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BASIC CONSIDERATIONS OF SEED STORAGE

James D. Helmer 1/  

The maintenance of seed viability during storage is a major problem encountered in many areas of the world. In the United States, the humid Southern region is frequently a troublesome area for safely storing seed in open warehouse storage for any length or period of time. For seed to maintain high viability and vigor during storage, a suitable storage atmosphere must be maintained. The two major components of the storage atmosphere which influence seed longevity are relative humidity and temperature. Both of these factors influence the seed moisture equilibrium, with relative humidity the most influential. If this moisture equilibrium is too high, seed deterioration is usually rather rapid.

Two methods may be used to control the moisture equilibrium of seed during storage. One of these methods is to store the seed in a controlled environment. Such an environment is attained by controlling the temperature and relative humidity. For cottonseed, moisture equilibriums at various levels of relative humidity are as follows:

Table 1. Equilibrium Moisture Contents of Whole Cottonseed, Meats, Hulls, and Oil-Free Meats at Various Relative Humidities at 25°C.

<table>
<thead>
<tr>
<th>R.H. (%)</th>
<th>Whole Cottonseed</th>
<th>Meats</th>
<th>Hulls</th>
<th>Meats Oil-Free</th>
</tr>
</thead>
<tbody>
<tr>
<td>31.0</td>
<td>6.03</td>
<td>5.13</td>
<td>7.67</td>
<td>8.32</td>
</tr>
<tr>
<td>43.0</td>
<td>7.23</td>
<td>5.92</td>
<td>9.60</td>
<td>9.33</td>
</tr>
<tr>
<td>62.0</td>
<td>9.25</td>
<td>7.73</td>
<td>11.85</td>
<td>12.11</td>
</tr>
<tr>
<td>71.2</td>
<td>10.27</td>
<td>8.89</td>
<td>12.62</td>
<td>13.72</td>
</tr>
<tr>
<td>81.1</td>
<td>13.21</td>
<td>11.73</td>
<td>15.31</td>
<td>18.29</td>
</tr>
<tr>
<td>93.0</td>
<td>22.19</td>
<td>21.40</td>
<td>22.35</td>
<td>32.80</td>
</tr>
</tbody>
</table>

Data by Karon (2)

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What is a safe moisture level for the storage of cottonseed? This will vary depending on the temperature and moisture content of the seed during storage. Storage of cottonseed for six years at 8 - 10 percent moisture was found by Christides (1) to be non-detrimental on seed germination at temperature from 1 to 32°C. Simpson (4) has reported that cottonseed with a moisture content of less than 13 percent did not deteriorate in germination after 15 years storage when stored at 33°F, when the moisture content was 13 percent, full viability was retained for 13 1/2 years.

These examples clearly indicate one point concerning seed storage -- that is the higher the seed moisture content, the lower the temperature must be for safe storage and visa versa. Some general "rules of thumb" on seed storage may well be in order at this point. One of these rules states that if you lower the seed moisture content by one percent, you will double the life of the seed, or if you lower the storage temperature 10°F., you will also double the life of the seed. Theoretically then, according to this rule, the longevity of seed stored at 10 percent moisture and 60°F. should be four times greater than comparable seed stored at 11 percent moisture at 70°F.

The other rule of thumb is that for good safe storage, the numerical value of the temperature, in degrees fahrenheit plus the percent relative humidity should be approximately 100. Under conditions at which this value is obtained, say for example 60 degrees R.H. and 40°F., no problem should be experienced in maintaining seed viability over prolonged periods of storage.

Another method of controlling the moisture equilibrium of seed in storage is to dry the seed to a safe storage moisture level and then package in a moisture proof container. Once the seed are inside the container, the seed moisture content should never change, regardless of the environmental conditions which surround this storage container. However, the moisture content at the time of packaging is very important. If this moisture content is too high, seed deterioration will proceed more rapidly than it would have if the seed were stored in some type of porous or open container. A good example of this is indicated in some work by Simpson (3) wherein cottonseed stored at six to eight percent moisture in sealed jars remained high in germination for seven years, whereas cottonseed stored at 11 percent moisture in sealed jars was worthless after two years.

In summary, I would like to point out what items of information are necessary before one can adequately answer the question - "at what moisture content should seed be stored"? First, the kind of seed must be known. Seeds differ in chemical composition and many times the chemical composition has a great influence on the longevity of seed at a given moisture level. For example, seed high in oil content will not store as well as "non-oily" seed,
if both types of seed are maintained at the same moisture level. Why? Because oil is not an imbibant of moisture and consequently, seed containing 20 percent oil which test 10 percent moisture are actually 12.5 percent in moisture content if the oil percentage is discounted. Secondly, one must know whether the seed are to be stored in a moisture proof or open, porous type container. Normally seed can be safely stored at a higher initial moisture content in non-moisture proof containers, because of the free transmission of moisture vapor from the inside of the bag to the surrounding atmosphere. Therefore, a certain amount of drying can occur when seed are stored at a relatively high moisture content in non-moisture bags, if the storage environment is such that the vapor pressure inside the bag is higher than the vapor pressure in the surrounding atmosphere.

Third, some knowledge concerning the storage conditions is necessary. If some type of refrigeration is available, seed can then be stored at a higher moisture content than if no refrigeration is available.

Finally, the length of storage desired must also be known. If seed are to be stored for several years, then the moisture content necessary to maintain high germination over this period of time would be different than the moisture content necessary for safely storing these seed for only 6 months.

Literature Cited