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FOMES STUMP TREATMENT – AN UPDATE, by J. E. Pratt

Summary

Future changes in the substances used for stump treatment against *Heterobasidion annosum* in Britain are reviewed.

Introduction

1. It is probable that during the next few years changes will be made to the current recommendations for stump treatment against Fomes root and butt rot caused by the fungus *Heterobasidion annosum*. The Forestry Commission is seeking approval from the Pesticides Safety Directorate (PSD) for two stump treatment materials, namely PG Suspension, and disodium octaborate tetrahydrate (DOT). The need for approval of the former has arisen from recent changes in the formulation and the application of the product (the fungus *Peniophora gigantea*) as well as in the legislation, whilst use of the latter will provide an improvement on the current material, urea. It is hoped that approval for PG Suspension will be obtained within two years, and that recommendations for DOT will be made within the same period.

PG Suspension

2. PG Suspension is a biological control agent formulated from the spores of a naturally-occurring wood-rotting fungus, *Peniophora gigantea*. This non-pathogenic fungus is widely distributed among the temperate conifer forests of the Northern Hemisphere, and has also been recorded in Australasia, South America and North Africa.

3. The ability of *P.gigantea* to prevent infection of pine stumps by the pathogenic fungus *Heterobasidion annosum* was discovered in the 1950s by the late Dr John Rishbeth of Cambridge University. With his research associates, Rishbeth undertook experiments on the interrelationship of these two fungi, to evaluate what ultimately became the world's first commercially-available biological control treatment for a plant pathogen. The early methods that were developed for producing *P.gigantea* for commercial use appear crude now: the fungus was grown in the laboratory on agar gel or on wood blocks from which the spores were scraped and added to water in the forest. The resulting spore suspension was applied to stumps with a brush.

4. In 1970, Eric Tridgell, of Ecological Laboratories Ltd., developed the product in use today: spores are mixed into a viscous sucrose medium and are packaged into hermetically-sealed PVC sachets. At the start of a working day, the sachet contents are squeezed into water to make the working solution. Each new batch produced by Ecological Laboratories is tested by the Forestry Commission to ensure that it contains adequate numbers of viable spores. Successful trials in Thetford Chase have led to the regular use of PG Suspension in some types of harvesting machine. To accommodate the larger volumes of treatment solutions needed, the capacity of sachets has recently been increased from 1ml to 10ml.

5. Because of these changes in application technique and in sachet size, and because of recent legislation, it has become necessary to obtain full approval for PG Suspension for use as a pesticide. An application for approval was lodged by the Forestry Commission early in March 1996. PG Suspension will be considered by PSD in the same way as any other novel pesticide, and a decision is expected within 18 months. During this period, arrangements have been made which allow us to continue to monitor its effectiveness in harvesting machines. For administrative reasons, however, its use is confined to the Forestry Commission, within Thetford Chase.

Disodium octaborate

6. The only chemical that has approval for stump treatment in Britain is urea. Although this material provides adequate control of Fomes when applied at high dose rates (37% w/v, to point of run-off), there is now evidence that it may fail under some circumstances, for example where coverage of the stump is incomplete or if stumps are very wet. In addition to these drawbacks, urea is highly corrosive of mild steel, and when temperatures are abnormally high or low it readily crystallises and may block nozzles and delivery pipes on harvesters. Finally, urea is a nitrogenous fertilizer, and there are concerns in some nitrate-sensitive water catchments over its continued use.

7. An alternative to urea is the borate salt disodium octaborate tetrahydrate (DOT). Borates are naturally-occurring minerals, and are essential plant and mammalian micro-nutrients. They are widely used in industrial and domestic products, including glass-fibre and washing powders, and as a consequence a large body of ecotoxicological data has been assembled for them. With a few exceptions, they are not recognised as hazardous materials. Borates have had an excellent record as fungicides in wood preservatives since the last war: it was this attribute that led to the selection of DOT for stump treatment. In Britain, when the toxic substance sodium nitrite was the preferred stump-treatment chemical, DOT was recommended as an alternative for use in woodland with water catchments or where livestock were free to roam. In the USA, the related product Borax was chosen, and is applied to stumps in a powder form. The background to these treatments has recently been reviewed (Pratt, 1996).

8. DOT is a manufactured borate (technically it is a solid solution of borax in boric acid), and has high solubility. Recent trials in Britain have shown that its efficacy as a stump treatment depends on the dose applied so that application of DOT above 50 g m^{-2} completely prevented stump infection by *H.annosum*, whereas lower application rates did not. At the lowest application rate (15g m^{-2}) colonisation by *H.annosum* was similar to that in untreated stumps.

9. It is now clear that the logistics of supply comprise a great part of the cost of mechanical stump treatment. Reducing the volumes of liquid is one effective way of reducing costs, and this may be possible with DOT by increasing its concentration. An acceptable dose rate of between 30 and 50g DOT m^{-2} is indicated, and trials to determine the optimum combination of DOT concentration and application rate to achieve these dose rates are currently being planned. Because of the insolubility of DOT at low temperatures, methods of maintaining DOT in solution or in suspension in harvester tanks at high concentration will be studied.

10. Although borates have low mammalian toxicity (LD_{50} >3000 mg per kg of body-weight), limits have been set for their concentration in drinking water of 2 mg boron per litre. Borates are soluble and mobile in most forest soils, especially in areas with high rainfall. However, an experimental study using harvester-applied DOT in a 31 ha clear-fell in Loch Awe Forest, west Scotland showed that the concentration of boron in water draining from the site never exceeded 1/10th of the prescribed upper limit, and returned to pre-treatment ambient levels within 6 months of the end of treatment (Pratt *et al.*, 1996).

11. An application for approval of DOT for stump treatment was lodged at PSD by the Forestry Commission early in 1995, and a decision is expected in 1997.

The situation abroad

12. Overseas, several factors are acting together to change the attitude towards stump treatment, most notably in Scandinavia where an increasing risk of Fomes has been recognised. The result is that the forest industry of the Nordic countries is beginning to invest heavily in stump treatment systems, based on both biological and chemical agents. FC researchers are actively involved in this European initiative.

References

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