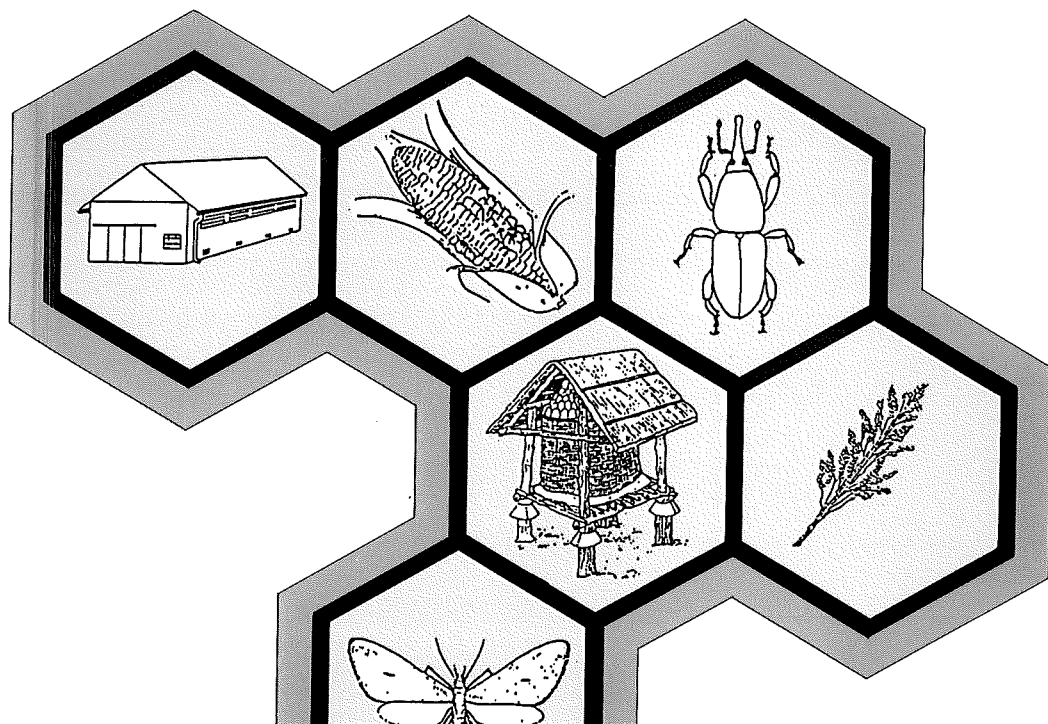




# MANUAL ON THE PREVENTION OF POST-HARVEST GRAIN LOSSES

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THE PREVENTION OF POST-HARVEST GRAIN LOSSES



Damage caused by fungi is often neglected until it has reached an advanced stage. Fungi do not only cause direct losses but also threaten the health of both man and animals by producing poisons, so called mycotoxins, which are contaminating food and feed.

Storage fungi require a relative humidity of at least 65 % which is equivalent to an equilibrium moisture content of 13 % in cereal grain. They grow at temperatures of between 10°C and 40°C (see Section 2.2.5).

Every species of fungus has its own optimum climatic requirements.

Infestation with certain species of fungi may already occur in the field which leads to a considerable reduction of the grains' storage life.

### 6.1 Storage Fungi

Store fungi include above all species of Aspergillus and Penicillium.

The following table shows the minimum moisture contents required in grains for the growth of some important storage fungi.

Species	Minimum Moisture Content in Grain	Mycotoxins
<i>Aspergillus restrictus</i>	13.5 %	not found
<i>A. glaucus</i>	14.0 %	not found
<i>A. candidus</i>	15.0 %	not found
<i>A. ochraceus</i>	15.0 %	Ochratoxin
<i>A. flavus</i>	18.0 %	Aflatoxin
<i>Penicillium</i> spp.	16.5 - 19.0 %	Ochratoxin, Patulin

Fungus development occurs if

- grain is stored without having been sufficiently dried
- the moisture content of the stored produce increases during the storage
  - as a result of moisture being absorbed from the air
  - as a result of condensation (see Section 2.2.3)
  - in "hot spots" (see Section 2.2.3)
  - because of penetration of water (leakage)

The following damage can be caused by storage fungi:

- Loss of nutrients
- Discolouration of grain
- Reduction in germination capacity
- Caking of grains
- Increase in the temperature of the stored goods up to spontaneous combustion
- Mouldy smell and taste
- Production of mycotoxins

Attention must be paid to the following in order to avoid damage by fungus:

- Dry the produce as quickly and evenly as possible after harvesting
- Keep the store cool and dry
- Prevent condensation (keep temperatures in the store as constant as possible)
- Carry out regular controls
- Prevent moisture absorption as a result of incorrect ventilation or water entering the store

## 6.2 Mycotoxins

Mycotoxins are metabolic substances which are produced by various fungi under certain conditions and remain in the stored produce as residues. They are highly poisonous to both humans and animals. If eaten, they lead to illness known as mycotoxicoses.

The best-known mycotoxins are Aflatoxin, which are produced by Aspergillus flavus, Ochratoxin, Patulin and Citrin. Aflatoxin B<sub>1</sub> is regarded as being the most dangerous naturally occurring substance causing cancer of the liver.

Mycotoxins can be found in the stored produce as soon as 24 hours after infestation with fungus.

Particularly endangered products are peanuts and other oilseeds although maize and other types of grain may also be affected.

Mycotoxins are highly stable and cannot be destroyed by boiling, pressing or processing. This means that infested produce has to be destroyed. The problem cannot be dealt with by mixing contaminated produce with healthy grain or by feeding it to animals, as the toxins will be accumulated in their body and later consumed by people in form of milk or meat.

This danger is reflected in the laws of a number of countries concerning the maximum residue limits (MRL) of dangerous substances in foodstuffs. As an example, the maximum residue limits of Malathion and Aflatoxin B<sub>1</sub> are shown in mg per kg of grain:

- |                            |       |       |
|----------------------------|-------|-------|
| - Malathion                | 10    | mg/kg |
| - Aflatoxin B <sub>1</sub> | 0.005 | mg/kg |

This means that the maximum residue limit of Aflatoxin B<sub>1</sub> is 2000 times less than that of Malathion.

The optimum climatic conditions for the growth of fungi and the formation of mycotoxins are often not identical and depend on various unidentified factors. Therefore mycotoxin contamination can only be stated with certainty by means of laboratory examinations.

Note: Mycotoxins can only be avoided by preventing the growth of fungi.

## 6.3 Further Literature

Christensen, C.M. & R.A. Meronuck. 1986. Quality Maintenance in Stored Grains and Seeds, University of Minnesota Press, Minneapolis, 138 pp.

Multon, J.L. (Ed.) 1982. Conservation et stockage des grains et graines et produits dérivés, Paris, volume 1, 576 pp.

Multon, J.L. (Ed.) 1988. Preservation and Storage of Grains, Seeds and their By-Products, Paris, 1095 pp.

## 7 Important Pests in Storage

The greatest damage to stored produce is generally caused by insects, though this may be exceeded by rodents in some countries.

A high rate of reproduction and a short development period enable them to cause important damage by rapidly developing from a small number of individual insects to a large mass.

The multiplication factor of Tribolium is 70, for example. This means that under optimum conditions one pair of Tribolium will have the following offspring:

after 1 month:	2 x 70 =	140
after 2 months:	140 x 70 =	9,800
after 3 months:	9,800 x 70 =	660,000

### 7.1 Identification of Pests

Insect species are different from one another in terms of their behaviour, their damage caused and their reaction to control measures. It is essential to identify insects found in the store and to know about their biology in order to be able to answer the following questions:

- Is it a storage pest?

Example:

Several species of Bruchus are field pests of legumes and may be brought into the store where they cannot develop. In this case, these insects are no storage pests.