MICROBIAL INFESTATION OF MAIZE DURING STORAGE IN AN AN EWE-BARN

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by

M. HALM

Food Research Institute, (C.S.I.R.) Accra

INTRODUCTION

Traditionally, farmers store their crops in various structures specially designed for the purpose. Though these structures have not been completely adequate to protect the stored produce, they have been of tremendous benefit to farmers in the storage of food crops to the extent that the farmers often see no need to change to newer and more effiient methods and practices even where available. This is because most of the changes introduced are often incapable or unsuitable to the local situation. Therefore the tradititional practices and structures have persisted. It has become clear therefore that in order to solve the food storage problem it would be necessary to identify the limitations in the traditional practices and upon these propose improvements.

In pursuance of these objectives, a project was initiated to determine the efficiency of existing maize storage structures with respect to design materials of construction, durability, storage losses due to insects, fungi, rodents, mites etc. The project is being tackled by a multi-disciplinary team each member working on a specific aspect. The work reported here was carried out to determine the incidence of fungi on maize during storage in an Ewe-Barn.

Materials & Methods

Description of Ewe-Barn

The Ewe-barn consists of a circular platform of radiating sticks constructed on wooden stalks of two to three feet height. Maize cobs with the sheath on are stacked into a compact cylinder with the pointed ends of the maize directed inward at an angle, an automatic arrangement which follows the shape of the barn. The stack of cobs in girdled at intervals with ropes or twines made from the back of trees to give support to the structure. The maize is normally covered with thatch roof made of raffia leaves or grass straw. The capacity of the barn ranges from 5 to 10 bags of shelled corn.

Experimental Ewe Barns

Two Ewe Barns were constructed by local farmers in a farm 3km off Dobro, a village on the Accra-Nsawam Road. All materials of construction ie. ropes, sticks, thatch etc were provided by the farmers. The barns were stacked with maize-cobs with husks to appreciable height and then covered with thatch. The maize used for the experiment was of a local variety.

The total weight of maize cobs put in the store was 1300kg and the initial moisture was 14.5%. The maize was stored for a period of 40 weeks.

Results

A total of 10 types of fungi were isolated. Eight of these were of the genus Aspergillus. The other two genera were Penicillium and Fusarium. Only four of the Aspergilli were identified to the species level ie. Aspergillus flavuus link ex Fr., Aspergillus ochraceus Wilhelm, Aspergillus niger and Aspergillus glaucus group. These identifications have since been confirmed by the Centraalbureau Voor Schimmelcultures in the Netherlands. Of the two Penicilli isolated one was identified as Penicillium citrinum Thom.

The list of species that were isolated from the maize grains during storage, is presented in Table I. The data show the moisture content of the samples and the percentage incidence of occurrence of each type of fungi over the storage period of 40 weeks. A number of species pg. Aspergillus niger, Aspergillus flavus, Aspergillus ochraceus, Penicillium citrinum and Fusarium spp. were isolated from the maize grains at the onset of storage. The rest of the species appeared during storage. Field fungi were not enumerated because only the storage fungi were of interest.

Aspergillus flavus was found in 17 per cent of the maize grains. This percentage fell to 11 after 9 weeks storage and rose again to 15 per cent after 14 weeks. By 21 weeks it had fallen to 10 per cent and at the end of the storage period of 40 weeks it was found in 10 per cent of the grains.

The rest of the species were found in not more than 3 per cent of the grains at the beginning of storage. There was some increase in the incidence of occurrence of Penicillium spp. and Penicilluim Citrinum over the 40 weeks storage period. Penicillium citrinum rose from 3 per cent at the start to 22% after 25 weeks storage and by the end of 40 weeks fell to 16 per cent. Penicillium spp. showed no increase until after 34 weeks when it rose to 16 per cent and remained at that level to the end of 40 weeks. Aspergillus niger which had an initial incidence of 1 per cent rose to 8 per cent at the end of the storage period. Fusarium spp. rose steadily from 2 per cent at the beginning to 16 per cent by the end of storage. Aspergillus ochraceus was found in 4 per cent of the grains at the onset of storage and 19 per cent after 14 weeks storage then followed a decline in numbers until the end of 40 weeks. Aspergillus glaucus was isolated only after 21 and 25 weeks in not more than 11 per cent of the grains.

Discussion

All the above mentioned fungi are known to cause damage to stored grains under various conditions, the major ones being, the moisture content, temperature, time, proportion of atmospheric gas constituents and mutual specific interactions (Pelhate, 1969). Moisture content, temperature and time are all intimately related to the growth of molds in stored grains. The higher the moisture and temperature, within limits of growth of the fungi involved, the shorter the permissible storage time. Apparently the absolute lower limit of moisture content that will permit growth of storage molds in grain over a period of time is that in equilibrium with relative humidity of 70 per cent in the interseed air. Even in the most adverse conditions of relative humidity (September/October) the theoretical equilibrium moisture content of maize is just over 16 per cent (Boshoff, 1975). The initial moisture content of the maize used in this experiment was 14.5 per cent. By the end of the storage period it had dried down to 13.5 per cent. Thus the moisture levels during the storage period fell within the threshold value for the safe storage of maize. The microflora found therefore could be said to have developed on the grain during the period of drying down in the field as is the practice with the traditional farmers.

During the drying down period, the levels for development of storage fungi can be attained and result in the invasion of these fungi right from the field.

Grains examined immediately after harvest were mostly damaged by fungi followed by insects, but as storage progressed fungal damage became less important and the insects took over. Of the total fungi isolated, the most dominant species causing damage to the grains were Aspergillus niger, Aspergillus flavus, Penicillium citrinum and other Penicillium species. Similar findings were reported by Moubasher et al (1972) who found that the dominance of common species of Aspergillus and Penicillium on stored maize varied with the length of storage period as well as moisture content. He also observed that severe deterioration was caused by Penicillium Citrinum, Penicillium variable and Aspergillus niger.

The prevalence of Aspergillus flavus throughout the storage period of 40 weeks strongly suggests the possibility of aflatoxin production. Future work would therefore include the determination of aflatoxin levels in stored maize.

TABLE I

PERCENTAGE INCIDENCE OF OCCURRENCE OF VARIOUS SPECIES OF FUNGI ISOLATED FROM MAIZE STORED IN AN EWE-BARN AND THEIR MOISTURE LEVELS

STORAGE PERIOD (Weeks) / FUNGI	0	9	14	21	25	34	40
Aspergillus Flavus	17	11	15	10	11	10	13
Aspergillus Ochraceus	4	15	19	12	4	4	6
Aspergillus glaucus	-	-	-	10	11	-	-
Aspergillus niger	1	2	2	13	4	16	16
Aspergillus spp. 2	1	-	-	-	-	-	-
Aspergillus spp.5	-	15	6	-	-	-	-
Aspergillus spp. 11	-	-	-	5	-	-	-
Penicillium citrinum	3	7	14	14	22	16	16
Penicillium spp.	3	3	3	3	4	16	16
Fusarium Spp.	2	2	8	19	14	13	16
Moisture %	14.5	13.5	12.8	13.4	-	13.7	13.5

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