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Grain Moisture Content Effects and Management

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Grain moisture content affects the quantity of grain, price discounts and premiums, as well as grain storability, so moisture content may affect economic return.

Moisture Content

Grain moisture content is expressed as a percentage of moisture based on wet weight (wet basis) or dry matter (dry basis). Wet basis moisture content is generally used. Dry basis is used primarily in research.

$$Mw \text{ (wet basis)} = \frac{w - d}{w} \times (100)$$

$$Md \text{ (dry basis)} = \frac{w - d}{d} \times (100)$$

w = wet weight
d = dry weight
M = moisture content on a percent basis

A representative sample must be obtained to provide a useful moisture content evaluation. Also, the moisture content of the product must be maintained from the time the sample is obtained until the determination is made by storing in a sealed container.

The moisture content can be determined by an oven method, which is a direct method. The grain is weighed and dried, then weighed again according to standardized procedures. The moisture content is calculated using the moisture content equations. Most moisture meters measure the electrical properties of grain, which change with the moisture content. This is considered an indirect method and must be calibrated by a direct method. It is important to follow moisture meter directions carefully to achieve an accurate moisture test. A moisture meter should be periodically checked to see if it is accurate. One method of checking the meter is to compare it to at least two other meters.

Grain Quantity

Changing the moisture content of grain changes its weight. This change is normally called "shrink" when grain is dried. The moisture shrink is calculated using the following equation.

$$\text{Moisture Shrink (\%)} = \frac{Mo - Mf}{100 - Mf} \times 100$$

Mo = original or initial moisture content (%)
Mf - final moisture content (%)

The moisture shrink when drying sunflower from 15 percent to 10 percent moisture content is:

$$\text{Moisture Shrink (\%)} = \frac{15 - 10}{100 - 10} \times 100 = 5.56$$

One hundred pounds of sunflower at 15 percent moisture would weigh 94.44 pounds after drying to 10 percent moisture [(100 lb – (5.56 percent x 100 lb)].

Many times a shrink factor is used to determine the amount of weight lost during drying. The shrink factor is the average shrink per point of moisture removed. In the sunflower example, the shrink was

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5.56 percent when the sunflower was dried five percentage points. The shrink factor then is 1.11 percent (5.56 divided by 5). The shrink factor depends on the final moisture content. Some shrink factors are listed in Table 1. If wheat is dried from 17.5 percent to 13.5 percent, the shrink factor is 1.1561 percent and the moisture shrink is 4.62 percent (1.1561 x 4 percentage points).

The same principle applies to moisture contents below the market standard. Wheat at 11 percent moisture has a moisture shrink factor of 1.1236. Therefore, wheat at 11 percent moisture rather than 13.5 percent will have a moisture shrink of 2.809 percent. Sixty pounds of wheat at 13.5 percent moisture content will weigh 58.31 pounds at 11 percent [60 – (2.5 x 1.1263 percent x 60)]. Table 2 shows the pounds of grain needed to equal a bushel at market standard moisture contents.

Table 1. Moisture shrink factors for drying grain to various moisture levels.

Final Moisture Content	Moisture Shrink Factor (% shrink per point moisture removed)
15.5	1.1834
15.0	1.1765
14.5	1.1696
14.0	1.1628
13.5	1.1561
13.0	1.1494
12.5	1.1429
12.0	1.1364
11.5	1.1299
11.0	1.1236
10.5	1.1173
10.0	1.1111
9.5	1.1050
9.0	1.0989
8.5	1.0929
8.0	1.0870
7.5	1.0811
7.0	1.0753
6.0	1.0638
5.0	1.0526
4.0	1.0417
3.0	1.0309
2.0	1.0204
1.0	1.0101
0	1.0000

The following equation shows the adjustment in quantity due to a change in moisture content.

$$\text{Adjusted Quantity} = \frac{100 - \text{Actual Moisture (\%)}}{100 - \text{Base Moisture (\%)}} \times \text{Measured Quantity}$$

One thousand pounds of wheat at 17.5 percent moisture would weigh 954 pounds at 13.5 percent.

$$\text{Adjusted Quantity} = \frac{100 - 17.5}{100 - 13.5} \times 1000 = 954 \text{ pounds}$$

Also, 1000 pounds of wheat at 11.0 percent moisture would weigh 1029 pounds at 13.5 percent.

$$\text{Adjusted Quantity} = \frac{100 \times 11}{100 - 13.5} \times 1000 = 1029$$

Sometimes the term "shrink" causes confusion because it is used to refer to things other than moisture shrink. When grain is handled through a facility, there will normally be losses due to dust, grain and foreign material that are spilled or grain that is damaged. Usually this is about 0.25 to 0.5 percent and is considered handling loss. Handling loss is often added to moisture shrink by the grain trade and called shrink.

A drying cost is required if wet grain is to be dried to the market standard. It will cause confusion if this is added to the moisture shrink and just labeled shrink. Grain at a moisture content above the market standard that is not dried prior to sale may be subject to a moisture discount that equals the sum of the moisture shrink and drying cost. Handling loss is also commonly included as part of the moisture discount by the grain trade.

Correct terminology helps to avoid confusion. Moisture shrink, handling loss, and moisture discount describe specific and different things.

The following example shows the various terms applied to 20,000 pounds of 15 percent moisture sunflower valued at $10 per hundredweight (cwt) with 2 percent foreign material.