

Title Phosphine fumigation of silo bags
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Abstract

Fumigation with phosphine has the potential to disinfest grain stored in silo bags but only limited research has been conducted on whether phosphine fumigation can be undertaken effectively and safely in this form of storage. Fumigation with phosphine was tested on two (70 m) replicate silo bags each containing 240 t of wheat (9.9 and 9.2% m.c.). The target application rate of phosphine was 1.5 g m^{-3} with a fumigation period of 17 days. Aluminium phosphide tablets were inserted into each bag at ten release points spaced at 7 m intervals starting 3.5 m from either end of the bag. A total of 14 bioassay cages containing mixed age populations of strongly phosphine resistant *Rhyzopertha dominica* (F.) were inserted into each fumigated silo bag. Complete control of all life stages of *R. dominica* was achieved at all locations in the fumigated silo bags. Phosphine concentrations at release points increased rapidly and remained high for the duration of the fumigation. Concentrations at midway points were always lower than at the release points but exceeded 215 ppm for ten days. The diffusion coefficient of available phosphine averaged over the first three full days of the fumigation for both fumigated silo bags was 2.8×10^{-7} . Venting the silo bag with an aeration fan reduced the phosphine concentration by 99% after 12 h. Relatively small amounts of phosphine continued to desorb after the venting period. Although grain temperature at the core of the silo bags remained stable at 29 °C for 17 days, grain at the surface of the silo bags fluctuated daily with a mean of 29 °C. The results demonstrate that silo bags can be fumigated with phosphine for complete control of infestations of strongly phosphine resistant *R. dominica* and potentially other species.