Title Fumigation trial on direct application of liquid carbonyl sulphide to wheat in a 2500 t concrete silo

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Citation Journal of Stored Products Research, Volume 44, Issue 2, 2008, Pages 115-125

Keywords Fumigant; Fumigation; Carbonyl sulphide; Wheat; Insect; Grain storage; Residue

Abstract

Wheat (Australian Standard White) with a moisture content of 10.2% was fumigated with carbonyl sulphide (COS) at a calculated application rate of 24.14 g m^{-3}, in a sealed concrete vertical silo (3512 m^3, 2500 t wheat) located at Nevertire, NSW, Australia. The COS was applied as a liquid via the top of the silo and released 2 m below the grain surface. The application of 84.5 kg of COS was completed within 30 min. With 2 h of recirculation using a 0.4 kW fan, the in-silo concentrations of COS achieved equilibrium with a concentration variation less than 5% of the mean. After a two-day exposure period, the COS concentration in the silo remained at 29 g m^{-3}. The concentration×time product (*Ct*) was then 1900 g h m^{-3}, and this achieved complete kill of all life stages of mixed-age cultures of *Sitophilus oryzae*, *Rhyzopertha dominica*, *Tribolium castaneum* and *Trogoderma variabile*. After 2-days exposure, the silo was aired overnight with an aeration fan (25 kW) resulting in a COS in-silo concentration of below 4 ppm. This is 2.5 times lower than the Australian Experimental Threshold Limit Value (TLV) of 10 ppm. Residues of COS in the wheat declined to below the Australian Experimental Maximum Residue Limit (MRL) of 0.2 mg kg^{-1} after overnight aeration. The COS was not detected in any outloading samples at concentrations above the detection limit (0.05 mg kg^{-1}). The workspace and environmental levels of COS were monitored during application, fumigation, aeration and outloading. The levels of COS and hydrogen sulphide (H_2S) were less than the detection limit of 0.1 ppm, which was 100 times lower than the TLV of 10 ppm. The treatment with COS had no affect on the wheat germination and seed colour when compared with untreated controls. Oil quality tests showed that COS had no effect on total lipid (made from treated wheat) content or the lipid colour.