

FUMIGATION WITH SULFURYL FLUORIDE

by Marty Morgan and Bob Braun, Douglas Products, US

It has been 15 years since sulfuryl fluoride was registered under the brand name ProFume® gas fumigant for postharvest uses. Two industry professionals from Douglas Products provide an update on the use of this fumigant to protect grain from stored product pests

What led to the postharvest registration of sulfuryl fluoride?

Morgan: Sulfuryl fluoride (SF) has been used since 1961 as the active ingredient in Vikane® gas fumigant primarily to protect properties from drywood termites. While Vikane was the leading solution for structural fumigation, methyl bromide (MB) was the mainstay in postharvest uses.

However, in 1987, the Montreal Protocol, a United Nations (UN) treaty, required that MB be phased-out by 2015 to protect the Earth's stratospheric ozone layer. An alternative was needed, and in 1995 at industry request, Dow AgroSciences began investment to obtain a postharvest label for SF.

Braun: ProFume was registered in 2004 in the US. Today, ProFume is registered in more than 20 countries including Australia, Germany, Canada, and the UK. Codex listing for international trade followed in 2006. The registration of ProFume has been recognised with environmental awards by both the United Nations and the US Environmental Protection Agency.

When did Douglas Products enter the picture?

Morgan: In 2015, Douglas Products acquired Vikane and ProFume from The Dow Chemical Company. The acquisition included the SF manufacturing plant in Pittsburgh, California, which is operated by employees of The Dow Chemical Company. The acquisition of ProFume and Vikane made Douglas Products a leader in fumigation as the company holds federal registrations for both SF and aluminum phosphide.

You've been in development since 2004?

Braun: ProFume has become recognised as a fumigation standard for postharvest needs. Industry adoption resulted due to SF's demonstrated superior efficacy and other industry identified desirable qualities. SF has been proven effective on all life stages of a broad spectrum of stored product pests. It has low sorption and rapid desorption and does not affect commodity quality, texture, flavours or processing characteristics.

It has no impact on fumigation sites because SF is non-flammable and does not pose a corrosion risk even for sensitive equipment. And in comparison, with MB, SF allows for faster turnaround because it penetrates grain more rapidly to reach target insects, then aerates rapidly.

Morgan: The ProFume label also was written to span a range

of structures used to store, transport and process raw agricultural commodities and processed foods. So, you can fumigate silos, bins, trailers, shipping containers, stacked fumigation chambers, and stationary railcars and trucks.

The label also covers mills, food production facilities, and warehouses. Commodities on the label include corn, wheat, barley, millet, rye, rice, oats, flour, cocoa beans, coffee, peanuts, dried fruits, tree nuts and more.

What's the role of fumigation today?

Braun: Stored grain falls under the Food Safety and Modernisation Act legislation. Those regulations require a written plan to identify threats and have protocols in place to mitigate the identified threats and protect foods. Fumigation is an effective treatment to eliminate pests from facilities and from incoming commodities, or to react quickly in the event of a pest outbreak.

Morgan: Fumigation is a component of an integrated pest management (IPM) program. IPM can mean different things to different people, but an elevator or mill needs to have a customised pest management program based on the facility itself, the grain being stored and even the geographic location.

What might surprise an elevator or mill manager about ProFume® gas fumigant?

Morgan: ProFume utilises the proprietary Fumiguide® program developed to serve the global market. It provides calculations in English standard or metric, and it is available in multiple languages. This program is important for a couple of reasons. First is during the planning stage; the software determines the specific fumigant dose required by calculating the target pest,

temperature, half loss time and exposure time.

Second, the software can be used to fully document the entire fumigation process and kill. Monitoring equipment manufacturers have improved their equipment to remote monitoring of fumigations in real time. Because conditions always vary, no two fumigations are identical, even for the same facility. Monitoring helps ensure a kill by allowing adjustments to be made as needed.

Braun: The mode of action of SF also is important. SF controls insects by disrupting glycolysis and the citric acid cycle, which deprives insects of energy they need for survival. This mode-of-action is different from phosphine products, and as a result SF will control phosphine-resistant insects.

Managing resistance is critical because there are only two workhorse fumigants left, SF and phosphine. Resistance has been documented for phosphine among insects such as the lesser grain borer and the red flour beetle. If you suspect you may have insects that are resistant to phosphine, Kansas State University has developed diagnostic screening tests.

Are there important use restrictions or precautions?

Braun: ProFume is a federally Restricted-Use pesticide so applicators must have a fumigation license and meet the stewardship requirements of Douglas Products. We've taken the position as a company to work with professionally certified fumigation companies who use ProFume regularly and properly.

What would you tell a mill or elevator manager that might be unfamiliar with fumigation?

Morgan: From a management perspective I have seen three attributes of successful mills and food plants. First, hire a good pest management company, work collaboratively with them and stick with them. Second, look at the big picture in terms of an Integrated Pest Management (IPM) approach.

Your IPM plan should include preventive measures like inspecting incoming goods and rejecting any that are infected. Third, include fumigation in your pest management program as needed and focus on efficacy and safety.

Braun: Start by understanding your facility, clearly identifying the pests that you face and establish treatment action thresholds. We always recommend a positive identification of the pest, and if you are facing more than one pest then the Fumiguide® program will automatically calculate the pest that requires the highest dose.

Fumigation at the beginning of a pest invasion always prevents a bigger issue later. There is no residual protection with fumigation, so zero-out that initial pest infestation and then use topical grain protectants like food grade diatomaceous earth for residual protection.

With grain being stored longer you can use ProFume® gas fumigant for ground piles. We have done fieldwork that shows you can use multiple injection points for the fumigant and then rely on normal thermal movement to get gas circulation from one end to the other. Temperature always wants to reach equilibrium, so when the sun is shining that produces warmer air that wants to move from the outside into the grain pile, while the colder air inside will want to move to the outside.

What steps are there to ensure results with an SF fumigation?

Morgan: Good circulation and monitoring are important to ensure positive results. What some fumigators do is to place monitoring lines at different levels in the stack and when gas levels are the same at the top and bottom, they also should be the same in the middle of the stack. Also watch for any high moisture areas inside the grain. ProFume penetrates grain well but wet grain can slow penetration. Finally, the seal is critical in any fumigation. The gas must be held to get a kill.

Any advice to a grain manager about the use of SF?

Braun: The fast penetration of SF can give you a faster turnaround. I was doing a seminar and one of the participants got a call that a train was going to arrive there the next day. With ProFume you can increase the amount of gas used and turn the job around quicker, even within a 24- to 30-hour period from fumigant introduction through aeration. At the same time our calculator will go out one full week — 168 hours, so, if you are not in any hurry you can seal and hold that bin or bunker that long and use less gas.

What is the future of SF?

Braun: Fumigants are highly regulated, so proper use is essential to maintain them as a pest management tool. As a leader in fumigants, Douglas Products works with its distributors and fumigators to help ensure proper and safe use. We will not sell or allow a fumigator to use ProFume unless they are licensed, trained and agree to follow our stewardship program.

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