Salahaddin University - Erbil

College of Agricultural Sciences Engineering

Food Technology Department

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Cereal Technology (Practical)

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**Lecture 4**

**Moisture management for safe storage**

Unless unusual steps taken or abnormal conditions occur, all cereal grains contain some moisture. In this context, a difference in moisture content of 1% for any cereal grain can be translated into roughly a difference of 1% in the value of that grain. However, the moisture content is not essential only from an economical aspect, but it also important for the stability and sage storage of any cereal as well. On the other hand, temperature and time (duration of storage) are also significant variables that can affect the rate of fungal growth. Grains, like most other foods, could be stored better at lower temperatures. However, moisture control is practically paramount for ensuring safe storage.

Hence, it is obvious that different cereals have different maximum moisture levels for safe storage. For the majority of grains, these levels are: 12-13% for rice; 13% for barley, maize, oats, and sorghum; and 14% for wheat. However, the maximum moisture varies according to the temperature, uniformity of moisture in the mass, and other factors. Above the maximum levels quoted above, fungal growth begins. Between these maximum levels and about 20% moisture, a small increase in the moisture level greatly increases the rate of fungal growth and also changes the number and type of species that develop.

In fact, it becomes clear that it is not the moisture content, but the water activity, that controls the onset of fungal growth.

**Functional changes and indices of deterioration**

Several tests have been used to measure the condition of grain and thereby predict its future storage behavior. These tests include the evaluation of physical changes in the grain such as losing its natural luster and becoming dull in appearance. Also easily detected are changes in odor, such as acquiring in sour or musty smell.

One of the first signs of deterioration of grain is loss of viability. Thus, a germination test can be quite useful. As well as, this test could be useful also for grain that is to be used for seed or for malting. Additionally, the value of such tests could be used for predicting changes in grain which is used for feeding, bread making, or breakfast cereals. A biochemical test for seed viability (generally referred to as the “tetrazolium’’ test) is based on the reduction, by germ’s enzyme system, of 2,3,5-triphenyltetrazolium chloride. According to this test, the grain is still viable when a red coloration appears in the germ.

Several attempts have been made to develop a reliable and convenient biochemical test to determine storability of grain. These include assays of fat acidity and glutamic acid decarboxylase activity. Neither of these tests gives useful information for sound grain. However, during storage, particularly under non-ideal conditions, the value for fat acidity increases and that for glutamic acid decarboxylase decrease. Both tests appear to be useful to judge the storage condition of grain.

In grain trade, wheat that has suffered storage deterioration often is called “sick wheat”. The condition which is manifested by kernels in which the germ is dead and has turned dark and become fluorescent. Although darkening of the germ can occur with no fungal attack. The two are always found together in commercial samples, and the major cause of the loss of germination capacity is thought to result from the fungal attack.

A germination test is often the only test that a farmer can conduct on his seed before planting. Monitoring the time taken to germinate will also give an indication of vigor. This procedure is very easy, inexpensive and portable.

**Sampling**

To obtain a random sample for testing it is always best to take samples from different parts of the bag or container. If the grain to be tested is from a seed lot that contains more than one bag, samples must be taken from several bags. A good rule of thumb for determining how many bags to sample is to take samples from a number of bags that represents the square root of the lot size. For example, if the lot contains nine bags, then sample at least three bags. If the lot contains 100 bags, then sample at least 10 bags.

**Equipment and materials**

To conduct this test, you will need the following:

1. A waterproof tray.
2. A flat-sided water bottle, cut in half lengthwise, makes a good tray.
3. Water absorbent material. Tissues or cotton wool are ideal.
4. One hundred seeds.
5. Water supply.

**Procedure**

1. Place water absorbent material inside waterproof tray.
2. Take random sample from each seed lot and mix in a container.
3. Take at least three seed samples from the mixed grain.
4. Count out 100 seeds from each sample and place on absorbent paper inside the tray.
5. Carefully saturate absorbent material.

Each day check that absorbent materials remain moist and record number of germinated seeds. Do this for 10 days.

Compute germination test for five days and ten days

Rate of germination is an indicator of vigor. Rapid seed germination increases the chance that seed will establish in the field.

**Calculating germination rate**

Germination rate is the average number of seeds that germinate over the five-day and 10-day time period.

Germination (%) =

Example:

If 86 seeds germinated in a tray of 100 seeds:

Germination =

= 86%