JUST AGRICULTURE
multidisciplinary e-Newsletter

Germplasm Conservation of Vegetable Crops and Factors Affecting the Seed in Storage

M. S. Kanwar
High Mountain Arid Agriculture Research Institute (SKUAST-K), Leh (UT Ladakh)-India

ARTICLE ID: 22

Introduction:

The nature of the material to be conserved and the objectives of conservation would decide the strategies of conservation. The length of life cycle, mode of reproduction, number and size of individual plants to be conserved and evolutionary status (wild or domesticated) of the material determine the mode of conservation.

Conservation can be classified into 2 major categories:

1. In situ
2. Ex situ

The latter can further be divided into 5 sub categories:

a. Long term seed storage
b. Mass reservoir of composites
c. Field conservation
d. Cold storages freeze preservation of vegetative parts
e. In-vitro conservation

i) **In situ conservation**: In this approach, species are conserved in their natural state through the establishment of natural or biosphere reserves, national parks or by special legislation to protect endangered or threatened species. In this system, wild species and the associated natural ecosystem are preserved together to maintain the genetic integrity of the population and to allow natural evolution. This approach is not suitable for cultivated forms as there is no natural ecosystem to support them.

ii) **Ex situ conservation**:

a) ***Seed gene banks***: It is most practical and the cheapest method of conservation of genetic resources of species through long term cold storage of seeds. Only orthodox seeds which can tolerate a decrease in moisture content under low temperature could be stored in this way. Recalcitrant seeds on the other hand, do not withstand drying below relatively high

JUST AGRICULTURE
multidisciplinary e-Newsletter

moisture content without a serious loss of viability. Depending upon storage, 3 types of conservations are there:

- **Base collections:** Comprise long term stored materials disturbed only for regeneration purpose. Base collections contain seeds with 5±1% moisture content placed in sealed containers and stored at -18^0 to -20^{0}C.
- **Active collections:** Comprise medium term (10-15years) storages and used for regeneration, multiplication, distribution, characterization and documentation purposes. Temperature and moisture are kept 0^{0}C and 8%, respectively.
- **Working collections:** Comprise the genetic resources regularly used by the plant breeders, pathologists, entomologists etc. without the responsibility of maintaining them.

During storage in gene bank, it is necessary to control temperature and humidity to maximize the longevity of seeds. Harrington (1963) indicated that seed longevity is doubled for each 5^{0}C fall in temperature or for each 2% drop in moisture content. He called it as 'thumb rule'.

b) **Mass reservoir:** Simmonds (1962) suggested the use of mass reservoirs as a mean of long term conservation. Such reservoirs remain under an evolutionary stage. Mass reservoir originating from intermating a set of parents, constitute a created genepool.

c) **Field gene banks:** Perennial tree crops produce recalcitrant seeds and some of them even cannot be multiplied vegetatively. Hence, such spp. are to be conserved as living field collections. In most cases, these are unrepresentative of genetic variability range and most of them don't constitute more than a fraction of the variability which should be conserved for the future.

d) **Cold storage & freeze preservation of vegetative parts:** Rhizomes, corms, tubers, and cuttings are usually short lived and deteriorate fast after collection, unless stored under appropriate conditions. Methods of medium and long term storage such as cryo-preservation and in-vitro conservation can be utilized for vegetative propagated species.

e) **In vitro conservation:** Especially important for spp. which can't be conserved through orthodox seeds or whose seed production is very poor. The material can be stored at ultra low temperature of liquid nitrogen (-196^{0}C), thus giving high genetic stability and very long regeneration cycles. In-vitro culture technique avoids the need of going through

JUST AGRICULTURE
multidisciplinary e-Newsletter

sexual cycle of about 10to20 years in several tree species. However, the technique is applicable only to that spp. for which regeneration techniques are fully standardized.

Factors affecting seed in storage:

1. **Kind/variety of the seed:** Some kinds are naturally short-lived, e.g. onion, soyabean, peanuts etc. Genetic makeup of the lines/vars in the same kind also influences storability.
2. **Initial seed quality:** It has a direct relationship with longevity of the seed in storage. Only high quality seeds should be carried over.
3. *Moisture content*: It is probably the most important factor influencing the seed viability during the storage.
4. **Relative humidity and temperature in storage:** Seed attains rather specific and characteristic moisture content when subjected to given levels of atmospheric humidity. Maintenance of seed moisture content during storage is a function of relative humidity, and to a lesser extent, of temperature
5. **Provenance:** Samples of seed obtained from different sources may show differences in viability behaviour.
6. **Fluctuation in environmental conditions:** Fluctuations in environmental conditions are harmful.
7. **Extreme storage conditions:** The seed may loose viability due to germination (very high moisture), freezing injury or extreme dessication.
8. **Oxygen pressure:** Increase in pressure of oxygen tends to decrease the period of viability. Starch phosphate is very effective in prolonging the storage life of okra and onion.
9. **Activity of storage organisms:**To keep the activity of these organisms at a minimum, seeds should be stored at minimum moisture level possible, and in no conditions at more than 8%. There should be no openings which could help the birds and rodents to enter the store.
10. **Storage in transit and retailer's store:** Adequate precautions at all these stages are also necessary because it does little good to construct excellent warehouses if the seeds lose their viability due to improper storage during transit, retailing, or at the user's farm.