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Harvest 2017 Information for growers who have moisture meters – use and calibration

16 March 2017

Walnut moisture content

This year, the factory is changing the method of measuring the moisture content of walnuts. In the past we have measured the moisture content of the kernel only, but from 2017 onward we will be measuring the moisture content of the whole nut, i.e. both shell and kernel broken up together. This is the usual way it is done in USA and Europe so it will mean our measurements are consistent with international standards.

There is also another reason for using whole-nut, rather than kernel-only, testing, and this is particularly relevant to moisture testing during and immediately after the drying process. During drying, the shell quickly and easily loses its moisture, and then gradually the moisture from the kernel makes its way through the partition and out through the shell. After the walnuts are taken off the dryer, this process continues for several days until the moisture content of the kernel and shell come to equilibrium. Prior to equilibrium, while the movement of moisture is still occurring, it is important to measure the average across all components – kernel, partition and shell – because measuring the kernel only does not tell us what moisture content it will settle down to at equilibrium. So, for growers drying their own walnuts, we recommend using whole-nut moisture measurements for determining when the nuts are sufficiently dry and can therefore be taken off the dryer. Though kernel-only moisture measurement is valid during storage (at equilibrium) we will use whole-nut measurements at the factory for consistency.

In addition to the change in the measurement method, we will be requiring walnuts to be dried down to a lower moisture content than has been the case in the past (i.e. they must be drier). This is to ensure that our walnuts do not go mouldy in storage and also to minimise the risk of storage moth.

In 2017, your walnuts must be dried to 8% moisture content *of the whole nut*, i.e. the shell, kernel and partition broken up together should have a combined moisture content of not more than 8% moisture (by weight). Note that, at equilibrium, this is equivalent to a kernel-only moisture content of approximately 4% (which is drier than the 6% kernel moisture limit we have used in the past). The 8% (whole nut) moisture content has been the standard for storage in the USA, EU¹ and Chile for a long

¹ We are aware that the 'fresh nut' trade in Europe allows for up to 12% whole-nut moisture content (equivalent to a kernel-only moisture content of approximately 5.5%). However, these walnuts are usually not stored for very long – they are a seasonal product and typically consumed within a few months – whereas we need to plan for longer-term storage.

time, and mould development in storage is very rare at this level.

Moisture content is defined on a wet basis. To illustrate, let us say we have 100 g of walnuts (whole nuts) after drying. Of this mass, if 8 g is water and 92 g is walnut dry matter (kernel, partition, shell), then the moisture content is $\frac{\text{weight of water}}{\text{total weight of dry matter+water}} = \frac{8}{92+8} \times 100\% = 8\%$ *moisture content*.

Drying your walnuts to the correct moisture content

Ideally, growers will measure the moisture content of their crop with an approved meter before consigning the crop to the factory. However, for checking your walnuts during the drying process, a useful rule-of-thumb is to crack some 'average' walnuts to see whether the partition is brittle (snaps when you break it). Before you take them off the dryer, though, we recommend that you test them with your meter to ensure they are below 8% moisture content.

If you are using drying bins with air blowing up from underneath, remember that the nuts on the top of the bin will be the wettest, so if a sample from the top has less than 8% moisture, then the rest of the bin should also be under 8% moisture. Testing nuts from the top of the bin is therefore a conservative approach – all nuts would be at a safe moisture content, but you may have dried the nuts at the bottom of the bin more than necessary. Testing nuts from half way up the bin will give you an average. If you take the bin of nuts off the dryer based on your average measure, then mix all the nuts from the drying bin into a storage bin, they should come to a safe moisture equilibrium with one another in storage. But if you place just the top half of the drying bin into a storage bin (i.e. just the wetter ones, without the drier ones from the bottom), the average moisture content will be too high.

Remember also that there can be a lot of variability between nuts in the drying bins or racks, e.g. those that have just come out of their husks will take a lot longer to dry than those that have been out for a while, and if you have different varieties drying together, the different ratio of kernel to shell will also affect the drying process. If you are harvesting nuts that are still in their green husks (e.g. if you are shaking your trees early in the season and de-hulling the nuts) it is best to dry these in a separate bin, rather than mixing them with nuts that fell naturally from split husks. This is so that you can dry each case for the appropriate length of time, rather than over-drying one or under-drying the other.

When your crop arrives at the factory, we will test the moisture content. If a batch of walnuts comes in too wet (averaging above 8% whole-nut moisture content), we would initially reject the batch but, if the walnuts are of sufficient quality (e.g. not mouldy), then we would give the grower the option of drying the batch down further for re-submission. Alternatively, we may be able to arrange further drying, which would be done at the grower's expense.

Method for on-farm moisture measurement with your meter

We now describe the method for measuring whole-nut moisture content. For this you will be mincing up the whole walnuts and measuring the moisture content of the kernel, shell and partition mixed up together. You will need to get your meter re-calibrated at Formula Foods Instrumentation (see below) before using it for whole-nut moisture measurement on-farm.

1. Taking a representative sample: Take 12 to 15 nuts for your sample, from different places on your drying racks. If you have drying bins with air blowing up through them, you can take the sample from the top of the bins (where they are wettest) for a conservative result, or from half way up (for an average result – but see the notes above regarding variability). Don't include empty, shriveled or black ones in your sample.

2. *Grinding/mincing your whole-nut sample:* The walnuts must be minced/ground up in a way that does not heat up the sample, as this can affect the moisture reading – so a kitchen blender or food processor is not suitable as the speed of the blades will heat the sample. The equipment usually used by American walnut growers for preparing a sample for a hand-held moisture meter is an old-style hand-cranked meat/vegetable mincer, such as that shown in the photo. Further – and most importantly – the walnuts must be minced/ground in a way that is repeatable, i.e. so that every time you test a sample it has the same coarseness/fineness of grind. This is because the moisture reading will also be affected by the density of the sample. It does not matter how coarsely you grind your sample as long as: (a) the pieces are small compared to the size of the chamber in your moisture meter; (b) you always grind to the same level of coarseness i.e. using the same equipment with the same blades and fittings every time; and (c) you have had your meter calibrated using that same grinding method and coarseness of grind. See ‘Practical tips’ below.



3. *Mixing the sample:* After grinding, thoroughly mix the sample so that all the walnuts in it are represented throughout the sample.

4. *Place ground walnut sample in your meter:* Take however much of the sample you need to fill the chamber of your meter (the rest can be discarded). Take your reading as usual.

Practical tips for mincing/grinding walnuts

Where to get a mincer

The best type of mincer for the job is an old-style one, such as pictured here, as these come with fittings that allow for a coarser grind and easier grinding. You may be able to source one from the back of the cupboard, an elderly relative, or a second-hand shop.



These old-style mincers tend to have coarse cutters with just two blades, and can produce ground walnut such as that shown below, depending on the exit plate used. The coarser sample (picture on the left) would be suitable for use in the Wile 55 meter, with its large test chamber. We are currently getting advice as to whether it would also be suitable for use in the Protimer GrainMaster meters, which have quite small test chambers, or whether you would need to use the finer grind (picture on the right).



You can also buy new mincers at specialist kitchenware stores, such as Stevens. New ones are also available cheaply on Trademe but we do not know what the quality of these is like. We have experimented with a new mincer, bought at Stevens, and successfully ground up whole walnuts. The limitation with the mincer we tried (and with most of the new ones we have seen advertised) is that they only come with an extrusion plate for mincemeat (which has a series of approximately 5-mm holes) and a 4-bladed cutter, as shown in the photos below – these produce a fine grind (similar to the fine sample from the old-style mincer pictured above) but make the mincing rather hard work.



Tips for mincing

- Placing some pieces of rubber (or perhaps soft wood, or thick fabric) between your bench-top and the clamp on the mincer will help it grip the bench and avoid damage to your bench.
- Feed the walnuts in gradually – if you put in a lot at once it can get too hard to turn the handle.
- If it jams up, turn the handle backwards a few turns to loosen up the material, and then try again.
- We recommend using a thick stick or similar for pushing the walnuts into the mincer – don't endanger your fingers!
- You could fracture or slightly break the nuts before putting them in the mincer – either just in your hand, or with a light tap of the hammer – this makes them easier to feed through the mincer. However, do not actually smash them up prior to mincing. It is important to maintain the repeatability of your grind coarseness, and the mincer will do this for you, whereas the effects of a hammer used with enthusiasm are likely to be much more variable.
- For your sample, use only the product that comes out the exit of the mincer – do not add the half-ground product that may be still in the mincer when you clean it out, as this will have a different grind coarseness.
- Empty out and brush out the mincer between samples.
- We understand there are versions of these mincers that have small motors so you do not need to hand-crank them (but which still turn the blades slowly) – these would be suitable where many samples need to be tested, such as at SST and for the factory (we will be looking into this).

Moisture meters – calibration

Growers who own moisture meters (either the Wile55 or the Protimeter GrainMaster) will need to get their meter re-calibrated at FF Instrumentation so that whole-nut samples can be tested. Do not use your current kernel-only calibration for testing whole walnuts.

The calibration will also include your mincer. As mentioned above, the fineness of the grind and the density of the sample affect the moisture reading from your meter, so this must be adjusted for as part of the calibration. Therefore, you should take along to FF Instrumentation:

- Your meter
- Your mincer
- A sample of whole walnuts

The sample of walnuts will be ground up in your mincer. The calibration will then be specific to both your mincer (with the blades/fittings used during calibration) and your meter. From then on you must always mince your walnuts with the same equipment. Your calibration will be different from that of another grower who uses a different mincer or grind coarseness.

We have been advised by FF Instrumentation that it would be most efficient if several growers can take in their meters for calibration at the same time. That way, their drying oven can be used for several samples at once, rather than doing one at a time.

New system in 2017

We appreciate that this new system involves effort and adaptation from both growers and the factory. We would welcome your comments, questions and suggestions as we bed the new system in during this first year. We have prepared this document to the best of our current knowledge, but as we learn more and receive further advice from experts, we will pass on this information to you.

For advice and information during preparation of these instructions, we thank Don Osias (Applied Instrumentation, California, USA), Bob Alayo (FF Instrumentation, Christchurch, NZ), and Clive Marsh (Lightfoot Walnuts, NZ).