Shelf Life

HOW TO MASTER YOUR SEED WAREHOUSE MANAGEMENT

BY JOHAN VAN ASBROUCK (RHINO RESEARCH)
How does your company decide what seed lots should be stored till next season, and what seed lots should be sold this year?
Two major conditions that need to be perfect...

**Environmental conditions**
- Temperature
- Moisture content
- Oxygen

**Seed related conditions**
- Seed Quality
- Genetics
- Maturity
Two major conditions that need to be perfect ...

**Environmental conditions**
- Temperature
- Moisture content
- Oxygen

**Seed related conditions**
- Seed Quality
- Genetics
- Maturity
The environment

TEMPERATURE, HUMIDITY, OXYGEN ...
Thumb Rules for Seed Storage

**James’ Rule:**
Temp (°F) + RH (%) < 100  
Temp (°C) + RH (%) < 60

**Harrington’s Rule:**
Seed longevity decreases by one-half for every 1% increase in moisture content or every 10°F (6°C) increase in temperature.

**Bradford’s Metronome Rule:**
The “clock” starts running as soon as the seeds are mature and they have a total number of ticks before death. The rate at which the metronome ticks depends upon the temperature and moisture content.
Water content of air
And the impact of temperature

ATTENTION
This tells us that cooling a warehouse can have an adverse effect on storability!

<table>
<thead>
<tr>
<th>Condition</th>
<th>Water Content (gr)</th>
<th>Storability (SMC)</th>
</tr>
</thead>
<tbody>
<tr>
<td>100% RH</td>
<td>7 gr</td>
<td>21.5% SMC days</td>
</tr>
<tr>
<td>85% RH</td>
<td>8 gr</td>
<td>8.9% SMC months</td>
</tr>
<tr>
<td>50% RH</td>
<td>8 gr</td>
<td>5.3% SMC years</td>
</tr>
<tr>
<td>20% RH</td>
<td>8 gr</td>
<td></td>
</tr>
<tr>
<td>10% RH</td>
<td>8 gr</td>
<td></td>
</tr>
</tbody>
</table>

Amount of water that 1 kg air can contain at 5°C
Amount of water that 1 kg air can contain at 10°C
Amount of water that 1 kg air can contain at 20°C
Amount of water that 1 kg air can contain at 35°C

Chili seeds

ATTENTION
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Condense 1 gr

Cooling a warehouse has an adverse effect on storability!
Other storage problems are reduced at low RH

Dry Chain Concept

Developed by Dr. Kent Bradford and Ing. Johan Van Asbrouck.

A new and efficient way to look to storage and quality of seeds, grain and commodities.
Our answer for developing a drying system that is affordable, easy, fast, efficient and with low investment costs.

Seed companies can now dry their seeds to a sufficient low moisture content and thus reap the benefits from their work.
Disruptive technologies surprise experts

“The idea of installing ‘telephones’ in every city is idiotic... Why would any person want to use this ungainly and impractical device when he can send a messenger to the telegraph office and have a clear written message sent to any large city in the US? This 'telephone' has too many shortcomings to be seriously considered as a means of communication. The device is inherently of no value to us.” (Western Union)
Open storage vs. bead storage of onion seeds in Nashik, India and Basantour, Nepal

Open bags
- Seed MC reduced by 4% with beads.
- Germination decreased by 45% in open bags.

With beads
- Stored for 1 year by farmers
- Seed MC reduced by 4% with beads.
- Germination decreased by 45% in open bags.

Onion seed storage field trial, Basantpur, Rupandehi, Nepal

Courtesy of Dr. Keshavulu Kunusoth, ANGRAU, Hyderabad, India
“... We tested this new technology, and concluded that these beads are drying our seeds faster and deeper, obtaining a better quality that results in a longer storage potential, and all this with lesser costs. Therefore we made the executive decision to move ahead with implementing these beads for all our seeds and crops as soon as possible...”

A major seed company from Bangladesh
From manual systems to ...
... full automatic dryers and air conditioners (Beta Testing, commercial in 2017)
MATURITY IS THE KEY CONSTRAINT

Seed Related

GENETIC PURITY, SEED QUALITY, SEED MATURITY...
First, a seed will establish his final goal... the ability to germinate

Second, he will develop a desiccation tolerance (orthodox seeds)

Third, he will produce energy reserves, seen as vigor

Last, but not least, he will prepare himself for less than optimal conditions (longevity, storability)
Time of harvest is very important in achieving desired seed quality. However, environment is also important: nutrition, sink-source, applied chemicals, etc.
Germ | 100 | 100 | 100 | 100
Vigor | 50  | 80  | 95  | 100
Long  | 0   | 10  | 50  | 80

% of a maximum

days after anthesis or maturity

A B C D

Low vigor
Do NOT use
Sell NOW
STORE
Spectral properties of chlorophyll

Wavelength [nm]

Excitation

Fluorescence

Detector

Laser

Chlorophyll-a
Principle of CF measurement

- Fluorescence at 690 nm
- Laser at 670 nm
- Fluorescence at 730 nm
- Seed
CF Mobile

Measurement of true single seeds
Fast and precise
Truly mobile
Correlated to SMC%
Correlated to seed size
In this test we correlated the CF value just before harvesting and correlated this with the obtained germination.

The outstanding correlation is showing us that the CF measurement before harvesting carrot seeds will give us an excellent indication of the germination that will be obtained after harvest.

Correlation: $R^2$ equals 0.92
Only if you master all these different elements, you can make the right decisions and manage your inventory. Otherwise you will be managed by your inventory.

Seek professional help and advise as managing your inventory pays off very quickly.

Stand out in the crowd.
Thank You

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