Title A novel use of modified atmospheres: Storage insect population control

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Abstract

The research described here aimed to establish the feasibility of using modified atmospheres (MA) to protect commodities throughout their storage life by using oxygen (O_2) levels that disrupt the life cycles of the target beetle species. Rather than achieving complete mortality of all stages, the aim was to identify more easily obtainable MAs that would kill the most susceptible stage and prevent population growth. Simulated burner gas and nitrogen (N_2) atmospheres with O_2 contents between 3% and 6%, were tested, along with a N_2-based MA with elevated carbon dioxide (CO_2) (10–20%).

Laboratory tests were carried out on five species of stored-product beetles, *Cryptolestes ferrugineus*, *Oryzaephilus surinamensis*, *Sitophilus granarius*, *S. oryzae* and *Tribolium castaneum*. After exposure to the MAs for 28 d an assessment was made of the mortality of adults, the number of adults from progeny produced under the MAs and, for the simulated burner gas, the number of adults from progeny produced in a 28-d period after exposure to the MA. The tests were carried out at 20 and 25 °C with 75% and 85% r.h. at each temperature.

The O_2 content preventing population growth varied with species and temperature. For simulated burner gas or N_2 it was about 4% for *O. surinamensis*, *S. granarius* and *S. oryzae*, and about 3% for *C. ferrugineus* and *T. castaneum* at 25 °C. At 20 °C it was about 3% for all species tested. When CO_2 was increased to 10% or 20%, reducing O_2 to 5% was sufficient to eliminate emergence of *S. granarius* at 20°C, but a few individuals emerged at 25 °C. For *C. ferrugineus* there was a 95% reduction with 5% O_2 plus 20% CO_2 at 20 °C, but not at 25 °C.