THE USE OF CONTROLLED ATMOSPHERES FOR THE STORAGE OF GRAIN

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This paper deals with aspects of the use of controlled atmospheres for the storage of cereal grains with a moisture content not exceeding 13%. Controlled atmosphere storage of high moisture content grain has been dealt with by other authors [1].

The term "inert atmospheres" has also come to be used for atmospheres of the types we shall be discussing, namely those consisting of nitrogen or mixtures of air and carbon dioxide. We prefer not to use this terminology as carbon dioxide and air mixtures are not physiologically inert.

Two distinct approaches can be applied to the use of such atmospheres. The first is to use them as a method of slow-acting fumigation that does not leave any toxic residues. The second is to hold the grain in the atmosphere for the whole of its storage life thus gaining the advantage of a residue-free grain protectant.

Historically, airtight storage, which is a form of controlled atmosphere storage has probably been used, wittingly or unwittingly, in many parts of the world for a very long time. Thus, Hyde and Daubney [2] state that "Underground storage has been practised from time immemorial in certain countries, particularly those of the Middle East and Central Mediterranean regions". Underground storage does not necessarily produce atmospheres that will control insect pests but in those instances where the structures were built with sufficient care to prevent the ingress of soil moisture it is likely that true hermetic conditions were achieved. Thus in recent trials with the fossae that were constructed in Malta three hundred years ago, and whose capacities ranged from 50 to as much as 500 tons, the oxygen content of the intergranular air at the bottom dropped to almost zero within three weeks of filling with grain.

In most recent times large-scale installations have been employed in South America and a system of "Waller" bins, originally built in Cyprus has been extended to East Africa. All these are commercial scale projects, and reports suggest that in general, and in the context of the trading situation in which they exist, they are successful in reducing or eliminating losses due to insect pests. They may, however, leave much to be desired in terms of grain handling convenience.

Smaller-scale trials have been conducted using bitumenised construction [3] and more recently plastic and butyl rubber containers. These latter have not always proved very successful owing to rapid weathering, mechanical damage or the activity of rodents.

The scientific background of underground or hermetic storage has been investigated since about 1918 when the pioneering