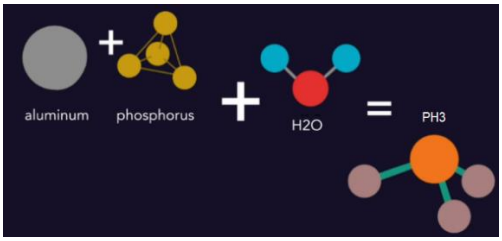
FUMIGATION COMPANIES COMMITTEE
TECHNICAL NOTE Number 001/2023

Dosage and exposure time of fumigations in Brazil: technical analysis of the effectiveness of application in exports to South and Central America, China, and other countries.

INTRODUCTION

The product used for the fumigation of grains in vessels' holds is Aluminum Phosphate (ALP), which reacts with atmospheric humidity to produce Hydrogen Phosphide or Phosphine (PH_3):



Each gram of commercial aluminum phosphide-based product releases one-third of its weight in phosphine (PH_3).

In Brazil, the dosages indicated by the manufacturer of the product for the control of stored grain pests, **according to the instructions in the leaflet, are:**

Culture	Dosage (g/m³)*
Soybeans	1 ou 2 **
Corn /Maize	2
Wheat	2
Rice	2

***g/m³:** The dosage is expressed in grams of phosphine (PH3) per total cubic meter volume (m³) of the hold to be fumigated and applies no matter the hold is partially or completely loaded

****Soybeans:** Depending on the pest contained in the grain, 1 or 2 g/m³ may be indicated, according to the product leaflet.

Brazilian legislation provides that using dosages not complying with the manufacturer's recommendation and/or product leaflet for the agrochemical product constitutes a violation.

This is because the dosages indicated on the product manufacturer's leaflet are those that have been tested and approved by the manufacturer and by the registering body — in Brazil, the Ministry of Agriculture (MAPA).

In 2010 MAPA, through the Secretary of Agricultural Defense (SDA), issued Normative Instruction Number. 4 (IN 4/2010), which now recognizes treatments carried out with a dosage equivalent to 1 g/m³ for corn, soybeans and soybean meal exported in ships' holds, despite the manufacturer's package insert recommends 2 g/m³.

> *Art. 1 Recognize the treatment with aluminum phosphide and magnesium phosphide, in a dose equivalent to 1 (one) gram of phosphine per cubic meter of chamber volume, in quarantine and phytosanitary procedures for the purpose of exporting corn in grains, soy in grains and soybean meal in ship holds.*

However, IN 4/2010 from SDA/MAPA only recognizes the application of phosphine at a dose equivalent to 1 g/m³ for corn, soybeans and soybean meal, that is, it only allows the application of a lower dosage than indicated, however this is not a recommendation for the application of a lower dosage than that recommended on the package insert.

Therefore, this committee via this technical note, points out that following the product manufacturer's package leaflet recommendations is

the best way to guarantee efficient treatment and avoid problems with insects at the destination.

EXPOSURE TIME

This is the necessary treatment time for the phosphine to reach the grain mass in all spaces in the hold of the vessel, and act lethally in the different stages of development of the insects. During this period, the vessel's hold must remain closed.

The exposure time recommendation varies depending on the temperature inside the fumigation chamber at the time of treatment, according to the fumigant product leaflet:

- Temperature <15°C: fumigation is not recommended.
- Temperature between 15°C and 25°C : 12 days (288 hours).
- Temperature >25°C: 10 days (240 hours).

According to IN 4/2010 SDA/MAPA:

> *Art. 1º ...*
>
> *Single paragraph. The minimum exposure time must be 6 (six) days.*

Even though the product leaflet recommends a minimum period of 10 days for fumigating large volumes, such as vessel holds, IN 4/2010 SDA/MAPA reduced this minimum time to 6 days. However, given the time required for the chemical reaction to complete and for the gas to reach the entire volume of the hold and act lethally on insects, there is no way to guarantee the effectiveness of the service by reducing the time recommended by the manufacturer.

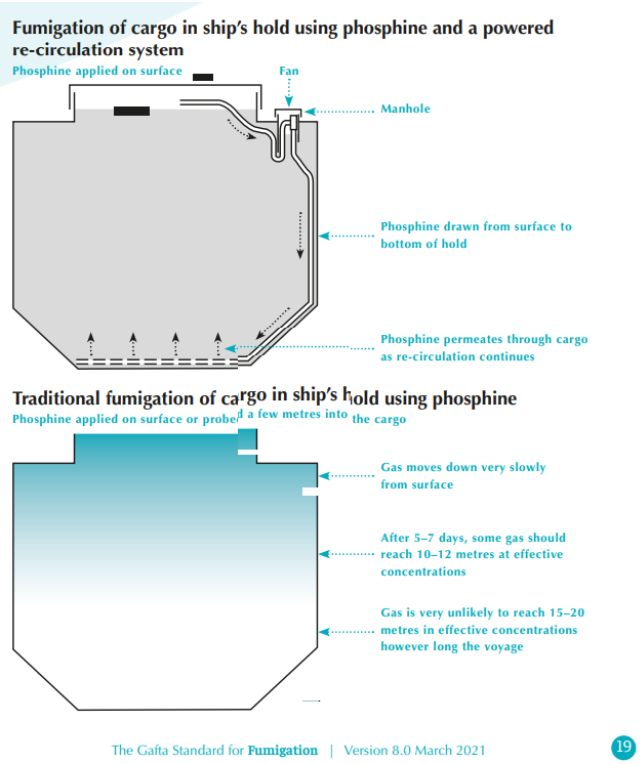
RECIRCULATION

The recirculation system consists of a set of tubes connected to a blower-type fan and installed prior to shipment, in the holds while they are still empty.

With this procedure, the phosphine gas formed in the upper part of the cargo hold is aspirated/inflated into the grain mass, establishing a uniform phosphine concentration. Dispersion of the fumigant concentration continues until all the phosphine is released.

This procedure ensures homogeneity and faster gas distribution throughout the cargo.

In the GAFTA Standard for Fumigation v 8.0 of 2021 (p. 19), the difference between fumigation with and without the recirculation system is found, demonstrating how important the system is for dispersing the fumigant throughout the cargo in the hold.



CORN FUMIGATION FOR LATIN AMERICA

The short transit time, from the ports in the North and Northeast Region of Brazil, to the ports located in Latin America, has forced fumigation companies to recommend an exposure time of six days (144 hours), in accordance with IN 4 /2010 of the SDA/MAPA and different from the product manufacturer's package leaflet, which requires at least ten days (240 hours) to guarantee the efficiency of the treatment.

Furthermore, if the dosage used in the treatment is 1 g/m³, permitted by IN 4/2010 SDA/MAPA, there is no technical guarantee from the product manufacturer, which recommends the dosage of 2 g/m³ for the treatment of corn.

To avoid complaints about the presence of live insects at the port of destination, which has been recurrent when using a dose of 1g/m³ for six days of treatment, this committee of fumigation companies recommends following the manufacturer's package leaflet (2g/m³) and, if it is not possible to wait the ten days of treatment, install a recirculation system, with the aim of accelerating the distribution and homogeneity of the phosphine in the hold, compensating for the shorter treatment period.

CORN FUMIGATION FOR CHINA

Even though the travel time to China is extensive, exceeding 30 days, we have noticed the request of using 1 g/m^3, according to IN 4/2010 SDA/MAPA, not following the manufacturer's package leaflet recommendation for fumigation of corn.

The Committee **recommends the use of the dosage established in the manufacturer's package leaflet for corn shipments destined for China, that is, 2 g/m^3 of phosphine .**

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