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REPLACEMENTS AND ALTERNATIVES FOR METHYL BROMIDE ~~1963-64~~: AN INTERIM REPORT OF WORK UNDERTAKEN IN AUSTRALIA BY THE STORED GRAIN RESEARCH LABORATORY.

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This paper reports on two aspects of research concerning methyl bromide with which the Stored Grain Research Laboratory is involved. Firstly, development of the new fumigant carbonyl sulphide (COS) as a replacement for methyl bromide, and secondly; efforts to reduce methyl bromide emissions by identifying and introducing alternative treatments in situations where this fumigant has been entrenched as the "traditional" means of disinfestation.

In the early 1970s most grain in the northern wheat belt of Australia, especially in Queensland, was fumigated with methyl bromide. This usage declined dramatically because of the better application of grain protectants, increasing use of phosphine, and the improved use of aeration in an integrated commodity management program. The Australian grain industry has had a policy, for over 20 years, of only using methyl bromide in sealed silos with recirculation facilities. This policy plus the successful use of alternatives greatly reduced methyl bromide emissions, even before the problem of ozone depletion was recognised.

1 Studies on carbonyl sulphide

The effect of COS on the quality of a number of commodities including, malting barley, wheat (hard, soft, noodle and ASW grades), sultanas, chickpeas and canola has been investigated. With barley there was no significant loss of malting in grain at 10% moisture content. Similarly, no significant effects have been observed on wheat or flour properties apart from marginal effects on dough properties, and no foreign odour was detected in the wheats, flours or products made from them. The work on canola and chickpeas has not yet been completed but little or no sorption occurred during 24 hour exposures and there was no detectable odour after 24 hours airing. Sultanas fumigated with COS were assessed for quality by taste, odour and colour change. Colour changes were not significant. However, fumigated fruit had a distinctive odour, which reduced over time.

Sorption of COS by wheat has been studied with the detection of very low levels of possibly naturally occurring COS in untreated controls. As concentrations of COS in fumigated wheat decline, it becomes very difficult to distinguish it from untreated wheat. In a comparative study on the effect of COS and hydrogen cyanide (HCN) on germination and plumule length of wheat there are indicates that COS can be used to control insect infestation in wheat without affecting seed viability or plumule length.

2 Alternative Treatments to replace methyl bromide

Methyl bromide currently provides the main means for disinfestation of timber imported into Australia, with mandatory high dosages required. Approximately 150 tonnes of this fumigant are used annually for this purpose. Research is underway seeking replacements for methyl bromide in this application. Laboratory studies have commenced to investigate the behaviour of fumigants applied to timber, its products and insect pests.

Methods previously used to determine diffusion, sorption/desorption and penetration of fumigants into timber have been assessed. A more accurate method has been devised. Initial results indicate that COS is less strongly sorbed by, and penetrates timber more rapidly than methyl bromide. A comparative study is currently underway.

The insecticidal effect of thermal regimes attained during kilning of tropical hardwoods will be investigated to rationalise requirements for heat treatments established by the Australian Quarantine Inspection Service. It is anticipated that this will reduce the need to fumigate some timber imported into Australia.

The Australian cut flower trade is subject to losses when insects are detected in overseas markets. The industry is heavily reliant on methyl bromide to control insect pests prior to export. Laboratory studies are underway to identify alternate fumigants and study fumigant sorption by flowers.

The toxicity and sorption of fumigants, including COS and methyl isothiocyanate, in soil is being studied. The potential for *Brassica* species as 'biofumigants' to reduce the need for soil fumigation with methyl bromide is being investigated[3,4]. *Brassicas* are known to release isothiocyanates when they break down in the soil and research is underway to investigate the processes involved.

The Laboratory has taken, or joined in, initiatives to terminate unnecessary use of methyl bromide in situations where it clearly plays no role, e.g. in exports of wheat to prevent transmission of ticks. We have also undertaken fumigation trials with low oxygen atmospheres to eliminate rodents in freight shipments to ecologically sensitive areas to protect native fauna.

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