# BASIC CAUSES OF POOR STORAGE AND REFRIGERATED DEHUMIDIFICATION

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For many decades, the retention of seed viability has been of major concern to seedsmen, plant breeders, nurserymen, farmers - in fact anyone who is concerned with plant life has been faced with the problem of the preservation of seed life. The major factor involved in the retention of seed viability is seed storage. Without a proper storage environment, the task of preserving seed life is impossible.

Before we delve any deeper into the area of seed storage, let us examine one of the prime prerequisites for good seed storage and that is, first of all, you must start with top quality seed. Conflicting seed storage data commonly occurs because of a difference in the vigor level of the seed to begin with. Although germination percentages of various lots of the same seed type may be comparable, a large variation may exist within these same lots as to the degree of seed vigor which each possesses. Consequently, different storage research data will be obtained when these lots of seed are placed under identical storage conditions. Therefore, to realize the maximum benefit from your storage facilities, you should start with high quality seed.

Table 1 shows different seed equilibrium moisture contents at 75° F. and various relative humidity percentages.

Table 1. The effect of various levels of relative humidity upon seed moisture equilibrium at 75° F.

| Seed | Relative Humidity (%) | | |
|---|---|---|---|
| | 55 | 70 | 85 |
| Reed Canarygrass | 11.4 | 12.1 | 15.4 |
| Orchardgrass | 10.0 | 11.1 | 14.9 |
| Sudangrass | 10.8 | 11.8 | 15.6 |
| Kentucky Bluegrass | 9.7 | 11.3 | 16.4 |
| Crown Vetch | - | 9.9 | 18.1 |
| Sweet Clover | - | 9.3 | 18.3 |
| Red Clover | - | 9.1 | 18.7 |

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The two main "demons" in seed storage are relative humidity and temperature. The moisture content which seed will attain during storage is dependent on these two factors. A storage environment which is characterized by a high temperature plus a high level of relative humidity will result in a high seed moisture equilibrium. Consequently, seed deterioration will be very rapid under these conditions.

As noted from the results in Table 2, relative humidity has a more pronounced effect on seed storage than temperature. However, it should also be kept in mind that an interaction does exist between temperature and relative humidity insofar as seed longevity is concerned.

Table 2. Germination percentages of sorghum seed after various intervals of storage at different temperatures and relative humidities.

| Relative Humidity % | Temperature °F. | Months of Storage | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | 0 | 2 | 4 | 6 | 8 | 10 | 12 |
| 20 | 50 | 95.2 | 93.5 | 94.2 | 95.7 | 95.7 | 94.7 | 96.5 |
| | 68 | 95.2 | 94.0 | 94.2 | 94.7 | 95.0 | 96.5 | 95.7 |
| | 86 | 95.2 | 93.2 | 92.5 | 95.2 | 93.0 | 94.0 | 94.5 |
| 40 | 50 | 95.2 | 94.2 | 93.7 | 95.0 | 95.0 | 96.2 | 95.0 |
| | 68 | 95.2 | 93.0 | 93.7 | 92.7 | 93.7 | 93.0 | 94.7 |
| | 86 | 95.2 | 93.0 | 93.7 | 95.5 | 93.2 | 95.2 | 92.0 |
| 60 | 50 | 95.2 | 93.2 | 93.2 | 95.2 | 93.5 | 94.5 | 97.2 |
| | 68 | 95.2 | 92.2 | 94.5 | 94.7 | 95.0 | 93.7 | 92.2 |
| | 86 | 95.2 | 92.5 | 94.2 | 89.2 | 89.5 | 86.2 | 75.2 |
| 80 | 50 | 95.2 | 92.7 | 92.3 | 56.7 | 47.5 | 44.5 | 38.0 |
| | 68 | 95.2 | 56.5 | 47.2 | 39.2 | 10.5 | 0.0 | 0.0 |
| | 86 | 95.2 | 45.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 100 | 50 | 95.2 | 85.5 | 44.0 | 22.7 | 0.0 | 0.0 | 0.0 |
| | 68 | 95.2 | 41.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 86 | 95.2 | 1.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |

Control of the relative humidity in a seed storage area can be accomplished in one of two ways. One of these methods is by dessicant type dehumidification and the other is by mechanical refrigeration.

Refrigeration dehumidification operates on basically the same principle as to why moisture will accumulate on the outside of an ice tea glass. If a given surface is at a sufficiently low temperature, moisture vapor present in the atmosphere, which the surface is in contact with, will deposit as a liquid on this surface. This temperature is referred to as the dewpoint. The dewpoint of an atmosphere is reached by simply cooling the air without changing its water vapor content.

Table 3. The effect of temperature and relative humidity on dewpoint.

| Temperature °F. | Relative Humidity | Dewpoint °F. (Approx.) |
|---|---|---|
| 60 | 60 | 46 |
| 50 | 60 | 37 |
| 40 | 60 | 28 |
| 30 | 60 | 19 |
| 60 | 30 | 29 |
| 50 | 30 | 21 |
| 40 | 30 | 13 |
| 30 | 30 | 5 |
| 60 | 10 | 6 |
| 50 | 10 | 0 |
| 40 | 10 | -7 |
| 30 | 10 | -16 |

The temperature of the cooling coils on your refrigeration system must be at or below the dewpoint temperature before you will get any drying or dehumidification effect. For example, if you had a storage atmosphere which you desired to maintain at temperature of 50° F. and 60% R.H., the temperature of the cooling coils must be at 37° F.

If the dewpoint of the coils is required to be below 32° F. to attain the desired level of temperature and relative humidity, then it will be necessary to periodically remove the moisture, which will accumulate in a solid state from the coils. This can be accomplished by installing a heating arm near the cooling coils. This heating arm should be activated periodically to melt the ice which has formed on the coils.

Remember, most seed can be safely stored for considerable periods of time if the storage atmosphere which the seed are in contact with is maintained at a proper temperature and relative humidity.