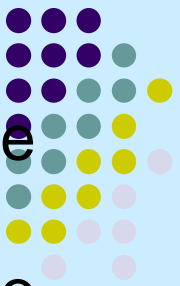


Methods of seed storage and Seed sampling methods





The goal of storage is to maintain seed quality in a safe and secure environment.

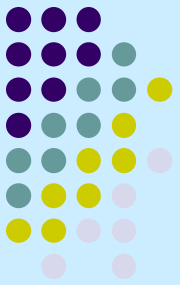
A number of different storage methods are available to have a safe storage.

The main factors affecting choice of the method are

- seed characteristics of the species in question,
- period for which it is to be stored
- cost.

The ideal storage condition is that there is no exchange of air or moisture between seed and the external environment.

Facilitating this will help in maintaining the viability of seeds for a longer period.

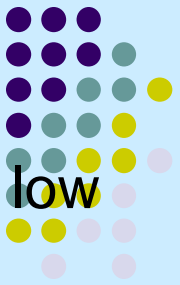


Seed storage methods

Storage at ambient temperature and humidity

Seeds can be stored in piles, single layers, sacks or open containers, under shelter against rain, well ventilated and protected against rodents.

Best results are obtained in cool, dry climates.

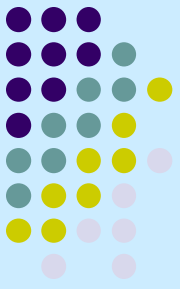


Dry storage with control of MC

Orthodox seeds retain viability longer, when dried to low moisture content (4 – 8 %),
But seeds should be stored in a sealed container or room in which humidity is controlled,
Storage life is further prolonged if cool, but not controlled, temperature conditions can be provided, e.g. at high latitude or altitude and in a cellar or other room screened from direct sunlight.

Seed stored in open containers in room maintained at RH of
15 – 20 % by dehumidifying machinery.
It is cheaper than using a humidity-controlled room.
This method is suitable for many species.

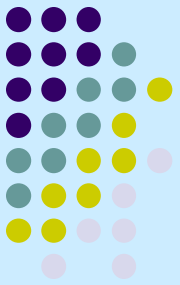
Dry storage with control of both MC and temperature



Standard practice for many orthodox species.

For many species a combination of 4 – 8 % MC and 0 to 5° C tempt. maintains viability for 5 years or more.

Some cool-temperate genera benefit by storage at sub-freezing temperatures too.



Dry storage for long-term gene conservation

Preferred storage treatment for long-term conservation of gene resources of orthodox seeds is -18°C and $5\% \pm 1\% \text{ MC}$.

Moist storage without control of MC or temperature

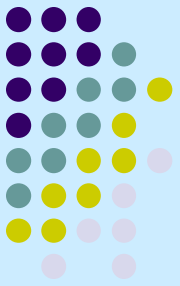
For storage of recalcitrant seeds for few months over winter.

Seeds may be stored in heaps on the ground, in shallow pits in well-drained soils or in layers in well ventilated sheds,

Seeds stored outdoors are kept moist by rain or snow, but those under shelter may need to be moistened periodically

The aim is to maintain moist and cool conditions, combined with good aeration to avoid overheating which may result from the relatively high rates of respiration associated with moist storage.

suitable for tropical recalcitrant species because ambient temperature is too high.





Moist cold storage, with control of temperature

Controlled low temperatures just above freezing or, just below freezing.

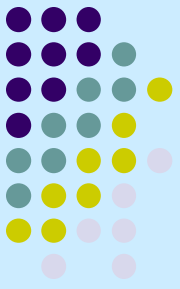
Moisture can be controlled within approximate limits by adding moist media e.g. sand, peat or a mixture of both to the seed, in the proportions of one part media to 1 part seed by volume, and remoistening periodically, by controlling the relative humidity in the cold store.

Here Respiration rate is reduced and storage life prolonged by the low temperature, but seed should not be stored in sealed gas-proof containers which would limit oxygen supply.

Conditions

- Closed polyethylene bags of 4 – 10 mil (100–250 microns)
- temperate recalcitrant genera and
- temperatures of 0 – 5° C

Extends viability up to 1 ½ to 2 years.



Other methods

Storage of recalcitrant seeds in running (not stagnant) water.

Storage under partial vacuum.

Storage in gases other than air e.g. nitrogen or CO₂.

Coating individual large seeds with paraffin or latex to prevent moisture exchange. This method is highly suitable for recalcitrant seeds to maintain moisture content during storage.



Modified atmospheric storage

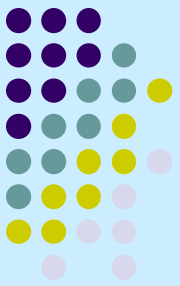
Air-tight storage - maintaining the quality of seed and protect seeds from pest and diseases.

Little air in the container exhausted by respiration of seeds and insects.

The limited air cannot support the respiration of insects, which eventually die out.

Also it prevent further insect development by creating a low oxygen, high CO₂ atmosphere lethal to insects already present inside the container.

Also inhibits the growth of molds as well as deterioration of the commodity by protecting it from the high outside relative humidity levels that prevail in hot humid climates.



The MA achieved by

- (i) by adding gaseous or solid CO₂,
- (ii) by adding a gas of low O₂ content or
- (iii) by allowing metabolic processes within an airtight storage to remove O₂, usually with associated release of CO₂

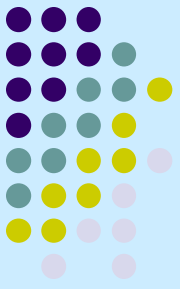
Factors affecting MA

- temperature and moisture content of the seeds,
- species and storage life of pests,
- gaseous composition,
- uniformity of gas distribution and
- exposure time of the MA treatment.

Bera et. al. (2004) - complete control of *Rhizopertha dominica* and *Corcyra cephalonica* in storage seeds - 20% CO₂.

Major limitation

High initial cost of airtight storage structures and sealing the existing structures to the desired airtightness.



Seed sampling

Objectives

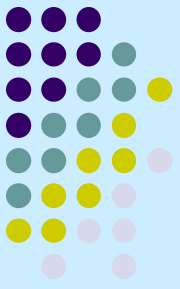
To obtain a sample of a size suitable for tests, in which the probability of a constituent being present is determined by its level of occurrence in the seed lot.

Seed Lot

Specified quantity of seed physically identifiable and homogenous from which a representative sample can be taken

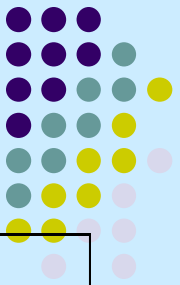
Sample

Definite quantity that is a true representative of seed lot taken for testing - components are same as that of seed lot.



Criteria for Seed Lot

- ❖ It must be homogenous
- ❖ Of same variety, same season, same producer
- ❖ Moisture must be homogenous
- ❖ Must be found in same place
- ❖ Must be kept in similar containers
- ❖ Must be accessible for sampling



Definition seed lot quantity (International Seed Testing Association, 1985)

5000kg	seeds of size less than or equal to <i>Fagus</i> sp. and <i>Quercus</i> spp.
10000kg	seeds of agricultural and horticultural crops of size \leq to wheat / rice
20000kg	seeds of agricultural and Horticultural crops of size \geq to wheat / rice
40000kg	seeds of maize and larger and for vegetatively propagated material

General Procedures

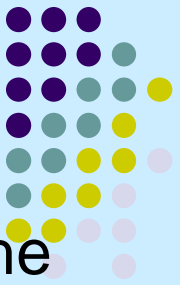
A. To secure a representative sample, equal portions must be taken from evenly-distributed parts of quantity of seed to be sampled. Access must be had to all parts of that quantity.

B. For free-flowing seed in bags or bulk, a probe or trier long enough to sample all portions of the bag or bulk must be used.

C. Non-free-flowing seed, such as chaffy grass seed, which is difficult to sample with a probe or trier, must be sampled by thrusting the hand in to the bulk and withdrawing representative portions.

D. As the seed is sampled, each portion must be examined. If there appears to be a lack of uniformity, the portions must not be combined, but must be retained separately for laboratory analysis. If the portions appear uniform, they may be combined to form a composite sample.





Sampling instruction

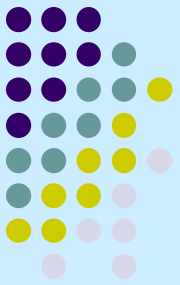
Person taking sample has to get permission from the owner of the lot in writing

Take three representative samples.

One sample - sent to the seed testing lab,

Second one - handed over to the owner after getting due acknowledgement

Third one - retained with the person responsible for sampling.



Types of sample

(i) Primary sample

Sample drawn from the lot at random

first handful of sample if done manually, trier full of sample if done using trier.

(ii) Composite sample

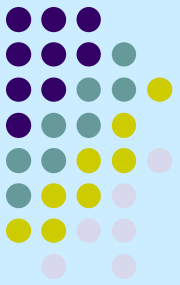
The primary samples are thoroughly mixed and combined to form composite sample.

(iii) Submitted sample

Sample submitted to the Seed Testing Lab – Obtained from composite sample.

(iv) Working sample

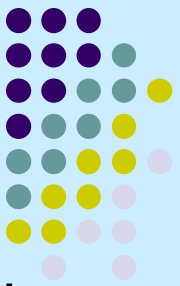
Obtained from submitted sample after through mixing and dividing - used to conduct tests like germination and purity.



Sampling methods

Seeds lots are generally composed of free flowing seeds like wheat, rice, legumes etc. but some lots like those of cotton, grasses, tomato and carrot have seeds that are non-free flowing.

Based on this criterion, the sampling methods differ.



Hand sampling

Hand sampling is done in case of non-free flowing seeds.

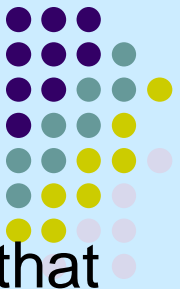
Mechanical sampling

Mechanical sampling is done using triers.

Triers are long, hollow tubes with pointed end that can hold seeds.

Automatic sampling

Processing machines have automatic sample collectors that regularly collect sample while seeds are being processed.



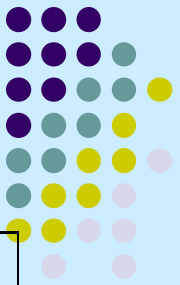
Sampling intensity

Sampling intensity is total number of primary samples that should be taken from a lot / containers.

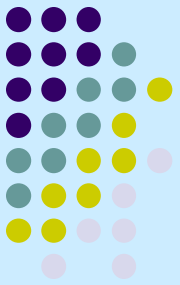
The primary sample should be of equal quantity.

Sampling intensity differs between bulk seed lot and those that are packed in containers

Sampling intensity for bulk sampling

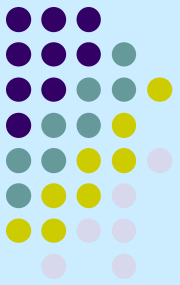


1	< 50kg	Three primary samples
2	51 – 500kg	One primary sample for every 100kg and at least five samples
3	501 - 3000kg	One primary sample for every 300kg and not less than 5 primary samples
4	3000 – 20,000kg	One primary sample for every 500kg and not less than 10 primary samples
5	20,000 kg and above	One primary sample for 700kg and not less than 40 primary samples



Sampling intensity for container / bag sampling

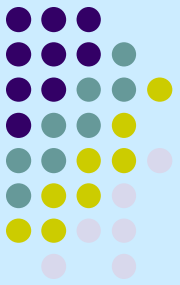
1	1 to 5 bags / containers	Sample all containers maximum 5 primary samples
2	6 to 30 bags / containers	One primary sample for every 3 containers minimum 5 samples
3	31 to 400 bags / containers	One primary sample for every 5 containers minimum 10 samples
4	400 and above	One primary sample for every 7 containers minimum 40 primary samples



Very small containers

Containers having flower and vegetable seeds can be bulked to form lot size of 100kg and should be treated as bulk

Five primary samples can be taken @ one primary sample for every 100kg.



Sampling equipments

Sampling is done using triers like nobbe trier, stick or sleeve trier or bin triers for bulk seeds

Limitation in using triers

Different insects preferentially attack different commodities and consequently inflict greater damage

When insects are present in low numbers and are unevenly distributed, sampling triers are likely to give an inadequate assessment of the infestation,

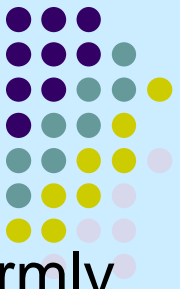
The sampling size required to give an accurate assessment of the infestation is often laborious.

The sample taken is rarely a random sample, due to the difficulty of sampling from the central portion of the stack.

Sampling spears damage sacking and consequently create potential for more spillage

Samples taken from individual bags is rarely a random sample or truly representative of the condition within the bag.

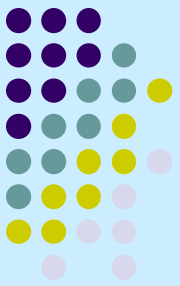




Insects do not distribute themselves randomly or uniformly in any container of grain. They are most often found in pockets associated with dust, broken grain, and foreign materials towards the bottom or in areas of localized heating or wetting.

Large population crawling on the bottom could be completely missed, if samples are not taken from bottom layers

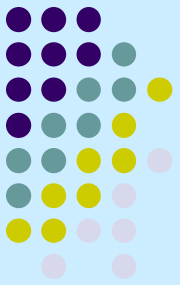
Alternatively, small pockets of insects within the bulk maybe, by chance, included in a spear sample.



Compartmental triers

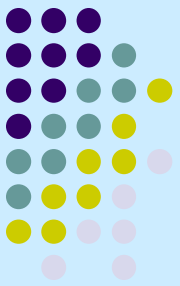
To obtain more representative samples, a sectional probe should be utilized. These are available in sizes suitable for bags, or in larger sizes for probing deeper piles in bins, sheds, transport vehicles, etc.

For larger samples in bulk grain, suction samplers consisting of a small hollow spear, hollow extension rods and suitable end attachments for the connection of an industrial type vacuum cleaner are adequate for drawing samples from up to 10 m below the surface.



(i) bag snaking:

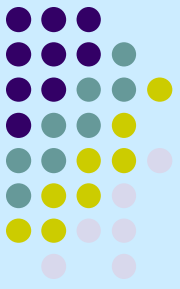
A number of bags maybe emptied by pulling the open bag backwards over the floor surface, allowing a small stream of grain to flow out gradually. Most visible insects will be concentrated in the latter portion and will be readily observed at the sides of the band.



(ii) coning and quartering:

Simple and cheap method of obtaining highly representative samples

But suffers from time and capacity constraints.



(iii) sieving:

"Hand held sieves" are useful in assessing the dust content and live insects from small samples.

Different-sized mesh openings can be used for different particle size, or a combination of appropriate sizes can be used for mixed commodities varying in particle size.

Seed Standards for Insect Damage

A seed lot under certification shall not have visible evidence of damage by insects in excess of

1.0% for the seeds of maize and legumes and

0.50% for the seeds other than maize and legumes

