

# Low-cost monitors of seed moisture status

## Technical Information Sheet 07

Knowledge of seed moisture status is important in maintaining seed longevity in storage. Seed equilibrium relative humidity (eRH), is usually determined using expensive electronic instruments (see [Technical Information Sheet 05](#)). For precise scientific studies, and for the purposes of long-term seed conservation, there are no acceptable cheap alternatives.

However, there is a range of low-cost products that can be used to aid decision-making where exact measurement of eRH is not necessary. Such monitors are useful when processing collections or determining whether seeds are sufficiently dry for storage.

This information sheet describes some of the options for low-technology, low-cost monitors of seed moisture status that have been tested by the [Millennium Seed Bank](#). They are based on the principle that seeds are hygroscopic and rapidly gain or lose moisture depending on the relative humidity (RH) of the surrounding air. Sealing these monitors in a container of seeds and allowing them to equilibrate, provides an indication of seed eRH. A simple salt test is also described, which can be used to determine whether seeds are dry enough for short-term sealed storage. Refer to [Technical Information Sheet 08](#) for low-cost drying methods.

### Dial hygrometers

These hygrometers (Fig. 1) consist of a metal coil coated with a hygroscopic chemical, attached to a needle, which rotates as RH changes.



Figure 1: Dial hygrometer reading 54% RH.

The change in moisture status is measured on a graduated scale, so quantification of RH is possible.

### Moisture indicating strips

These cards (Fig. 2) are chemically impregnated with a range of concentrations of indicator, which changes colour under different RH conditions. RH is measured by matching the colour on a scale with the colour of the control spot.

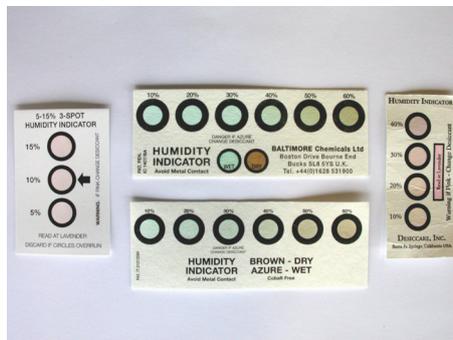


Figure 2: Moisture indicating strips with various chemical indicators.

### Indicating silica gel

This silica gel contains a chemical indicator which changes colour as RH changes. Methyl violet indicator changes from green to orange below about 20-25% RH (Fig. 3). When added to a sealed container with seeds, this will indicate when seed moisture is at a level that will permit safe storage for many years.

Indicating silica gel is available in clear 1 g sachets (Fig. 4). Loose beads can also be used in small porous containers, such as gelatine capsules or glass vials sealed with cotton wool bungs (Fig. 3). A photographic colour chart can be produced by equilibrating sachets to a range of RH conditions (Fig. 5).

### Monitoring seed eRH

- Fill a container or bag at least half-full with seeds. Using a transparent container will allow readings to be taken without opening. A full container will enable quicker equilibration and produce a more accurate result.



Figure 3: Loose methyl violet indicating silica gel beads, in gelatine capsules and glass vials with cotton wool.

- Ensure that the seed sample and the moisture monitor are at the same temperature. Put the moisture monitor on top of the seeds in the container and make sure the container is well sealed. Avoid leaving the container in direct sunlight.
- Leave sealed until the seeds are fully equilibrated with the air inside the container. For dial hygrometers and indicator strips, this will take a few hours, depending on the quantity and structure of the seeds.

### Monitoring drying

- When monitoring the drying rate of seeds, bury the moisture monitor deeply within the collection.
- Indicating silica gel sachets should be equilibrated to a similar eRH as the seeds, before being added to a fresh collection. Compare the sachets with a colour chart on a weekly basis during drying. Sachet equilibration may take several weeks.
- When placing monitors in a drying container with freshly dried desiccant, remember that artificially low RH readings will be given until the system reaches equilibrium.

### Practical issues

#### Accuracy

The dial hygrometers and indicator strips will measure to within  $\pm 10\%$  RH. Indicating silica gel only indicates changes either side of the colour change point (typically 20-25% RH).

## Speed of response

The dial hygrometers and indicator strips only take a minimum of one hour to equilibrate, so are suitable for monitoring seeds in the field or during drying. As indicating silica gel equilibrates more slowly, this method is better for assessing drying rates and monitoring conditions during long-term storage.

## Interpretation

The dial hygrometer is relatively easy to read, though the scale is rather small. Any monitoring using colour change is subject to individual interpretation and light conditions. The colours in indicating silica gel can be affected by aromatic oils in some seeds.

## Practicality

The dial hygrometer and moisture indicating strips can be added to large containers of seeds or included in collecting bags if there is sufficient volume of seeds. Indicating silica gel sachets can be added to relatively small collections, but are difficult to find in larger collections.

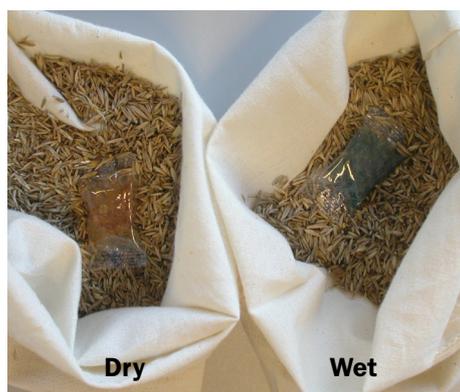


Figure 4: Methyl violet indicating silica gel sachets in dry and wet seed collections.

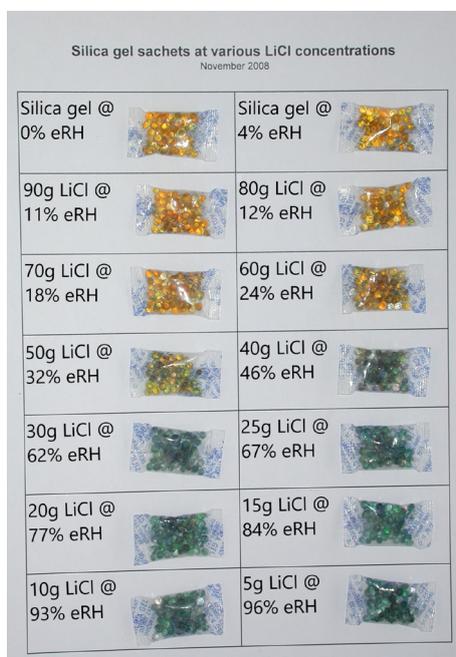


Figure 5: Photographic colour chart with methyl violet indicating silica gel sachets at a range of relative humidities.



Figure 6: Assessing wet and dry seed collections using a salt test.

## Temperature

These techniques do not include temperature compensation. The temperature/RH relationship must be taken into consideration during use (refer to [Technical Information Sheet 09](#)).

## Salt test

A cheap and simple salt test can be used to show if seeds are dry enough to seal and store safely in the short-term. As salt forms clumps at RHs greater than 70-75%, it can be used to assess whether seed eRH is above or below this point.

- Mix dry common salt with seeds in equal measures in a glass jar, half-filling the container.
- Leave for 10-20 minutes then shake the jar gently.
- If the seeds are dry, the salt will return to the bottom of the jar with the seeds. If the seeds are wet, the salt will have absorbed moisture and will stick to the sides of the jar (Fig. 6). In this case, the seeds require further drying before they can be sealed and placed in ambient or cool storage.

## Acknowledgements

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## Equipment specifications\*

Description	Model/Product	Supplier
Dial hygrometers		Available locally or online
Moisture indicating strips	Various types	Baltimore Chemicals Ltd. <a href="http://www.baltimoreinnovations.co.uk">www.baltimoreinnovations.co.uk</a>
Indicating silica gel	<ul style="list-style-type: none"> <li>• 1g sachets containing orange/green silica gel impregnated with methyl violet indicator</li> <li>• Loose beads of orange/green silica gel impregnated with methyl violet indicator</li> </ul>	Baltimore Chemicals Ltd. <a href="http://www.baltimoreinnovations.co.uk">www.baltimoreinnovations.co.uk</a>
Small vials	2cm <sup>3</sup> glass vial	Scientific Laboratory Supplies Ltd. <a href="https://www.scientificlabs.co.uk">https://www.scientificlabs.co.uk</a>
Gelatine capsules	Size 000	Agar Scientific <a href="http://www.agarscientific.com">www.agarscientific.com</a>

\*Please note that the above equipment is used by the Millennium Seed Bank and has been chosen carefully using our many years' experience. The list of suppliers is for guidance only and does not represent an endorsement by the Royal Botanic Gardens, Kew. The manufacturer's instructions must be followed when using any of the equipment referred to in this Information Sheet.