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Managing genetic resistance to phosphine in stored grain pests: an integrated strategy ensuring grain biosecurity and market access

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ABSTRACT

Pressure from insect infestation is so high that storage managers are forced to rely on chemical treatments, particularly the fumigant, phosphine (PH₃). The latter is a unique material and is favoured for several operational reasons and its acceptance as residue-free treatment in international markets. The development of resistance to phosphine, however, seriously jeopardises grain trade for Australia and food security in India. Two multi-faceted collaborative research projects on grain storage conducted in India and Australia over the last eight years (2012-2020) enhanced our scientific understanding, providing a basis for developing and implementing an integrated pest and resistance management approach (IPRM) in each country. The backbone of the Australian IPRM module is implementing improved pest and resistance monitoring programs (phenotypic and molecular), followed by adopting two major pest intervention strategies: (1) non-chemical (hygiene, aeration and grain cooling, and mass trapping) and (2) chemical (structural treatments, grain protectants, and fumigants). Successful adoption of selective combination these strategies facilitated managing Australian grain industry's most challenging pest, rusty grain beetle, *Cryptolestes ferrugineus* (Stephens). Though, developing a similar IPRM program is difficult for India, our research identified the need for implementing the following: (i) improved fumigation methods for bag-stacks, (ii) new prophylactic treatments, (iii) transitioning into modern storages, and (iv) reducing losses in grain transports. The project also emphasized the need for outreach of the findings to the end-users in India, through a national alliance currently functioning in Australia for its perpetuity. Based on this, our team is developing an effective IPRM module for India, which can be selectively adopted in other countries, facilitating global food security and market access.

Keywords: Stored grains, Fumigants, Grain protectants, Resistance, Management