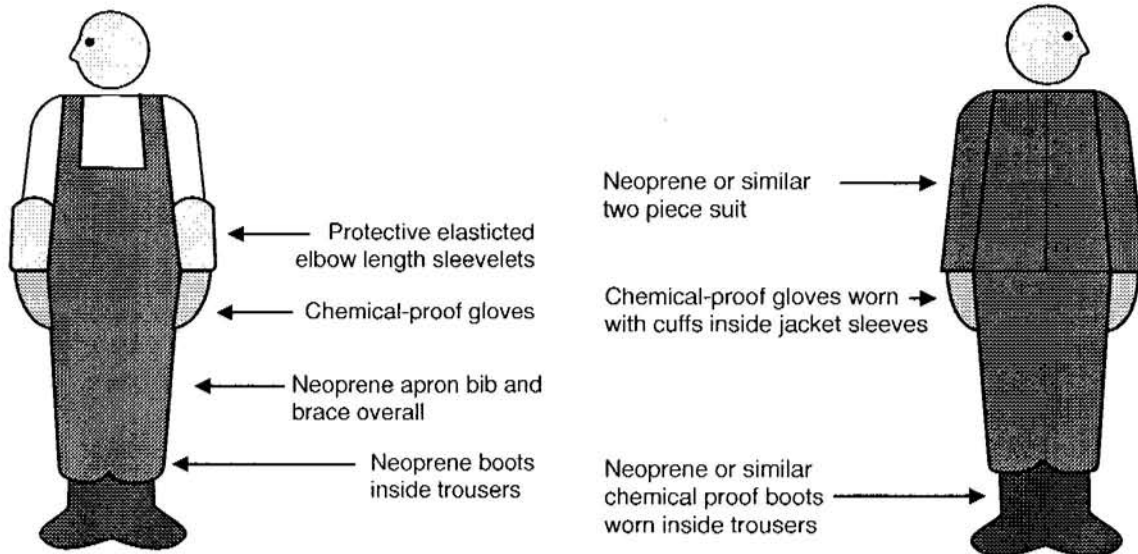


Figure 2. Choice of protective clothing necessary for planting.

## Care of the environment

15. These insecticides are non-specific and may be highly toxic to non-target organisms such as fish and bees. Great care should be taken to ensure that the risk from accidental loss during the treatment process is minimised. This may include such measures as the use of double walled dipping tanks and catchment sumps to contain any spillage. Authorised waste contractors should be used to dispose of contaminated soil and washing water. Care should be taken to ensure that treated plants or used containers do not contaminate surface water and ditches with chemical.

16. Experience of the use of insecticides applied before planting to protect plants from weevil damage has been gained through a large number of experiments and field trials. These have all demonstrated that during the first season after planting, most insecticide treatments provide some level of protection. Permethrin provides a level of protection that is equal to or greater than that provided by Gamma HCH. The level of protection increases with increasing concentration but so does the risk of phytotoxicity.

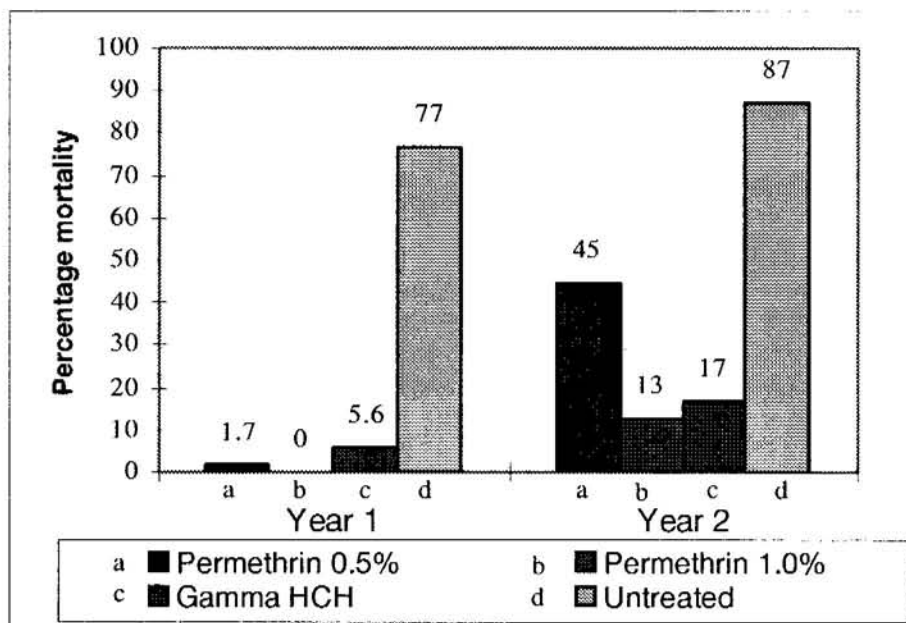


Figure 3. A comparison of plant mortality to insecticide treated plants caused by *Hylobius abietis* (data averaged from 12 experiments).

17. The phytotoxic effects of insecticides on the quality of planting stock will vary depending on the choice of chemical and formulation, the plant species and plant handling system. The plant species used in the trials varied in their susceptibility to phytotoxic effects, with Sitka spruce more vulnerable than the pine. Sitka spruce was particularly sensitive to root contamination by the recommended concentration of gamma HCH and this should be avoided during plant dipping.
18. The ideal treatment should be robust so that slight errors in making up the solution will not result in inadequate protection nor plant death from phytotoxicity. The choice will inevitably be a compromise between achieving the highest possible level of protection whilst minimising the risk of phytotoxicity. The impact of plant treatment will be reduced by applying the least phytotoxic product to high quality planting stock, using the method which minimises plant handling and storage.
19. An application of permethrin at 0.8% (a.i.) should provide an adequate level of protection during the first season after planting and minimise the risk of phytotoxic effects. None of the treatments provides assurance of protection in the second season after planting. Therefore, where weevil populations are high, it is recommended that a top up spray be applied at the start of the second growing season.

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