

Using meta-analysis to analyze efficacy data from multiple mill studies

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Abstract

It is difficult to evaluate the efficacy of structural treatments such as fumigation when applied in commercial food facilities such as wheat and rice mills. This is due in part to the considerable variation among facilities and within a facility over time in factors such as pest population size and distribution when treatment was applied, environmental conditions, and facility characteristics. To accurately determine treatment efficacy and the level of variation in efficacy it is important to evaluate a large number of treatments applied at different times and at different locations. This is especially important when making comparisons among alternative treatments: for example, comparing sulfuryl fluoride fumigation, methyl bromide fumigation, and heat treatments. Large datasets also enable the impact of covariates such as pest population size, temperature, and season on efficacy to be evaluated. We have accumulated a large dataset of more than 100 structural treatments from multiple facilities (from data we have collected and from the literature) and have used meta-analysis and other statistical methods to evaluate the impact of structural treatments on red flour beetle (*Tribolium castaneum*) captures in traps and the rate at which beetle captures rebound following treatment. This analysis enables alternative treatments to be compared and factors associated with higher efficacy to be identified. This data also provides important insights into the population trends of red flour beetles in mills that are useful for the development of monitoring thresholds.

Keywords: fumigation, *Tribolium castaneum*, flour mill, rice mill, efficacy