

Water Activity and Fungal Growth

James Thompson



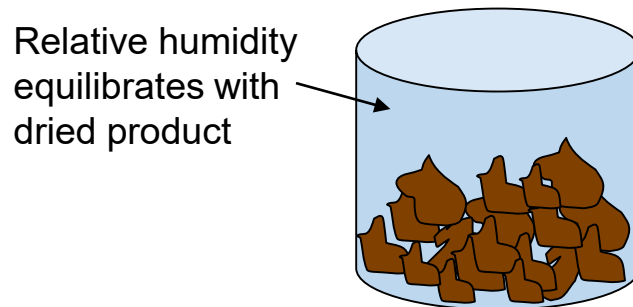
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Equilibrium Relative Humidity & Water Activity

- Equilibrium relative humidity = headspace humidity above a product.



- Water activity = $ERH/100$
- $0.65 A_w = 65\% ERH$

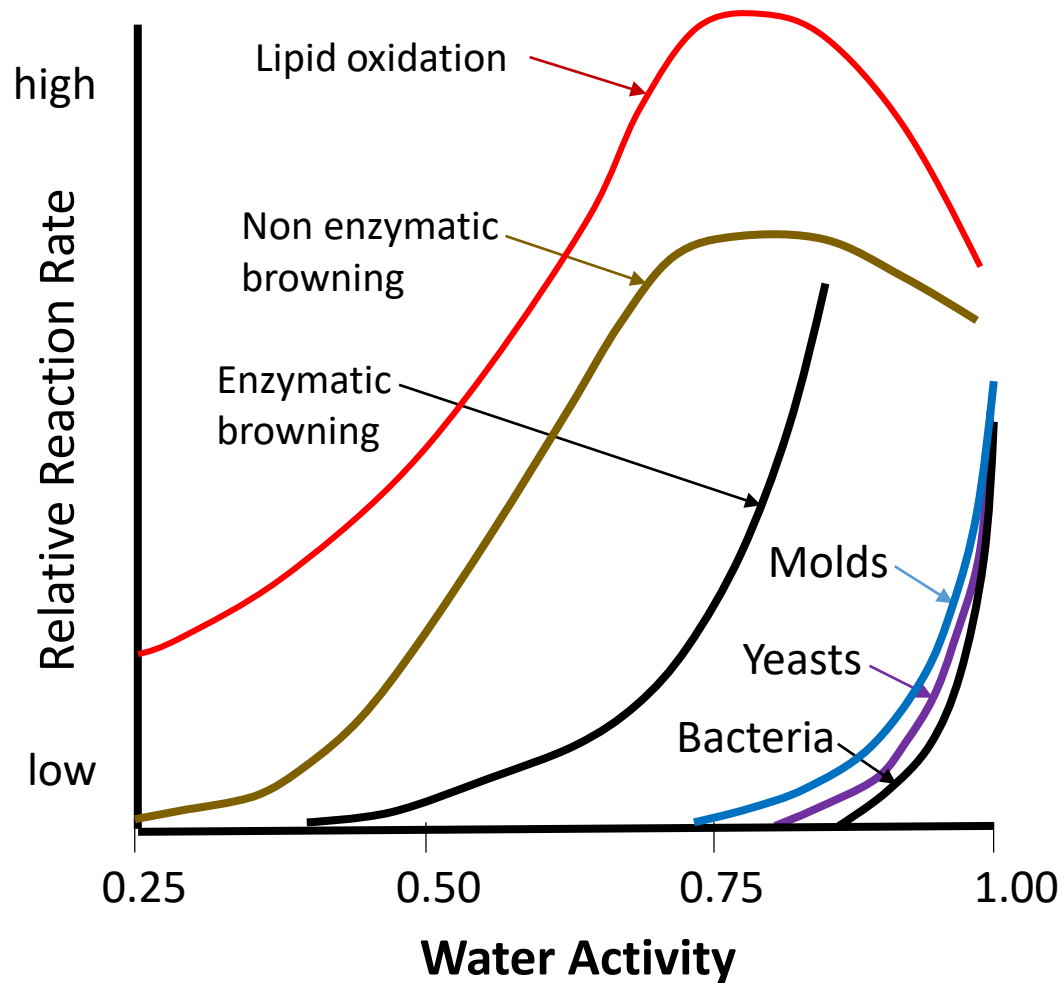


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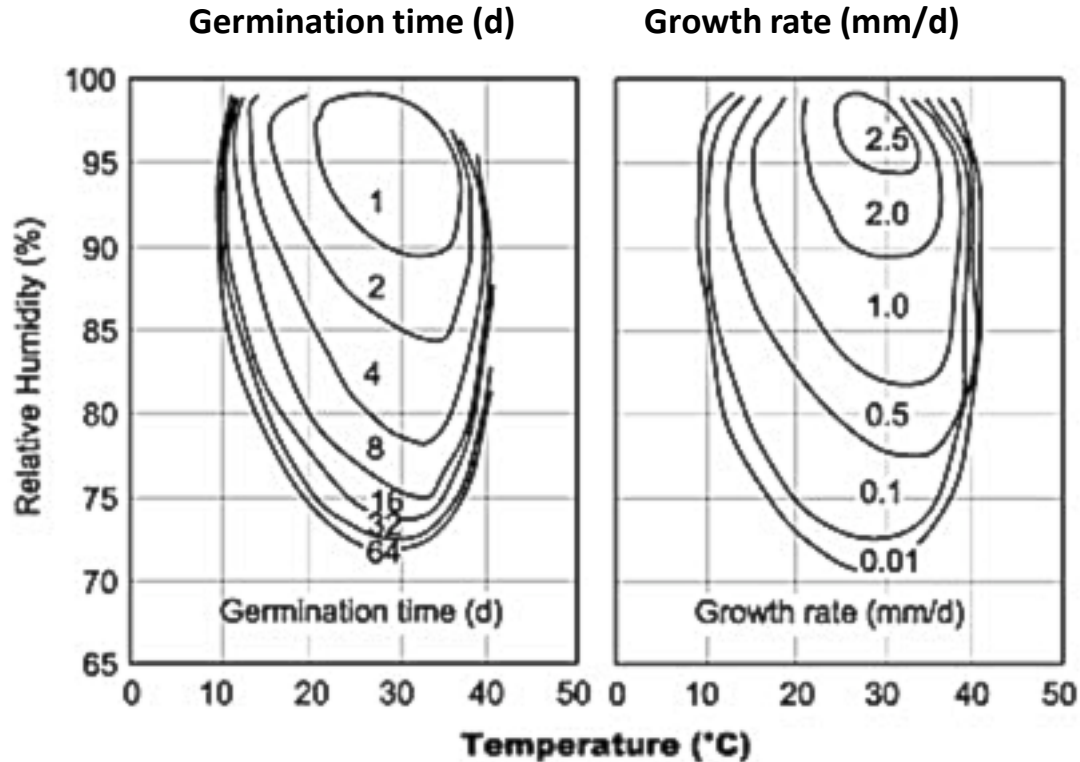
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Water Activity and Food Stability



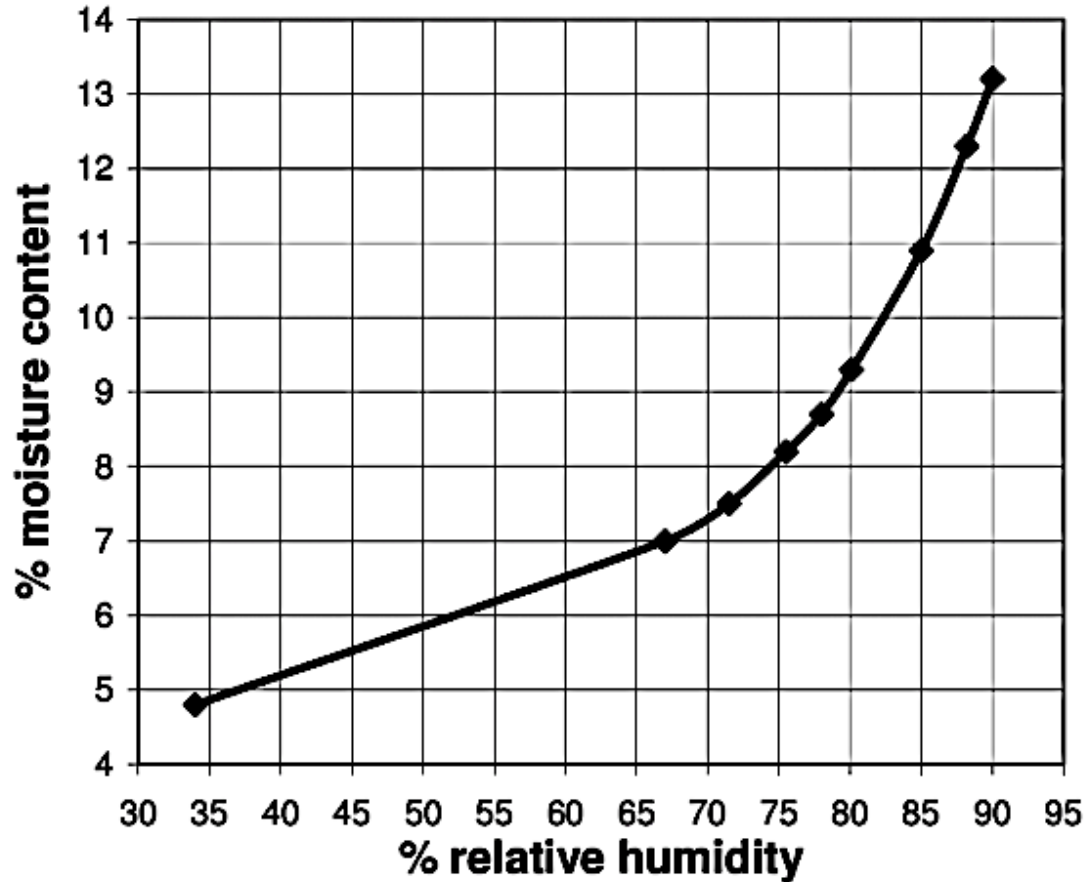
Fungal Growth



1. ERH below 75 – 80% allows more time for drying.
2. ERH below 65% allows safe long-term storage.

<http://www.wbdg.org/resources/indoor-air-quality-and-mold-prevention-building-envelope>

Equilibrium Moisture Content



Equilibrium moisture content of cocoa beans at 27° - 29°C (Gough, 1975).

ERH & Moisture Content

Relationship affected by:

- Product temperature
- Adsorption/desorption (hysteresis)
- Cultivar
- Growing conditions
- Drying, particularly high temperature exposure
- With an ERH/MC model determined for a particular grain sample, ERH will predict MC within $\pm 0.5\%$ ¹

¹Chen 2001

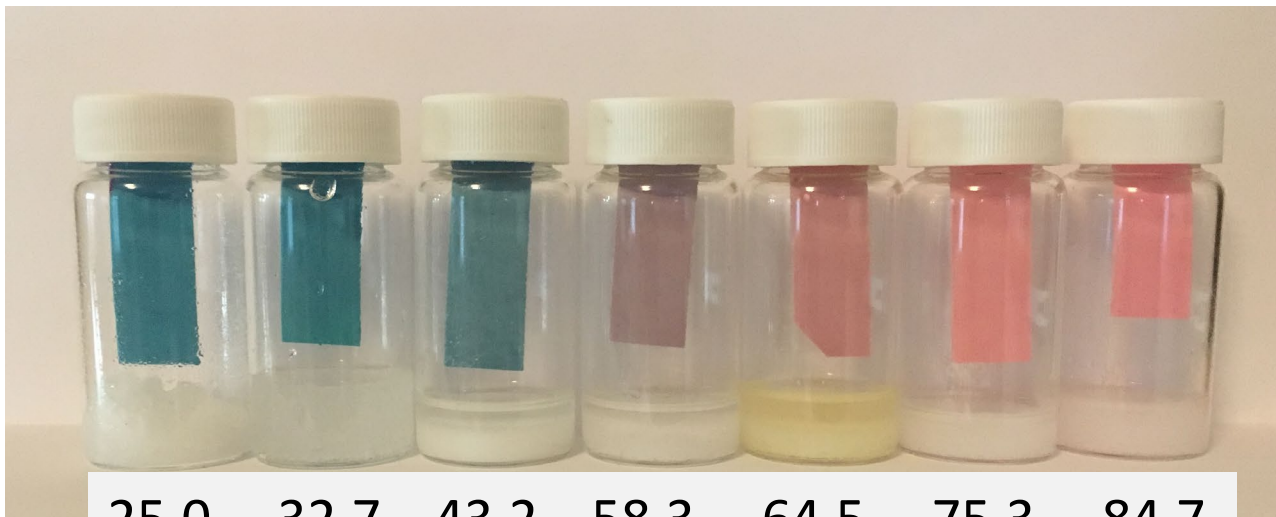
Measuring Moisture Content

- Fast measurement
- Low cost units, <\$300, have an accuracy of $\pm 0.5\%$ to $\pm 1.0\%$ MC.
- Bench top units \$2000 – \$5000 have an accuracy of $\pm 0.1\%$.
- Need separate calibration for each product and for each growing location.
- Important to obtain a representative sample.



DryCard

Equilibrium relative humidity calibration
with saturated salts



25.0 32.7 43.2 58.3 64.5 75.3 84.7

useful range

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DryCard™

Seal this card in a jar or bag with your dry product. Check the card after 30-60 min.

Wet
75 Molds grow
65 Molds don't grow
55
45 Dry
35

Is your product dry enough to store safely?

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Options for measuring ERH

DryCard



\$1 – 1.50

Hygrometer



\$3 - 10

Water activity meter



\$12,000

Measuring ERH

- Product has equilibrated after drying for 4 to 24 hr depending on particle size.
- Product has a uniform temperature.
- DryCard or hygrometer is exposed to product for 30 to 60 minutes for an approximate ERH determination.
- DryCard or hygrometer is exposed to product overnight for precise ERH determination.

DryCard



Hygrometer

