Understanding Corn Test Weight

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Corn test weight (TW) is an often discussed topic of conversation among corn growers. The topic moves to the forefront in years when corn has been stressed at some point during the grain filling period or when the growing season is ended by frost before physiological maturity is reached. In many cases, the concept of test weight is misunderstood.

Test weight is volumetric measurement. An official bushel measures 1.244 cubic feet. To measure TW, we usually take the weight of some smaller unit of measure and make a conversion. The official minimum allowable TW for U.S. No. 1 yellow corn is 56 lbs. per bushel, while No. 2 corn is 54 lbs. per bushel. It's unknown how this all started hundreds of years ago, but perhaps it was easier and more fair to sell things based on volume (length x width x height), something a person could see, instead of weight. Today, of course, corn is sold by weight and often in 56-pound blocks that we, for some reason, still call a bushel. Because weight is contingent on moisture content, grain buyers base their price on a "standard" moisture of (usually) 15 or 15.5 percent.

Test weight and yield...

Sometimes high TW is associated with high grain yield and low TW is associated with low grain yield. In fact, there is a poor relationship between TW and yield. The same TW can exist across a wide range of yield environments and genetics. Similarly, there can be a wide range of TW values across the same high or low yielding environment. That said, high TW corn can result in a grower being paid for more "bushels." For example, there are more bushels (those 56 lb. blocks) of 58 lb. TW corn in a truck or bin than the same truck or bin with 54 lb. TW corn.

Factors influencing test weight...

Many factors influence the measured TW of corn. The **physical characteristics** of the kernel certainly come into play. These include such things as size, density, shape, and "slickness" of the outer kernel layer. **Hybrid** differences exist for TW, but a high-yielding hybrid may not necessarily be a high TW hybrid, and vice-versa.

Perhaps the most important relationship to understand is between **grain moisture** and TW. As kernel moisture decreases, grain TW increases. Why? The reason is two-fold: as grain dries it also shrinks allowing for more kernels to "pack" into a volume bushel (think of it as the equivalent of cramming defensive linemen into a phone booth versus cornerbacks). Additionally, dry corn is naturally more slippery, or slick, which tends to allow for better packing. In 2009, it's certain that corn will come off the field wetter than most years. Expect lower TW's from the moisture factor alone.

Exactly how much TW increases after it has dried is somewhat variable. Factors such as hybrid, mechanical condition of the grain, and drying temperature come into play. Grain with a high percentage of damaged kernels will increase less than high quality grain. Grain dried at temperatures in excess of 180 degrees will also have less of an increase. Table 1 shows the "average expected" increase in TW as corn grain dries to 15 percent.

Table 1. Increase in test weight during drying for mature corn harvested between 18 and 28 percent kernel moisture

Harvest Moisture Content	Increase in Test Weight
%	lbs/bu
18	1.5
20	2.0
22	2.5
24	3.0
26	3.5
28	4.0

Other major factors influencing final TW are **plant stresses** caused by diseases, insects, soil fertility and/or environmental conditions (e.g. drought, hail, and premature frost). In other words, anything that impacts the movement of nutrients to the kernel during grain fill or degrades the integrity of the kernel (e.g. ear rots and molds) once it is filled will lower grain TW's.

Test weight and immature corn...

What happens when corn doesn't quite make it to physiological maturity (black layer) before frost puts an end to the growing season? University of Minnesota researches conducted such a study several years ago. They collected immature ears and dried them at either 80 or 120 degrees. The results are presented in Figure 1 (KM=kernel moisture).

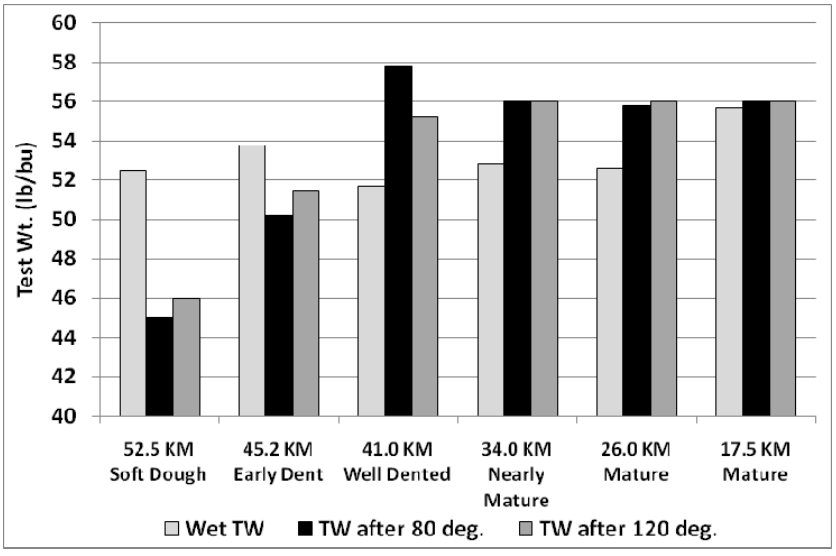

Figure 1. Wet and dry test weights for grain harvested at soft dough through mature kernel stages and dried to 15.5% moisture at 80 or 120 degrees (Hicks, 2004)

Kernels that were in the soft dough to early dent stages actually decreased in TW after drying. Immature corn that was well dented to mature (~52-53 lbs/bu initial TW), but with high moisture content, all approached 56 lb/bu TW's after drying.

In years when corn maturity is challenged, we can expect low TWs off the field simply because of moisture. Test weight after drying will increase, but the magnitude of the increase will depend on initial kernel moisture and overall grain quality. Generally speaking, the research suggests that feeding low TW corn (fed pound for pound) results in similar animal performance as high TW corn, however, the bin or silo may empty a bit more quickly.

References:

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