

Title Two decades of monitoring and managing phosphine resistance in Australia.
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Abstract

The Australian grain industry relies heavily on phosphine to meet domestic and international market demand for high-quality grain, free of insects. Phosphine usage has increased markedly over the past 10 years, because of market reluctance to accept chemical residues and resistance in target pests to grain protectants. The threat that insects may also develop resistance to phosphine led to resistance-monitoring projects being initiated across all cereal-growing regions of Australia. The rationale was that the industry needed to be proactive in developing strategies to combat resistance when it evolved, and required early warning of the development of resistance and a scientific assessment of its likely impact. With industry support, these projects have now amalgamated to form a national phosphine resistance monitoring and management programme. Insect population samples are collected from farms, grain merchants, mills and central storages, and tested for resistance. If the resistance is classified as significant, then action is taken to eradicate or control the strain and, where feasible, to prevent its further distribution. In addition, research is undertaken to fully characterize the resistance and to develop control options such as changes to fumigation concentrations and exposure periods. Although the three collaborating laboratories are widely spaced geographically, they maintain close links through data sharing on an Internet-accessible database. They share a common procedures manual, and the groups independently confirm diagnoses of significant resistance made in other laboratories. They also hold regular national workshops to benchmark their suite of bioassays and other techniques and report at least annually to the industry through various forums. The Australian approach is unique in that it has drawn together primary producers, bulk handlers, chemical companies, industry funding organizations and government research institutions from across the country to combat the national threat of phosphine resistance.