FUMIGATION OF FREIGHT CONTAINERS - A STUDY IN JAMAICA

R W D Taylor, Natural Resources Institute, UK.

Introduction

The fumigation of freight containers has long been considered a convenient practice, an added advantage being that commodity re-infestation in containers is most unlikely. Increased use of containers for transporting infestible commodities is occurring in developing countries, for example in Thailand, in 1992, 20,000 containers were fumigated for export purposes. Because a short-period disinfestation method bests suits export situations, methyl bromide has been most commonly employed for containers although phosphine is also used. There is a limited amount of published data on the effectiveness of container fumigation (De Lima *et al.* 1994) but little, if any, from developing countries. This study was intended to help redress the situation.

Container fumigation in Jamaica

In Jamaica, the responsibility for container fumigation rests with the Ministry of Industry, Investment and Commerce, almost all fumigations taking place within the port of Kingston. Because containers remain on the wharf throughout the treatment period the system made it possible to investigate the effectiveness of gas retention during routine commercial fumigations. The principal commodities exported include bagged pimento and cocoa beans, and the design of containers fumigated varies greatly in length and in height, but more importantly with respect to the degree of ventilation. This includes containers with no ventilation at all, those with small top-corner ventilators only, and other types with large areas of ventilation running the full length of the container. Normal practice has been to cover ventilation openings with a paper-based masking tape to prevent escape of fumigant. Methyl bromide is applied to containers from cans (c. 680 g) via copper tubing, terminating in a T-piece. Because containers are already stuffed, the application tubing can normally only be inserted as far into the load as can be accessed from the doorway. If phosphine is employed, solid preparations of aluminium phosphide are placed as convenient inside the container just before the doors are sealed. Routine fumigant application rates are: methyl bromide 20 g/m^3, phosphine $1g/m^3$.

Fumigant monitoring programme

Fumigant concentrations in treated containers were monitored by withdrawing samples via nylon capillary tubing inserted into the commodity load. In some instances, where stuffing had not commenced, it was possible to position these tubes at the far end of the container, furthest from the door but, in many, siting was at the door end only, as far into the load as was accessible from the door. Measurement of concentrations of methyl bromide was by AGL thermal conductivity meter, and of phosphine, by Bedfont EC80 monitor. Leakage of methyl bromide was detected using an electronic leak checker.

During the investigation, 22 fumigated containers were monitored, 14 being treated with methyl bromide and 8 with phosphine. At an early stage, it was concluded that the paper-based masking tape provided little barrier to the passage of fumigant and was most unsuitable for

sealing ventilators and needed be replaced with a good-quality plastic adhesive tape.

Results and conclusions

All fumigations with methyl bromide were of 24h duration, and those containers with the lowest level of leakage retained concentrations of the order of 5 mg/l at the end of the treatment (Figure 1). Minimum concentration x time products in these containers were 150 mg/l/h and, at the temperature range of 28-34°C recorded, would be sufficient to control most common stored product insect pests except *Trogoderma granarium*. Containers best able to retain methyl bromide were those with minimal ventilation (or no ventilation), and those least able to retain the fumigant had large areas of ventilation. An extra problem encountered involved containers having internal floor-level ventilators (connecting to the exterior through the underside), and which were not visible on the inside of stuffed containers due to covering by the commodity. Methyl bromide applied to this type of container was completely lost in 4-5 hours by leakage through these ventilators.

In most containers fumigated with phosphine, the gas concentration fell to less than 50 ppm after 48h, although in one, with only top corner ventilators, it was still 50 ppm at 120h (Figure 2). Taking into account a recommendation by Friendship (1989) that, in effective treatments, at least 150 ppm phosphine should remain after 120h, none of the containers retained fumigant sufficiently well.

Because of the poor gas retention found during the investigations in Jamaica, and the growing importance of this method of disinfestation, additional data on the effectiveness of container treatment is desirable, particularly from developing countries. The following conclusions were made regarding the treatment of containers under Jamaican operating conditions:

- fumigations should not be undertaken routinely using phosphine, but if this is specifically required by an importing country, treatment should be under sheets with the container doors open;
- containers with large numbers of ventilators should preferably be avoided or, alternatively, fumigated under sheets;
- there must be access to containers with internal floor-level ventilators prior to stuffing, to allow sealing operations.

Methyl bromide is particularly useful for disinfesting containers because the short exposure period involved is very suitable in busy port areas, and because it permits effective fumigation where treatment with phosphine is difficult or impossible. If methyl bromide is eventually phased out, an alternative method of disinfesting containers will be essential. Any alternative technology introduced should be easy to use and must take account of practical working conditions.

References

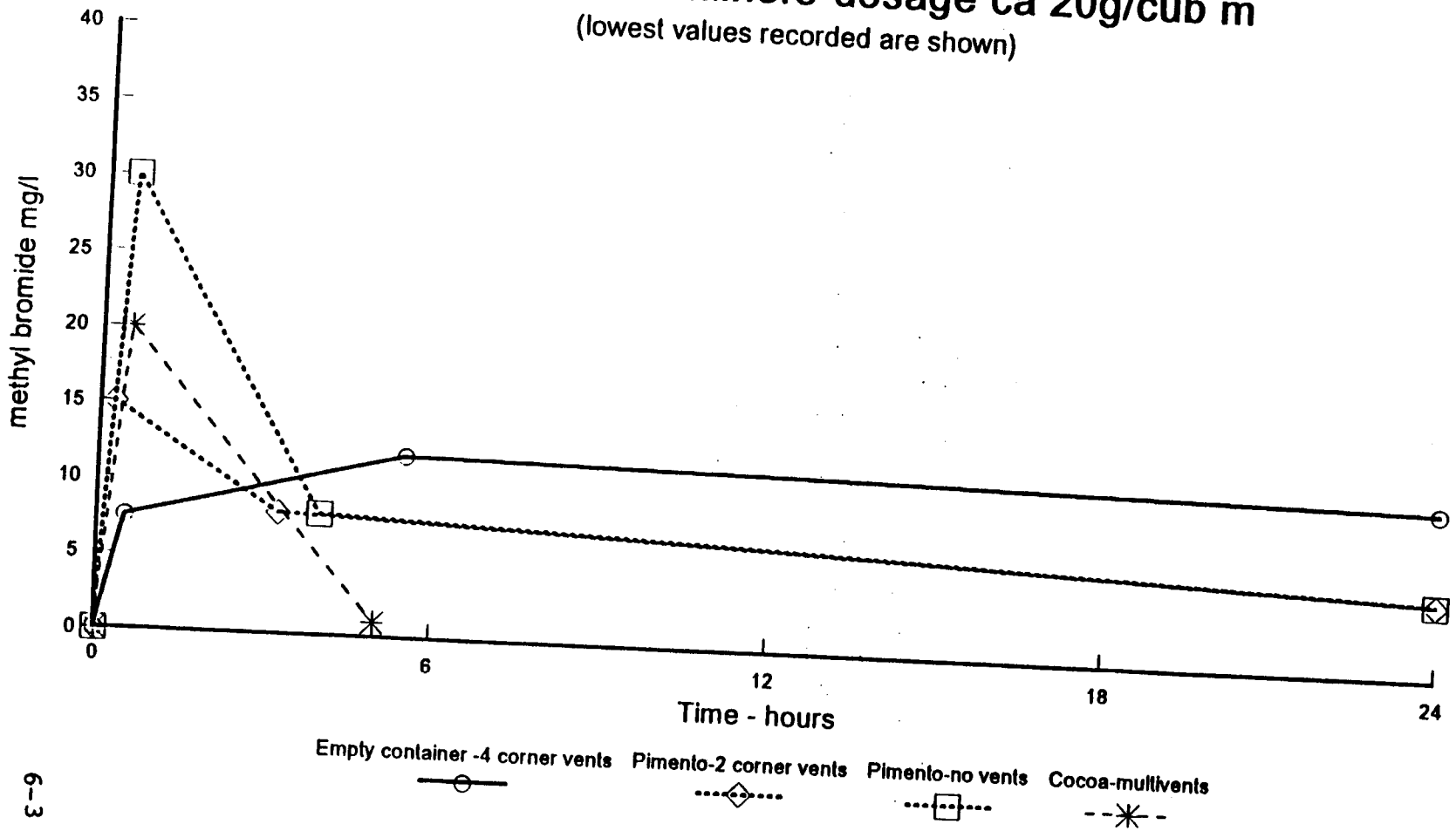
De Lima, C. F. P., Emery, R. N. and Jackson, P. (1994) Improved procedures for fumigation of oaten hay in shipping containers. In: Proceedings of the 6th International Working Conference on Stored-product Protection, 17-23 April 1994 Canberra, Australia. 71-77.

Friendship, R (1989) Fumigation with phosphine under gas-proof sheets. Overseas Development Natural Resources Institute Bulletin, No. 26, iii + 22 pp.

Figure 1.

Methyl bromide concentrations recorded during fumigation of containers-dosage ca 20g/cub m

(lowest values recorded are shown)



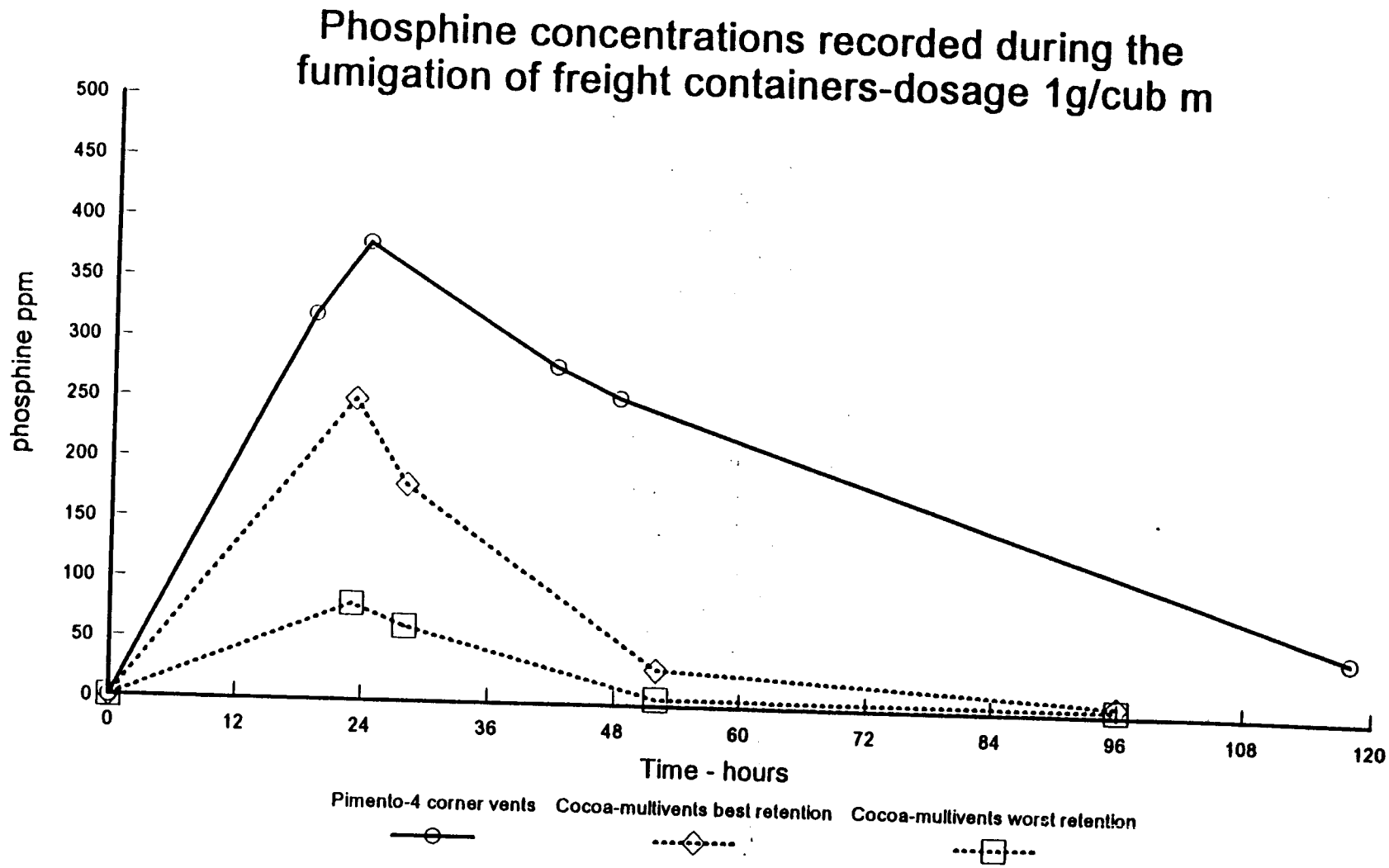

Phosphine concentrations recorded during the fumigation of freight containers-dosage 1g/cub m
phosphine ppm
500
450
400
350
300
250
200
150
100
50
0
0
12
24
36
48
60
72
84
96
108
120
Time - hours
Pimento-4 corner vents
Cocoa-multivents best retention
Cocoa-multivents worst retention

Figure 2.