

## REQUISITES OF SAFE SEED STORAGE

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Whether a seed will grow when removed from storage depends upon several factors. Of course the conditions under which the seeds are stored are important but equally if not more important is the treatment that the seed received prior to being placed in storage. Seed can be no better after storage than it is before storage.

Let us look at a few of the pre-storage factors which have an effect upon the storability of seeds. Environmental conditions during the growing season of the seed crop are important. If a seed crop is grown under conditions of poor nutrients, temperatures or moisture, chances are the seed produced will be of lower quality than a crop produced under favorable conditions. High quality seed will store better than low quality seed.

The environmental conditions in the period from seed maturity to harvesting can be damaging to the quality of seed which in turn determines its storability. Many crops, especially those of indeterminate flowering habit, mature differentially. With crops such as cotton, some seeds will reach maturity 6 weeks to 2 months before other seeds on the same plant. After reaching maturity, seeds exposed to adverse conditions in the field will deteriorate in vigor and viability. In order to produce seeds which will store well, they should be harvested as soon after maturity as possible. Immature seeds will also be lower in vigor and viability than will those which are fully mature.

Mechanical damage to seeds during harvesting and processing can affect their storability. Seeds which are injured are more likely to deteriorate during storage than are sound seed. Improper setting and operation of combines or harvesters, cleaning equipment, scarifiers, dryers, or conveying equipment may be sources of mechanical damage to seeds. This injury should be kept to a minimum.

Efforts should be made to insure that freshly harvested seed does not "heat" or absorb excessive amounts of moisture. Seed should be carefully dried as soon as possible after harvest to minimize post harvest damage.

Field infestations of insects and diseases can cause considerable damage to seeds in the field, as well as being a source of contamination in actual storage where further damage is likely to occur.

Let us now consider some of the factors affecting seed during actual storage. The factors of most importance are, of course, temperature and moisture. High temperatures and seed moistures tend to increase respiration of the seeds which in turn increases deterioration. High levels of moisture and temperature are also conducive to rapid growth of disease organisms and injurious insects. It is generally agreed that a low moisture level of seed will

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compensate for a high temperature and vice versa. However, if both moisture and temperature are at high levels in the storage environment, seed deterioration may be expected to be very rapid.

Of these two factors, temperature and moisture, moisture is the easiest and most practical to control. Efficient drying procedures have been developed for many crops which enable seeds to be dried down to a level which is safe for storage.

There are several types of storage conditions available and several means of controlling the storage environment. First, uncontrolled or open storage, is the type most commonly used by seedsmen today. Seed is stored either in textile bags or in bulk in warehouses with no control of temperature or moisture. This type of storage is dependent upon the environmental conditions of the location for its success. In the far Western areas where humidities are low, this type of storage can be very successful and seeds may be carried over several seasons with very little deterioration. In the more humid regions of the country, as in the Southeast, seed deterioration may be very rapid, and storage with no loss in quality may be limited to only a few months.

In an attempt to prolong safe storage time in the less favorable storage areas, several ways have been developed for controlling the storage environment. One of the first methods tried was temperature control or cold storage. This method has been useful in prolonging the storage life of seeds but has its disadvantages. The method tends to be expensive and is therefore limited to seeds of high value. Also, if humidity is not controlled, seed while in cold storage will pick up moisture and when removed from storage will deteriorate very rapidly. For this reason they must necessarily be planted very soon after removal from cold storage. This limits the usefulness of this system.

Seeds have also been stored in humidity controlled rooms with no temperature control. This method is very effective and does not have the disadvantages of the previous system. It is however, expensive to operate.

Ideally, the best system of course is one in which both temperature and humidity are controlled. This system is quite costly but very effective. It is used to a limited extent today mostly for high priced seeds, such as breeding materials and foundation seed stocks.

A more practical approach to controlling the storage environment is rapidly gaining favor. In this method, seeds are dried down to a level which has been determined to be safe for sealed storage, then packaged in moisture-proof containers. The advantages of this system are obvious: costs are reduced over other controlled methods and much more versatility in seed movement is possible. The seeds are protected up until the moment of planting.

Basically three types of containers are being used for moisture-proof packaging. The first to be used was sealed tin cans. This container is very effective but is limited to those seed kinds which are normally packaged in small containers such as vegetables and tobacco.

Containers being used for field seeds, which are normally packed in larger containers, include polyethylene bags and various types of multiwall paper bags with moisture barriers. These barriers may be free polyethylene films, polyethylene-coated papers, laminated polyethylene-aluminum foil paper, or asphalt laminates. Some of these barriers are essentially moisture-proof while others may be classed as moisture resistant, that is some exchange of moisture vapor will occur through them.

A survey of the literature was made concerning safe moisture levels of various kinds of seeds. This information is presented in Table 1. The first column lists the seed kind, the second column lists the moisture content safe for sealed storage and the third column lists the literature citation from which the information was obtained.

One precaution which should be rigidly observed is not to package seed in moisture-proof containers which is above the safe moisture content. Seeds sealed in these containers at a higher than safe moisture level will deteriorate much more rapidly than if they were stored under open storage conditions.

Many improvements have been made in methods of storing seeds in the past few years. Currently, it is a subject which is receiving a large amount of attention from researchers throughout the country. It is reasonable to believe that in the future, better methods of seed storage will be made available to the seedsman.