Grain Measures (Chondrometers)

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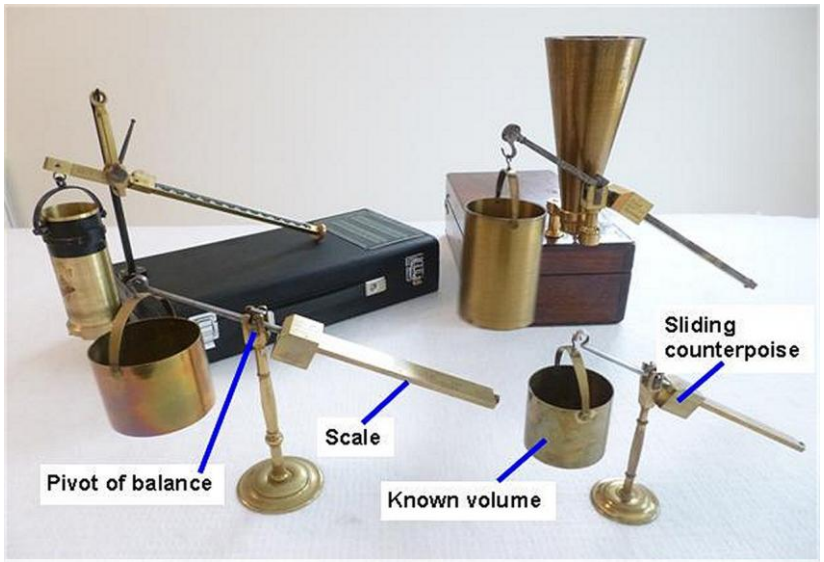
A chondrometer is a steelyard used to determine the weight of a bushel of grain, using only a small sample. 'Chondro-' is said to be derived from the Latinised form of Greek khondros meaning grain, hence a chondrometer is a grain measure.

The author's collection of chrondrometers, varying in volume from 0.15 to 0.5l.



Chondrometers were developed in response to the 'Act for Ascertaining and Establishing Uniformity of Weights & Measures' of 17 June 1824, which came into force on 1 January 1826. The act, in part, served to define the Imperial gallon as the standard unit of volume for liquids and dry goods. With regards to trading dry goods such as wheat, barley, and oats the ***bushel*** (equal to 8 Imperial gallons) became the standard unit for buying and selling purposes. As the quality (density and size) of cereals can vary, then also the weight for a given volume can vary. The chondrometer was developed in order to calculate the weight per bushel (bushel weight) from a small sample. This allowed a trader (or miller) to gauge the quality of the cereal.

Bushel weight (alternatively referred to as specific weight or test weight per volume) is a function of packing efficiency (the percentage of the bulk volume occupied by the grain) and grain density. The value is influenced by shrivelled grains, grain shape, and surface characteristics such as brush hairs, and surface condition which can be rough or smooth. A high bushel weight indicates large dense grains with lots of endosperm in them, which is good for producing white flour. A low bushel weight would indicate small thin even shrivelled grains, with lots of corresponding surface area of bran and low amounts of endosperm. This would not be ideal for white flour extraction.

Grain moisture and bushel weight are related in that as moisture decreases, test weight increases. One reason why test weight increases as the grain dries is that dry grain packs

together more easily than wet grains. Additionally, as moisture decreases, the grains shrink and this allows for more grains to fill a volume.

Events that may occur during the grain-filling period of the plant growth will influence the test weight. Factors that decrease the rate or duration of grain fill can result in lower test weights at harvest. Included among these factors are excessive soil moisture, lack of sunlight, drought, frost, hail, temperature extremes, nutrient deficiencies, and insect damage to leaf and stem tissue.

Bushel weight is normally determined after mechanical cleaning of the wheat has taken place. Originally in the UK its value was expressed in ***pounds per bushel*** (lbs/bu), but now more normally in ***kilograms per hectolitre*** (kg/hl). (1 hl = 100 litres). The bushel weight for UK wheat is usually in the range of 74 to 85 kg/hl (NABIM).

To use the chondrometer (as shown) the value is obtained by pouring a sample of wheat into the known volume, which is then levelled off with a wooden 'strickle' to remove the excess grain from the top. This is achieved using zigzag motions of the strickle.

The volume is carefully placed on a scale and the counterpoise is slid along the scale until balance is achieved. The test weight is then read off the scale, which is calibrated in 'lbs per bushel'.

Later chondrometers have an additional charging volume (conical or cylindrical in shape) used to provide uniform packing by filling in a controlled manner. This is achieved either by opening a valve or by use of a 'cutter'. The cutter is a metal blade (which also replaces the strickle) that can be slid through the column of grain to isolate the known volume. The process is shown below.

1.Zero (tare) the known volume on digital scales

2. Insert the cutter bar

3. Place the charging volume on top

4. Fill the charging volume with the grain

5. Remove the cutter bar to allow the grain to fall into the known volume

6. Replace the cutter bar and remove the charging cylinder

7. Remove excess grain

8. Remove the cutter bar and weigh the grain-filled volume

9. Refer to conversion chart to determine bushel weight. In this case, 193gm is equivalent to 77.25 kg/hl.

The known volume can then be weighed as in the previous manner using the steelyard or nowadays by using digital scales and converting the weight to kg/hl with a conversion chart.