

A NOTE ON THE ASSESSMENT OF THE EFFECTIVENESS OF FUMIGATION OF GRAINED FOODSTUFFS INSIDE THE SILOS

by

N. P. Rao

Defence Science Laboratory, Delhi

ABSTRACT

A method for rapid assessment of the effectiveness of fumigation for dis-insectisation of grained foodstuffs at different levels inside the silos (in a flour mill milling wheat for the Armed Forces) has been described. Results of examination of samples of fumigated wheat, applying the above method, have been reported.

Introduction

In an earlier paper¹ the author reported the prevalence of endemic insect infestation observed in milled foodstuffs at a selected flour mill (milling wheat for the Armed Forces) and discussed the possible sources of insect infestation, and the anti-insect measures required to be taken in processing, packing and despatch of the product. As the incidence of infestation could not altogether be checked inspite of the preventive measures normally adopted it was considered worthwhile to assess the effectiveness of fumigation for dis-insectisation of the wheat itself at different levels inside the silos using the existing fumigant Killoptera (Ethylene dichloride; Carbon-tetrachloride, 3 : 1 mixture, vol/vol) and carrying out the fumigation in the usual way (at the rate of $3\frac{1}{4}$ gallons per thousand c.ft. for 48-72 hours).

Sampling

From the wheat so fumigated in the silos, 5 different one lb samples were drawn *at random* representing the grain at different levels. As it takes 24 hours for a silo to be emptied and the wheat is drawn from the bottom of the silos, the first sample was taken at the commencement of operation and the remaining 4 samples at 6 hourly intervals. The samples were drawn four times in a year—March, June, September and December so as to cover all the seasons, and were kept under observation for a period of 8—12 weeks.

Observations

Of 40 samples of the fumigated wheat drawn at periodical intervals, 9 showed live infestation by *Calandra sp.*, *Triboleum sp.* and *Rhizopertha sp.* Details of the insect infestation are given in the Table.

TABLE

Details of infested samples, silos and location of samples therein, period after which observations are made and type and extent of infestation

Infested sample	Silo No. and location of samples in silo	Observation after	Type and extent of infestation
1	Silo No. 10, Bottom	3 weeks	1 live <i>Rhizopertha</i> adult.
2	Silo No. 4, Middle	5 weeks	4 live <i>Calandra</i> sp. adults + 25 + 48 + 68 in next few weeks.
3	Silo No. 6, Bottom	5 weeks	6 live <i>Calandra</i> sp. adults + 28 + 58 + 85 in next few weeks.
4	Silo No. 6, Middle	5 weeks	60 live <i>Calandra</i> sp. adults + large Nos. in next few weeks.
5	Silo No. 6, Middle	5 weeks	1 live <i>Calandra</i> sp. adult.
6	Silo No. 7, Bottom	5 weeks	93 live <i>Rhizopertha</i> sp. adults + large Nos. in next few weeks.
7	Silo No. 8, Bottom	5 weeks	5 live <i>Rhizopertha</i> sp. adults + 25 + 35 in next few weeks.
8	Silo No. 8, Middle	5 weeks	6 live <i>Triboleum</i> sp. adults + 4 + 15 + 28 + 35 in next few weeks.
9	Silo No. 9, Bottom	5 weeks	1 adult <i>Calandra</i> sp.

Discussion

General Remarks—It will be seen from the Table that the fumigation has not yielded 100 per cent kill of the insects in the wheat.

The limitations of Killoptera revealed from the experiments were also corroborated by the observations of earlier workers. As early as 1942, Richardson and Casanges² referred to the slow action of ethylene dichloride although its toxic effect lasted upto 20 days. It, therefore, required larger doses for its effect to last against insect eggs which the adults might continue to lay before they die. Young and Cotton³ found that admixture of ethylene dichloride, carbon tetrachloride with methyl bromide not only reduces volatilisation of the latter, but also increases the toxicity of the former mixture. They recommended a mixture of the following composition at the rate of 2 gallons per 1000 bushels for fumigating grain in elevators, the insects involved being *C. oryzae* and *T. confusum*:—

Ethylene dichloride	.. 27 parts	} corresponds to Killoptera
Carbon tetrachloride	.. 9 parts	
Methyl bromide	.. 4 parts	

Cotton *et al*⁴ further reported that 15 : 85 vol/vol mixture of methyl bromide and ethylene dichloride; carbon tetrachloride mixture gave satisfactory kill of insects in grain elevators, when used @ 1½ gallons per 1000 bushels.

Methyl bromide is coming increasingly into vogue in other countries as a fumigant for grain.

If taking due precautions its use is resorted to for fumigation of grain, the recommended dosage is 1-1½ lb methyl bromide per 1000 cu. ft. for 12-24 hours⁵.

Ethylene di-bromide (B.P. 130-131°C) (either alone or mixed with methyl bromide in equal proportions), at the rate of 3-4 lbs. 1000 cu. ft. and exposure for six days, has been recommended for fumigation of grains by CFTRI Mysore⁶.

Conclusions

(i) Ethylene dichloride: Carbon tetrachloride mixture, while safe to handle is, however, slow in action and will prove more effective if used in larger doses as reported by Richardson *et al*².

(ii) Subject to special precautions, methyl bromide may be used (if not alone, at least admixed with the ETC mixture) for fumigation of grain (whole) as recommended by Young and Cotton *et al*^{3, 4}.

(iii) Other fumigants *e.g.*, ethylene dibromide⁶ should be introduced.

(iv) Search for more effective fumigants should continue.

Acknowledgements

The author thanks the ISSPO.

References

1. Rao, N. P., *Def. Sci. J.* **9**, 1959.
2. Richardson, H. H. and Casanges, A. H., *J.E.E.*, **35**, 664, 1942.
3. Young, H. D. and Cotton, R. T., *J.E.E.*, **35**, 796, 1943.
4. Cotton, E. T., Wagner, G. B. and Winburn, T. F., *Pests*, **10**, 17, 1942.
5. May and Baker, "*Methyl Bromide—A Review of The literature*" **20**, 1946.
6. Cent. Food. Tech. Res. Inst. Mysore, *Project Circulars* No. 3 and 4, 1958.