FUMIGATION OF BULK STORED WHEAT WITH CARBONYL SULFIDE

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CSIRO Entomology, and it collaborators, have undertaken a progressive series of trials to determine the suitability and efficacy of carbonyl sulfide (COS) when applied to a range of grains and legumes stored in bulks of varying sizes.

The work reported here covers the treatment of 2,500 tonnes of wheat (Australian Standard White) stored in a concrete silo. In this trial COS was applied as liquid, from the top of the silo, and released 2 m below the grain surface. A phosphine recirulation system (0.4 Kw fan) installed in the bin was used to distribute the gas throughout the grain bulk. Equilibrium (variation < 5%) was achieved within two hours. In-bin COS concentrations over the two day exposure period averaged 29 gm^{-3} (range 28-30 gm^{-3}).

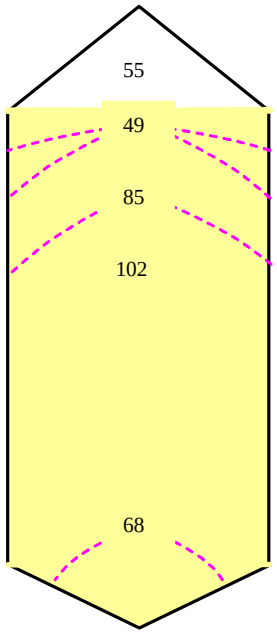
At the end of the exposure period, the grain was ventilated overnight using the installed aeration system (2.5 Kw fan) installed in the bin. The following morning, in-bin COS concentrations had fallen below 4 ppm, which is 2.5 times lower than the 10 ppm Australian Experimental Threshold Limit Value.

The decline of in-grain COS residues was monitored throughout the ventilation process. When this was stopped, in-grain COS residues were found to have fallen below the 0.2 mg kg^{-1} Australian Experimental Maximum Residue Limit.

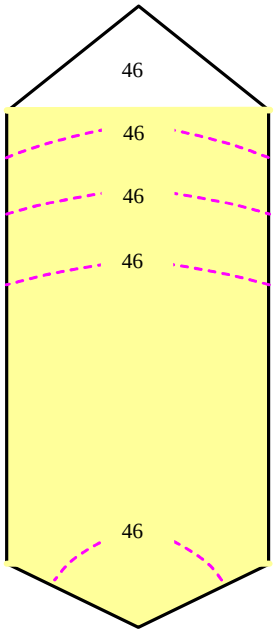
Workspace and environmental levels of COS were monitored throughout the fumigant application process, the exposure and ventilation periods, and during outloading. It was found that the levels of COS and H_2S present during these stages of the fumigation process were below 0.1, which is 100 times lower than the 10 ppm Threshold Limit Value.

The 1,900 g h m^{-3} Ct product obtained for COS when the exposure was terminated, was sufficient to kill all life stages of a natural infestation of *Tribolium* and *Sitophilus* spp, as well as mixed age bio-assay insect cultures consisting of *Rhyzopertha dominica, Sitophilus oryzae, Tribolium castaneum,* and *Trogoderma variabilis.*

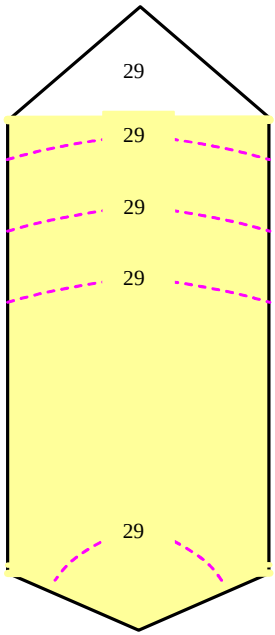
The effect of this treatment regime on grain quality was evaluated. It was found (i) that COS had no effect on germination of wheat seed and seed colour and (ii) COS did not affect total lipid content or lipid colour.



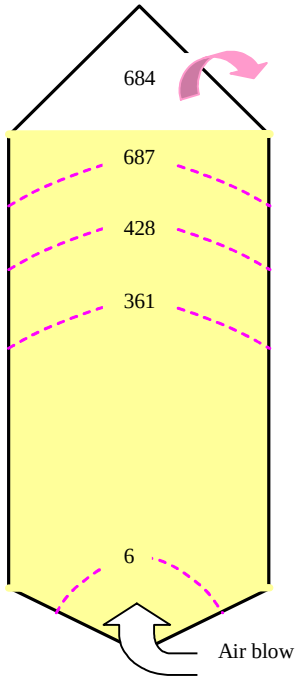
At 1 hour after application



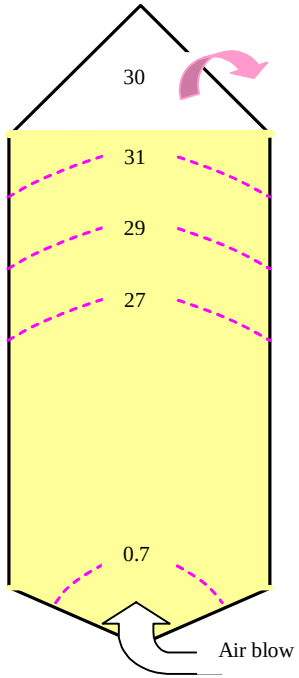
At 3 hours after application



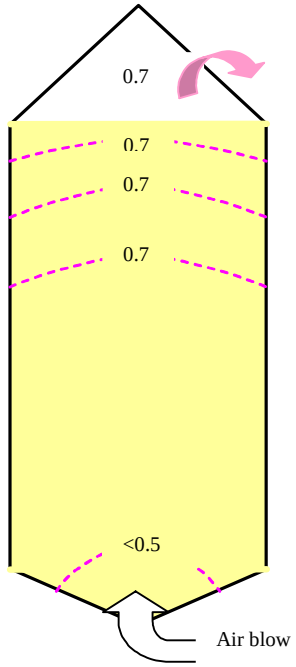
At 47 hours after application



At 1 hour after aeration



At 4 hours after aeration



At 18 hours after aeration