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Phosphine distribution patterns during fumigation in temporarily-sealed steel silos

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ABSTRACT

Phosphine is used extensively as a fumigant for controlling insects in stored grain. Effective application of the phosphine can be hampered by poor distribution of the gas. Leaks in the enclosure, foreign material in the grain, and improper placement can cause areas of insufficient phosphine concentration, allowing insects to survive and leading to phosphine-resistant insect populations. Phosphine concentrations were evaluated during field tests in temporarily sealed silos to compare distribution from application with conventional probing of aluminum phosphide tablets to the distribution from application with a closed-loop recirculation system. Constant pressure tests were performed on the silos prior to fumigation to assess leakage of the silo envelope. Large differences were observed between phosphine concentration patterns for the two application methods. Application with conventional probed tablets resulted in uneven distribution patterns as well as leakage over time, leading to many areas in the lower half of the grain mass remaining below the target phosphine concentration for the entire period of fumigation. Application with the closed-loop system using the same phosphine dosage yielded more uniform phosphine concentrations but there were equal or greater phosphine losses from leakage. These results highlight the need for even gas distribution from the phosphine application system and to exercise care to temporarily seal silos adequately to prevent excess leakage.

Keywords: Phosphine, AIP tablets, CLF, leakage, Constant pressure test