TRADITIONAL PRACTICES AS A BASIS FOR THE IMPROVEMENT OF ON-FARM STORED PRODUCT PRESERVATION IN TROPICAL AFRICA

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INTRODUCTION: Many examples exist of novel storage methods and structures that have been advocated for on-farm grain storage. The basic aim in most cases appears to have been to introduce dramatic improvements over the traditional systems, relying on the use of such inputs as metal drums and silos, concrete silos, plastic bags, insecticides, and the use of mechanical driers.

There are virtually no examples where such novel introductions have succeeded in being universally accepted by the majority of growers. In fact, adoption usually comes to an abrupt stop the moment the extension efforts of the initiators are removed.

Almost invariably, failures can be traced to ignoring the fact that traditional practices are based on many years of experience by farmers. The techniques adopted thus fully take into consideration such factors as the effect of climate, availability of bought inputs, limitations in technical and managerial skills, and a host of socio-economic constraints which are not immediately evident to the newcomer on the scene.

In other instances, proposed improvements have contained distinct technical and practical weaknesses, which, through inadeqate prior evaluation, had not been revealed before encouraging farmers to adopt it.

An appreciation of the need for studying traditional practices and for the development of improvements based on them and with actual farmer participation is becoming increasingly recognized (1, 2).

The current paper underlines this need by relating some experiences associated with, respectively, humid and dry zones, and suggesting possible future approaches to the problem.

DRYING OF GRAIN CROPS IN HUMID ZONES: In humid zones in West Africa there is a bimodal rainfall pattern. In these areas when a major crop is a grain, such as maize, it ripens largely during periods of intensely humid conditions. To the casual observer, the drying of the crop under these conditions would seem possible only through the use of some form of artificial means. As a result, many attempts have been made to provide mechanical drying and related bulk silo storage facilities at strategic centres, where small producers can have their maize dried, shelled, and stored. These have not succeeded, largely as unavoidable delays between harvesting of the crop and ultimate drying regularly results in heavy losses and deterioration of the crops, notably through fungal attack. This system is of course feasible on large scale farms, where the harvest rate and drying capacity can be matched, but is impossible to achieve when the supply of material is provided intermittently by numerous small producers.

A study of traditional practices for maize in the humid tropics will reveal a significant appreciation by farmers that in spite of intense relative humidity conditions, the crop will nevertheless lose moisture under natural conditions after ripening at 35% moisture content. This is borne out in Figure 1, where it will be noticed that the equilibrium moisture content of the crop is in the order of 16% even if the daily mean relative humidity reaches 85%, which is the level attained in highly humid conditions.

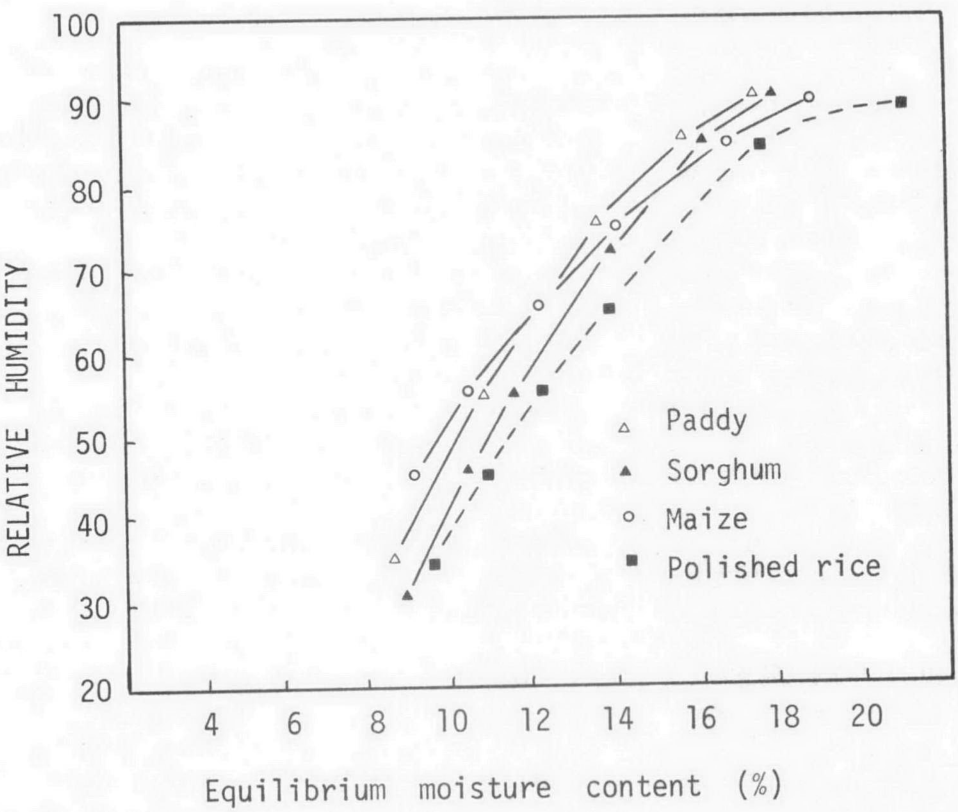

FIGURE 1. Equilibrium moisture content of common grain crops in relation to atmospheric mean daily relative humidity

Farmers also appreciate that the loss of moisture will be slow, but the crop would be quite safe from fungal attack, providing it is kept in an environment allowing the free circulation of air around it.

This is reflected in the traditional practices, where maize cobs undehusked, and thus partially protected from insects, are suspended in trees, on poles and in roofs of domestic houses. In slightly more advanced cases, maize cobs are heaped on platforms under which periodic fires are lit to somewhat speed up the drying and to repel insects.

As the scale of production increases, especially when commercial levels of production are aimed at, these techniques become rather limiting and the tendency is to leave the crop unharvested in the field until it reaches a moisture content of around 18-20% and to then place it in simple round structures having slatted walls or similar means to allow for the free passage of air through the undehusked cobs.

The period of field drying exposes the crop to many hazards, and field losses are inevitable. The opportunities for using the land for a second crop in the same year are also reduced and often nullified.

In examining the scope for natural drying under highly humid conditions (3), it has been established that dehusked maize cobs, harvested at over 35% moisture content (soon after ripening) will dry equally well without the danger of fungal infection provided it is placed in very ventilated conditions. Such conditions can be achieved in cribs with an appropriate width, ranging from 60 cm in extremely humid conditions, to 150 cm under more moderate conditions.

Attempts to introduce the crib concept to farmers has been only moderately successful, largely as the structures initially recommended were based on construction materials that were costly and seldom readily available. An evaluation of these cribs with farmer participation would have revealed this shortcoming much earlier.

In more recent times, cribs based on the use of exactly the same home-grown materials that are traditionally available have been developed and are being evaluated on farms. Some resistance to the concept of a rectangular structure, rather than the traditional round structure, is being encountered. Although much more material is required to build a number of small diameter round structures to hold the same volume of cobs as would a rectangular one, the innovators may have to succumb to popular opinion and give equal stress to round and rectangular structures initially.

The control of insects in cribs, although somewhat reduced by really early harvesting of crops grown for commercial purposes, remains an important problem. Effective and easily applied insecticides are being produced for application to dehusked cobs, but their general use thus far is restricted primarily by a lack of efficient supply lines to farmers. For the time being farmers who have no access to such inputs have little alternative choice but to accept losses in weight in the order of 5% to 8% over a 3-month drying period for untreated dehusked cobs in cribs and to shell and dispose of the crop at this stage to agencies in the marketing chain, which have access to and are better able to carry out insect control measures.

It is significant to note that the storage of shelled grain in solid walled structures in very humid conditions is not traditionally practiced. It implies that farmers are aware and unable to cope with the many pitfalls that this technique holds, in humid zones. These are primarily problems relating to getting the grain dry enough for bulk storage, the shading of the structure to avoid undue temperature fluctuations and hence condensation, and of course the control of insects.

STORAGE IN DRY ZONES: In zones where a distinct dry season follows the ripening of the crops, usually associated with mono-modal rainfall patterns, the drying of the crop is seldom a problem.

The dominant grain crops in these areas are sorghum and millet, which are traditionally stored on the farm in the unthreshed form, in solid walled traditional mud structures (4).

On the whole, damage and losses by insects are insignificant for the first part of the storage period, due to favourably dry conditions. As the new rainy season commences, some 5 to 6 months after the harvest, damage due to moths becomes noticeable.

Storage of the crops in the threshed form can reduce the extent of moth damage, but many of the mud walled traditional structures are not sufficiently strong to withstand the extra stresses imposed by the higher density material.

A more substantially walled structure would seem to be an improvement worth considering, more especially if it could be damp proof, air tight, and rat proof.

Many excellent examples of novel developments of such improved silos are available. They depend almost exclusviely on the use of one or more bought input, such as cement, wire netting, and galvanized iron sheeting. Few have generally been adopted, suggesting that a modification, much closer in material specification and cost, to the traditional may yet have to be developed.

In fact, many existing traditional structures already come close to the ideal specifications and a valuable starting point for improvement is obviously to encourage the less enlightened farmers to adopt the techniques of the better informed in the region.

CONCLUSIONS: A superficial look at traditional practices for the preservation of stored products will reveal many obvious weak elements in the system which could potentially be eliminated by alternative practices.

However, when attempting to persuade farmers to adopt alternative practices and techniques, the reaction is seldom positive. A closer examination of the reasons behind this reveals many constraints which the innovators do fully take into account. Among the more obvious are factors such as the cost of the improvements and more especially the availability of bought inputs. The more subtle sociological and managerial factors are even less readily identifiable.

As a starting point for improvement, a thorough knowledge of traditional practices and reasons for them are essential. The encouragement of the less enlightened farmers to adopt the techniques of the better informed within a society can often result in notable improvements in the short run.

More elaborate modifications, including novel introductions should evolve, rather than be imposed, on farmers, and this can only be achieved by developing such innovations with actual farmer participation.

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