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## Are my seeds dry enough?

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Protecting the viability of seeds during storage can be a difficult task in the tropics, which often have high temperatures and high relative humidity. In May of 2017, ECHO hosted a seed saving workshop at our Global Farm in North Fort Myers, Florida. Both in preparation for and during this workshop, we encountered many helpful ideas related to appropriate seed storage. Dr. Tim Motis, Agriculture Technical and Research Director, will share them through upcoming Research Blog (<http://echocommunity.site-ym.com/blogpost/864698/Research>) posts and *EDN* articles. One simple idea is the use of salt and jars to estimate seed moisture content.

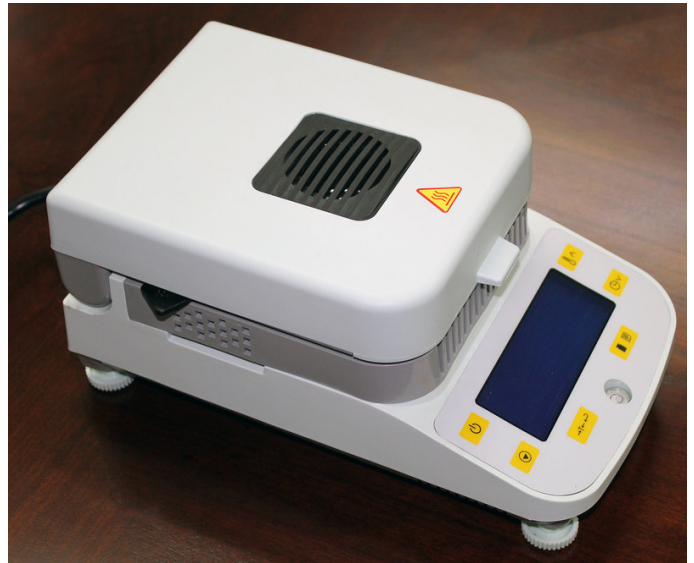
### Why seeds should be dry before storing them

Orthodox seeds (seeds that can enter a resting state prior to germination) must be dry prior to storage. Drying reduces seed moisture content, so that seeds will not rot or prematurely germinate in storage. Orthodox seeds should ideally be dried to between 3% and 7% moisture content for long-term storage; however, during rainy season(s), you may not be able to dry seeds below 10% moisture content, owing to high relative humidity levels. Several technologies are regularly used for detecting seed moisture content.

### Ways to determine seed moisture

#### Moisture meters

Seed moisture meters can be helpful for organizations or groups that need frequent and/or precise seed moisture readings. The one shown in Figure 11 displays seed moisture content after heating a small sample of seeds. Other meters make use of the fact that electrical conductance varies with seed moisture. Moisture meters may be inappropriate and/or unaffordable for most farmers.



**Figure 11.** Moisture analyzer used at ECHO in Florida.  
Source: Tim Motis

## Oven drying

Seed moisture content can also be determined with an oven. Take a random sample of your seeds and obtain the fresh weight. Then, place the fresh seeds in the oven, wait for the temperature to reach 130°C, and maintain that temperature. Remove the sample from the oven after 4 hours (maize), 2 hours (other cereal crops), or 1 hour (other species). Allow seeds to cool, and then weigh them to obtain the dry weight. Use the following formula to calculate seed moisture content (as a %) (ISTA 2005).

$$\% \text{ moisture content} = \frac{\text{weight of fresh seeds} - \text{weight of dry seeds}}{\text{weight of fresh seeds}} \times 100$$

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Drawbacks of this method are that the seed sample is destroyed, and that many small-scale farmers may not have access to an oven.

## Bite and bend tests

Some simpler tests do not require expensive equipment. One common technique for determining if bean seeds are dry enough to store is to bite or press a fingernail into a seed. If no mark is left on the seed coat, the seed is most likely dry enough for storage. Seeds of cucurbit species can be tested by bending them; sufficiently dry seeds should not bend easily.

## Salt-jar test

The salt-jar test is another simple option. This test is based on the fact that salt clumps at relative humidity levels of 70-75% (Sutcliffe and Adams 2014). Seed moisture content is affected by relative humidity. At 70-75% relative humidity, the moisture content of maize seed stabilizes close to 15% (Mrema 2011). See Table 1 for detailed steps.

<b>Table 1. Steps described by FAO and Kew Royal Botanical Gardens for using the salt-jar test to determine if seeds are dry enough for storage.</b>	
FAO (Mrema, 2011)	Kew (Sutcliffe and Adams, 2014)
<ul style="list-style-type: none"><li>• Add 1 teaspoon of salt to a dry jar or bottle. To make sure the jar is dry, put the lid on tightly and roll the jar with the salt inside. If the jar is dry, salt will not stick to the sides.</li><li>• Now that you know the jar is dry, remove the lid and pour maize seeds into the jar [No specific amount/volume of kernels is given, but there needs to be enough empty space to shake the seeds and salt; the method to the right suggests filling half of a jar with seeds and salt.].</li><li>• Shake the jar and roll it gently for 2 to 3 minutes.</li><li>• If the salt does not form lumps or stick to the sides of the jar, the moisture content of the maize seed is probably less than 15%.</li></ul>	<ul style="list-style-type: none"><li>• Mix a 1:1 ratio of salt and maize seeds. The seeds and salt together should fill half the volume of the jar.</li><li>• Put the lid on the jar and leave it for 10 to 20 minutes.</li><li>• Shake the jar gently.</li><li>• If the salt falls to the bottom of the jar, the seeds are dry. If the salt sticks to the sides of the jar, the seeds need additional drying before being stored.</li></ul>

Dr. Motis decided to test the salt jar method using maize seed, before sharing the technique at the seed saving workshop. We took maize seeds out of storage at ECHO's Global Seed Bank. Half of the seeds were soaked in water for one hour, then patted dry with a paper towel to remove all excess water on the seed coat. We left the other half of the seeds, which had been stored in an air-conditioned room, unaltered. We placed the subsamples of seeds (one that had soaked in water and one that had not) in identical jars and added one teaspoon of salt to each jar. We put the lids on, let the jars sit, then shook them to mix the seeds and salt. Figure 12 shows the two jars at the end of the trial.

Using a moisture meter, we checked the moisture content of the seeds in each jar. The maize seeds that caused the salt to stick to the sides of the jar had a moisture content of 16%, above the 15% threshold at which salt grains would be expected to begin clumping. Seeds that did not cause salt to stick to the jar had a moisture

content of 11%, a level that would be acceptable for storing maize seed for over 6 months (see Table 1 in Part V of a Virginia Cooperative Extension document by Chappell et al. 2000).

The salt jar test seems to be an extremely useful and simple technique for estimating appropriate seed moisture content before storage. It has even been adapted for use with an empty soda bottle (The Organic Farmer 2015



**Figure 12.** Salt jars with subsamples of maize seed; salt at bottom of jar indicates dry seed (left) and salt sticking to glass jar indicates wet seed (right). *Source: Tim Motis*

(<http://theorganicfarmer.org/content/simple-way-test-moisture-maize>)).

## References

ISTA. 2005. *International Rules for Seed Testing*. Edition 2005. International Seed Testing Association, Bassersdorf, Switzerland.

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The Organic Farmer 2015. A simple way to test for moisture in maize (<http://theorganicfarmer.org/content/simple-way-test-moisture-maize>). The magazine for sustainable agriculture in Kenya (an adaptation of the salt-jar test using an empty soda bottle).