CARBONYL SULFIDE – A POTENTIAL FUMIGANT FOR EXPORT HAY

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The disinfestation of export hay to meet the phytosanitary requirements of importing countries accounts for a growing amount of methyl bromide used for fumigation treatments in Australia. In the year 2000, 45 tonnes of methyl bromide was used to disinfest hay for export and this amount is expected to double during the current year. Alternatives currently available (phosphine and carbon dioxide) require long exposure times (7 days and 15 days respectively) and ambient temperature above 15°C. These two factors make the alternatives unacceptable to this growing industry.

Carbonyl sulfide (COS) has been studied extensively for its insecticidal properties on common stored product insects (Desmarchelier 1994, Zettler *et al* 1997). Of these insects, *Sitophilus oryzae* (and in particular the eggs of this species) is naturally the most tolerant and in depth studies have been conducted on this species (Weller 20001).

Based on the *Sitophilus* model, a maximum dose of 60 gm^{-3} for 48 hours was suggested for hay for temperatures above 15°C. At temperatures below 15°C the duration of the fumigation would need to be extended. However, as it is unlikely that *Sitophilus* eggs will be present in export hay (lucerne or straw), lower dosages and/or shorter fumigations may be found to be acceptable.

Fumigation of hay (oaten straw) was undertaken in a 2.5L gas tight chamber with a filling ratio of 40% at 25°C. COS was applied at the rate of 60gm^{-3} calculated on the volume of the empty vessel that resulted in an initial concentration of 64.5 g m^{-3}. After 48 hours the concentration of COS in the headspace had fallen to 56.1 g m^{-3}. This loss of COS in the headspace was less than 15%, compared to a loss for methyl bromide of >50% under the same conditions.

Desorption of COS from hay was rapid. Within 24 hours of passive aeration, the equilibrium concentration established from aired hay enclosed in a fresh gas tight vessel (at a fill rate of 40%) was <10ppm (v/v), the Australian experimental TLV for COS.

COS residues were analysed by the microwave irradiation method (Ren and Desmarchelier, 1998). These results showed that after 48 hours of passive aeration, residues of COS were indistinguishable from natural levels.

From these results, it appears that COS may offer an alternative to methyl bromide for the fumigation of export hay that is more acceptable to the industry than either phosphine or carbon dioxide treatments. Further work is planned to undertake large scale field trials that concentrate on issues concerning gas distribution, sorption, residues and efficacy against the target pests.

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