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# Postharvest Management in Agriculture

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*A S Chandel and R M Kamal*



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# CONTENTS

<i>Preface</i>	i
<i>Introduction</i>	ii
POSTHARVEST EQUIPMENTS	1
PACKING MATERIALS	14
AGRICULTURAL PRODUCE	25
CEREAL GRAINS	27
WHEAT	31
SORGHUM	35
MAIZE	36
BARLEY	38
MILLETS	38
RICE	39
SOYBEANS	60
VIGNA	62
LENTILS	66
STARCH CROPS	66
CASSAVAS	68
TOBACCO	70
COFFEE AND TEA	71
GARLICS	72
GINGERS	73
TURMERIC	75
SPICES	76
OILS	77
FRUITS	78
APPLES	83
PEARS	89
APRICOTS	90
PEACHES	91
PLUMS	92
PRUNUS DOMESTICA	94
CHERRIES	94
LITCHI CHINENSIS	94
CITRUS	95
ORANGES	97
KINNOWS	98
LEMONS	101

GUAVAS	102
SAPOTA	105
MANGOES	107
NUTS	115
COCONUTS	116
DATES	117
POMEGRANATES	118
PAPAYAS	118
JACKFRUITS	119
AEGLE MARMELLOS	120
AMLA	121
BERRIES	121
BANANAS	122
PINEAPPLES	126
ZIZIPHUS MAURITIANA	126
GRAPES	128
VEGETABLES	133
CARROTS	136
POTATOES	138
ONIONS	144
CAULIFLOWERS	151
TOMATOES	151
BRINJALS	156
PEAS	157
GROUNDNUTS	159
MUSHROOMS	162
OTHER VEGETABLES	163
FLORICULTURE	164
DAIRY SCIENCE	166
FOOD TECHNOLOGY	191
JUICES	205
WINE AND BEVERAGES	211
SEED TECHNOLOGY	213

*Term Index*

i

*Author Index*

xvi

of sorghum seeds. *Madras Agricultural Journal*, 77: 7-8, 278-280; 4 ref.

Sorghum cv. Co19 seeds were tested for viability after 3, 6 and 9 months storage following treatment with 0.2% thiram, Vitavax [carboxin] and captan, 0.4% wettable S, and 0.2 and 0.4% Panotine [guazatine acetates] and Panoram [fenfuram]. Seed viability after 3 months storage was 81.66-93%. After 9 months storage, thiram, Vitavax and 0.4% Panotine and Panoram maintained 66-73.66% seed viability compared with 45% for untreated seeds.

## MAIZE

### Storage and storage decay

279 AHMED, J; ELIAS, SM; ULLAH, MM; HOQUE, A. 1990. Farm level processing, storage and utilization of maize in Bangladesh. *Economic Affairs Calcutta*, 35: 1, 57-62; 9 tab., 3 ref., BLDSC.

Maize is a highly versatile crop which has multiple uses. However, although production technology is available, its adoption by Bangladeshi farmers is low. This paper assesses the existing storage methods and the losses incurred in storage; studies the consumption pattern; examines the processing methods and concomitant costs; and suggests future research priority areas. A survey was made of 117 farmers in four districts who were interviewed by pre-designed questionnaire. It was found that farmers store grain in jars, tins and pots. Extensive pest-proof storage facilities are needed and postharvest shelling and drying facilities need improvement.

280 CHATTERJEE, D. 1989. An effective formulation for mould- and aflatoxin-free storage of corn. *Letters in Applied Microbiology*, 9: 1, 25-28; 3 ref.

The ability of cinnamon oil, alone or with sodium chloride, to protect stored maize from fungal invasion and subsequent deterioration was investigated. *Aspergillus flavus* and *A. glaucus*, the predominant storage fungi, produced aflatoxin and caused a loss of germinability. Oil treatment at a non-phytotoxic level of 5  $\mu$ l/g maize in combination with 10  $\mu$ l/g NaCl solution (5%) synergistically inhibited fungal infection, growth, aflatoxin production and the loss of germinability. However, treatment with the oil alone was only effective at a phytotoxic level of 20  $\mu$ l/g maize.

281 CHATTERJEE, D. 1990. Inhibition of fungal growth and infection in maize grains by spice oils. *Letters in Applied Microbiology*, 11: 3, 148-151; 8 ref.

Essential oils of 12 spices were tested for inhibition of fungal infection and mycelial growth in postharvest maize grains during storage. The oils of cassia, clove ( $\geq 30$   $\mu$ l/g grain), star-anise ( $\geq 40$   $\mu$ l/g grain), geranium ( $\geq 30$   $\mu$ l/g grain) and basil (50  $\mu$ l/g grain) inhibit the in vivo mycelial growth of established seedborne infections of *Aspergillus flavus*, *Curvularia* [*Cochliobolus*] *pallidus* and *Chaetomium indicum* as well as preventing infection following inoculation with *A. flavus*, *A. glaucus*, *A. niger* and *A. sydowii*. The oils also preserved the grain from natural *A. flavus* infection during the experimental period. Nutmeg, ginger and cumin oil (all at 50  $\mu$ l/g grain) could control mould growth and grain infection for only a brief period.

282 CHATTERJEE, D; CHATTOPADHYAY, BK; MUKHERJE, SK. 1990. Storage deterioration of maize having pre-harvest infection with *Aspergillus flavus*. *Letters in Applied Microbiology*, 11: 1, 11-14; 6 ref.

Deterioration during storage of 2 lots of Ganga maize contaminated in the field by *A. flavus*, equally matured and freshly harvested and stored under the same natural atmospheric conditions was compared. The rate and extent of grain deterioration were much less in lot 2 than in lot 1 which had a relatively high pre-harvest internal *A. flavus* load. However, the deteriorative changes of both the lots could be reduced when the initial *A. flavus* infection was completely eliminated. Furthermore, of these already contaminated lots, and grains selected as free from infection at harvest also suffered less deterioration during storage.

283 DE, D; PRAKASH, S. 1989. Quantitative losses in the various kernel fractions of some maize varieties in storage due to *Sitophilus oryzae* L. *Journal of Entomological Research*, 13: 1-2, 57-59; 12 ref.

Feeding by the curculionid *Sitophilus oryzae* was found to depend on, to some extent, the maize variety infested. In the Basi local variety, the endosperm (23.76% loss) was preferred to the pericarp (18.13) and the embryo (0.00), whereas in the AEB composite (White), EC 857, EC 85142 and EHE 200886 the percent loss in the embryo and endosperm was equal. In EHE 20086, the percent loss was less in the embryo (14.75) than the endosperm (23.33).

284 IRSHAD, M; JAVED IQBAL. 1990. Accuracy of different loss assessment methods for maize during storage. *Sarhad Journal of Agriculture*, 6: 5, 491-494; 7 ref.

Various methods are used worldwide for determining

grain storage losses; these include Standard Volume Weight (SVW), Thousand Grain Mass (TGM), Multiple Thousand Grain Mass (MTGM), Count & Weigh (CW), Multiple Count & Weight (MCW), Indirect by Weight (Ind. Wt.) and Indirect by Number (Ind. No.). These methods were evaluated for maize loss assessment in the laboratory and compared with Standard Weighing (STD). In the 1st month, loss by Ind. Wt. was closest to STD, followed by Ind. No. and SVW. In the 2nd month, loss by CW was closest to STD, followed by SVW and Ind. No. In the 3rd month, loss by Ind. Wt., Ind. No. and SVW were almost equal but were much less than loss by STD. From the 3rd month onward, STD recorded higher losses. High correlation coefficients were found between the number of insects and the STD, barley Ind. Wt. and Ind. No. methods. The results indicate that the Ind. Wt. and Ind. No. methods of loss assessment most closely approximate the STD method, but they are time consuming.

**285 KUMAR, S; SINHA, RK; PRASAD, T. 1993. Propionic acid as a preservative of maize grains in traditional storage in india. *Journal of Stored Products Research*, 29: 1, 89-93.**

Maize cultivar "Diara composite" was treated with graded concentrations of propionic acid to evaluate its effectiveness as a grain preservative in traditional storages viz. kothi, bukhari and gunnybags. A concentration of 2 ml/kg was found to be effective in inhibiting the growth of fungi for 12 months in grains stored under gunnybags. For kothi and bukhari the effective concentration was 3 ml/kg. Germinability and the nutritional components of the grains were maintained at these concentrations. After 12 months of storage, the germination was 77, 75 and 74% from gunnybags, bukhari and kothi, respectively. Protein, sugar, reducing sugars and starch contents of the grains were preserved in gunnybags for 12 months of storage and in kothi and bukhari the losses were also negligible.

**286 PAYAK, MM; SHARMA, RC. 1985. Maize diseases and approaches to their management in India. *Tropical Pest Management*, 31: 4, 302-310; 50 ref.**

Of the 61 diseases recorded in this crop, 15 are considered to constitute major constraints limiting production and include 4 foliar diseases, 2 pre-flowering and 3 post-flowering stalk rots, 4 downy mildews and 2 sheath diseases. Information on ear, cob and kernel rots, smut and virus diseases is presented together with an account of post-harvest microbial problems. Four major approaches to disease management in the Indian context

are outlined and the most appropriate one is considered to be host resistance, adoption of this having yielded promising results for 5 major disease groups. Although 7 disease groups are amenable to chemical control a very favourable cost:benefit ratio (1:14) is obtained only with seed and seedling groups. The total estimate of loss in economic product/annum due to all the diseases together has been estimated to be 13.2%.

**287 SARUP, P; DE, D. 1989. Standardization of technique for evaluating maize and varieties of resistance to adults of *Sitophilus oryzae* L. in storage. *Journal of Entomological Research*, 13: 1-2, 1-5; 6 ref.**

A combination of 8 pairs of 7-day-old adults of *Sitophilus oryzae* per 20 maize grains (the local variety basi being used) in plastic tubes was found to be the most suitable for screening different varieties in storage for resistance.

**288 SHIVAKOTI, GP. 1984. Postharvest losses at storage due to stored grain pest of maize under different storage structures. *Summer Crops Seminar*. National Maize Development Programme, Rampur, Chitwon.**

**289 SINHA, KK; SINHA, AK. 1992. Impact of stored grain pests on seed deterioration and aflatoxin contamination in maize. *Journal of Stored Products Research*, 28: 3, 211-219; 29 ref.**

*Sitophilus oryzae* and *Tribolium castaneum* were the dominant species found in maize samples (stored for 4-12 months) collected from different localities of Bihar, India, during June-July 1988. Other species found included *Oryzaephilus surinamensis*, *Rhyzopertha dominica*, *Trogoderma granarium* and *Sitotroga cerealella*. The incidence of the *Aspergillus flavus* group fungi, as well as the level of aflatoxins, were comparatively higher in insect-damaged maize samples than undamaged samples. Losses in stored maize, influenced by *S. oryzae* and *T. castaneum*, were studied for 15 weeks either with or without inoculation by a toxogenic strain of *A. flavus*. Insect numbers, moisture content, germinability, dust weight production, mycoflora, especially *A. flavus* infection, and aflatoxin levels were measured. The number of both insect species increased rapidly after 5 weeks in uninoculated maize samples, and the multiplication rate of *S. oryzae* was greater than that of *T. castaneum*. In the presence of inoculated *A. flavus*, the number of both insect species decreased after 10 weeks. Rapid population growth resulted in an increase in the moisture content of grains, dust weight production, *A. flavus* infection and aflatoxin accumulation, in

contrast to a decrease in germinability. Toxigenic strains of *A. flavus* were isolated from both *S. oryzae* and *T. castaneum*.

**290** YASIN, M; HANNA, M. 1989. Potassium sorbate as a preservative for high-moisture corn. *Transactions of the ASAE, American Society of Agri. Engineers*, 32: 1, 280-284, 290; 17 ref.

Shelled maize, initially at 18.7, 24 and 28% m.c., was treated with potassium sorbate, and potassium sorbate plus propylene glycol. The chemical treatment levels used were 0.1, 0.4, 1.0, 1.5 and 2.5% (wet weight basis). The treated and untreated grain were stored without aeration, and with a 0.11 m<sup>3</sup> min<sup>-1</sup> Mg<sup>-1</sup> air flow rate at ambient temp. The treated grain samples were mould-free for 193 d with and without aeration. With aeration even the lower levels of chemical treatment gave the same number of safe storage days for high moisture maize as the higher treatment levels without aeration. Potassium sorbate and potassium sorbate plus propylene glycol extended the safe storage time of even the 28% m.c. grain. There was, however, significant discoloration of the grain and an increase in kernel breakage susceptibility.

## BARLEY

### Postharvest handling

**291** BALA, BK. 1991. Convective heat transfer coefficient of a malt bed. *Journal of Energy, Heat and Mass Transfer*, India: 13.

**292** BALA, BK; WOODS, JL. 1991. Physical and thermal properties of malt. *Drying technology (USA)*, 9: 4, 1091-1104.

**293** BALA, BK. 1992. Shrinkage of malt bed during drying. *International Agrophysics (Poland). A Quarterly Journal on Physical Properties and Processes Affecting Plant production*, 6: 1-2, 115-117.

**294** BALA, BK; WOODS, JL. 1984. Simulation of deep bed malt drying. *Journal of Agricultural Engineering Research*, U.K.: 30: 3.

**295** BALA, BK; WOODS, JL. 1992. Thin layer drying models for malt. *Journal of Food Engineering (UK)*, 16.

**296** GUPTA, MEERA; ROY, AN. 1987. Effect of certain chemicals on mould flora of barley in storage.

*Pesticides*, 21: 5, 28-29; 5 ref.

Seed of 2 cultivars was treated after harvest and then stored for 18 months. Of the 3 fungicides, Bavistin [carbendazim] gave the best control of storage fungi while maintaining a high percentage of seed germination. Phosfume [aluminium phosphide] was the best of 3 fumigants and calcium propionate the best of 3 organic acids.

## MILLETS

### Storage and storage decay

**297** EMAYAVARAMBAN, N; RAMABADRAN, R. 1986. Incidence of seed borne fungi of finger millet as influenced by moisture content, storage temperature, relative humidity and storage period. *Seed Research*, 14: 2, 189-196; 12 ref.

Initially only field fungi such as *Drechslera oryzae* [*Cochliobolus miyabeanus*] and *Alternaria* sp. were isolated from finger millet [*Eleusine coracana*] seed. However, after prolonged storage, storage fungi (mainly *Aspergillus* spp.) predominated. Increased storage temp., storage period and RH markedly influenced the change in fungal population.

**298** GAMBHIR, SP; KHAIRNAR, DN. 1989. Impact of different liquid media on amylase production by seed moulds of pearl millet (*Pennisetum americanum* (L.) Leeke). *Current Science*, 58: 15, 863-864; 7 ref.

Fungi were isolated from *P. americanum* seeds collected from the field and from storage. Amylase production by the 17 fungi was studied using 3 media. *Aspergillus flavus* and *Curvularia lunata* [*Cochliobolus lunatus*] were highly efficient amylase producers. Starch medium was superior to *P. americanum* flour or glucose media for measurement of amylase production. Details of the agar plate method are described.

**299** KAMBLE, MY; SALUNKHE, GN. 1992. Development of storage grain insect *Tribolium castaneum* on grain and flour of pearl millet. *Journal of Maharashtra Agricultural Universities*, 17: 3, 413-414.

**300** PANDEY, KN. 1986. Preservation of moist ragi grains with certain mild acids. *Madras Agricultural Journal*, 73: 10, 579-584; 15 ref.

Acetic acid was superior to propionic acid for preserving grains of *Eleusine coracana*. A 3% concn of acetic acid prevented growth and multiplication of all the mycoflora associated with the grains except *Aspergillus*