



# SEARCH CONTINUES FOR PHOSPHINE ALTERNATIVES

By Catherine Norwood

IT SEEMS UNLIKELY there will be a single solution to replace the highly effective phosphine. Rather, a suite of alternatives will be required, applied with tactical precision to extend the life of phosphine and maintain Australia's export commitment of nil live insects in grain shipments. Nitrogen seems likely to play a major role as a phosphine alternative, with field trials at bulk storages and on-farm underway this year (see page 3). Another controlled-atmosphere strategy being investigated is the use of ozone.

## OZONE APPROACH

As with nitrogen, ozone – or  $O_3$  (as compared to oxygen gas  $O_2$ ) – has been recognised for decades as an effective way to kill stored-grain insects. Although Murdoch University's Professor YongLin Ren, who leads several phosphine-alternative research projects for the Plant Biosecurity Cooperative Research Centre (CRC), says the technology is not new. Technical advances mean it could be an accessible and viable treatment.

The ozone research is being undertaken through the Plant Biosecurity CRC's partner Kansas State University in the US.

When  $O_3$  is applied at a rate of 200 parts per million in laboratory trials, it kills all stages of strongly resistant stored-grain insects within two days.

Professor Ren says field trials using  $O_3$

as a treatment in small-scale farm storages are likely to be held within the next six months. Other trials are planned to evaluate ozone in combination with nitrogen.

## SULFURYL FLUORIDE

GRDC-supported research through the Plant Biosecurity CRC and led by Associate Professor Paul Ebert at the University of Queensland is focusing on the synergistic or additive effects of various chemical combinations.

Sulfuryl fluoride is an alternative that provides a resistance-breaker effect in the bulk-grain-handling system for the treatment of strongly resistant rusty grain beetles (*Cryptolestes ferrugineus*). However, it is more expensive than phosphine and has restrictions on its use to prevent residue issues. Professor Ebert says the combination of phosphine and sulfuryl fluoride is showing promise as a way to control insects in a suitable timeframe at reduced cost. He says 100 per cent control of all life stages of rusty grain beetle has been achieved with one-third of the concentration of phosphine combined with half the dose of sulfuryl fluoride needed when either is used alone.

A sublethal dose of the botanical pesticide dimethyl disulphide (DMDS) makes phosphine 10 times more effective against strongly resistant lesser grain borer.

Several other gases and volatile compounds that enhance the activity of

phosphine in a variety of ways are also being investigated. Victorian researcher Dr Ross Mann is examining the potential of volatiles from fungi as part of the Plant Biosecurity CRC work. Endophytic fungi live symbiotically with their host plants and emit volatiles to protect the plants from insect pests. Strains of fungi have been identified that produce volatile chemicals capable of killing the lesser grain borer, red flour beetle and rusty grain beetle.

## SILICA POTENTIAL

The Plant Biosecurity CRC is investigating silica as a contact protectant for stored-grain insect control. Several synthetic silica compounds are being assessed and initial laboratory trials have identified compounds that provide strong control against key grain pests within 10 days. Field validation is now underway, with results showing possible competitive advantages for the silica compounds in price and efficacy.

The Plant Biosecurity CRC is also working on two possible market opportunities. One is the use of silica compounds as an admixture in grain flows. The other is as a structural treatment where the silica product acts as a barrier to insect movement when applied to both external and internal surfaces of structures used for the bulk storage of grains. □

### GRDC Research Code NPB00013

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“This allows the researchers, as well as the end users of the research, to see how different strategies or technologies interact with other activities and to identify any barriers to adoption, such as time or cost.”

## BULK-HANDLER

GrainCorp grain protection manager Robin Reid says the bulk-handler has been involved in trials to assess the impact of phosphine and sulfuryl fluoride when applied at different concentrations and over different fumigation periods as part of the industry impact work.

“If the grains industry is to maintain the use of phosphine, we need to look for alternative products and think carefully about the destination of grain to ensure delivery into markets is below the maximum residue limits,” he says.

“It's important to support this research, as the industry relies on scientific data for

products to be registered and accepted in the marketplace. Without research which responds to challenges facing the industry we would run out of pest-control options.”

## GROWERS

Growers involved in the Mingenew–Irwin industry impact site are accessing research tailored to their challenges, such as managing residue and resistance.

MIG executive officer Sheila Charlesworth says the benefits to growers from participating in an impact site are enormous.

“It ensures the end users of research can play a part in how this research is delivered, for maximum impact on-farm. Our growers are experiencing the research outcomes firsthand,” Mrs Charlesworth says. “It has also given our growers access to the Plant Biosecurity

Five sites are assessing how research outcomes fit together in the day-to-day operations on-farm, at ports and in bulk-handling facilities.

CRC's extensive collaborative network of researchers and organisations around Australia and overseas.

“As a result of this research, we are seeing growers extend power to their storage sites for aeration and show increasing interest in alternative non-chemical pest-control products such as nitrogen.” □

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