Sealed silos 'the only way to go'

SILOS NOT ONLY NEED TO BE SEALED, BUT DEMONSTRABLY SO, SAYS KEN BULLEN

MAINTAINING A HIGH concentration of phosphine over time is the trick to killing all grain insects and a successful fumigation.

Recent farm trials have confirmed the importance of sealed silos in getting a commercially worthwhile result from phosphine fumigation. Fumigation trials at Petersen Farms, Killarney, Queensland, showed clearly that even in well-built, modern farm silos, unless the silo is sealed to industry standards, distribution of phosphine gas throughout the silo is insufficient to kill insect infestations.

Queensland Department of Primary Industries and Fisheries (QDPI&F) researchers Greg Daglish and Philip Burrill, who set up the Killarney trials, report that after pressure-testing to check the effectiveness of seals, they monitored phosphine gas concentrations at various depths within the stored grain using portable phosphine monitors. They were then able to trace the evenness of phosphine distribution throughout the grain.

All sealed silos must be fitted with a pressure relief valve to allow the enclosed silo atmosphere to expand or contract as the silo is warmed or cooled throughout the day.

Without this pressure relief valve, sealed silos would explode or implode. Greg Daglish explains the procedure: "We first pressurised the silo using the aeration fan. The pressure relief valve contains a mineral oil through which expanding or contracting air can bubble out of or into the silo. The aeration fan produces a positive internal pressure inside the silo, causing a difference in oil levels in the valve.

"We use a stopwatch to measure the time taken for the oil level to move from 25 millimetres to 12mm apart. The industry standard (pressure half-life) for fully loaded sealed silos is a minimum of three minutes."

Greg adds: "With a pressure half-life of three minutes, we were able to obtain both the required lethal gas concentration and maintain that concentration for the required time period.

"When we backed-off the cams which seal the chute at the silo base and loosened top-hatch spring seals, and loosened the top hatch, we were unable to detect phosphine gas at the silo base (see figure 2).

"The pressure half-life with the silo in this unsealed condition was only eight seconds. This is a good example of a poorly-maintained sealed silo with damaged seals top and bottom.

"Phosphine fumigation aims to rid grain of insect pests. The label requires that lethal phosphine concentrations must be maintained for at least seven days with grain temperature above 25°C."

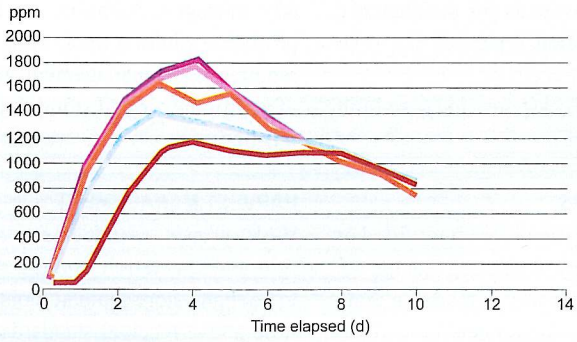
Greg says growers should seriously consider investing in aeratable sealed storages. Aeration not only helps to manage grain temperature and moisture, but allows forced-air ventilation of fumigated grain before it is safely shipped. For grain temperatures less than 25°C, a fumigation time of 10 days is necessary.

The fumigation time is measured from the time phosphine reaches all parts of the silo – usually starting about three days after dosing the silo with tablets.

Rod and Judy Petersen and their sons Scott and Wayne have about 1200 tonnes of grain storage capacity. About five years ago, Scott and Wayne installed two new sealed, aerated 130-tonne silos.

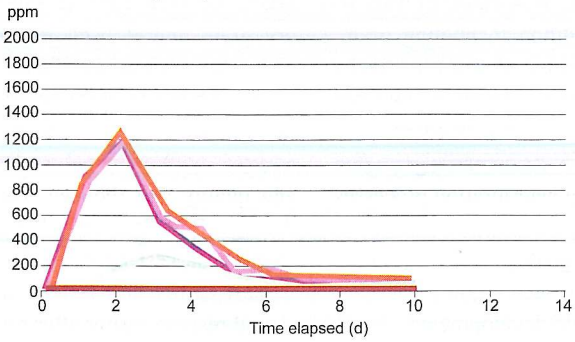
Rod says: "Our insect control measures had been failing, costing us time and money. Now we have largely eliminated the use of protectants which gives us market flexibility. Additionally, our phosphine fumigations are now doing the job much better since sealing."

Figure 1 Phosphine concentration in a sealed silo – adequate pressure test (pressure half-life of 210 seconds).



Petersen - Silo B - Trial 1 - wheat - 210s half-life

Figure 2 Phosphine concentration in an identical sealable silo purposely left unsealed, top and bottom. Inadequate pressure test (pressure half-life eight seconds only).



Petersen - Silo A - Trial 1 - wheat - 8s half-life (full cloud)

0.7m 1.8m 2.8m 4.8m 6.8m

This simple experiment by DPI&F researchers at Petersen Farms clearly demonstrates (figure 1) that a properly maintained sealed silo held phosphine gas concentrations over 200ppm for 10 days, the required minimum time in all parts of the silo – even near the silo base (6.8m depth in grain). When a neighbouring identical sealable silo was left unsealed (figure 2) to emulate a standard unsealed silo, phosphine gas concentrations reached 300 ppm only for four days and only in the topmost levels of the silo. Phosphine gas concentration and exposure time were insufficient to kill insects anywhere in this silo. These identical silos were treated simultaneously to ensure weather and atmospheric conditions would not cause differences.

The Petersens, from left: Scott, Rodney and Wayne, who farm at Killarney, Queensland.

GRDC Research Code DAQ00010

For more information: Philip Burrill, Development Agronomist – Stored Grains, QDPI&F, 07 4660 3620, Philip.Burrill@dpi.qld.gov.au; Greg Daglish, Principal Research Scientist, QDPI&F, 07 3896 9415, Greg.Daglish@dpi.qld.gov.au