+ Date Orchard in Coachella Valley

+ Date Orchard in Coachella Valley, California

+ Tamar Stage of Development
Harvesting Khalal Stage Dates

Ripening of Barhi Dates from Khalal to Rutab

Genotypic differences in color of khalal stage dates
Genotypic differences in color and size of tamar stage dates
Sun Drying of Dates

Sun drying of Majdool dates in a pallet wrapped with shrink wrap with ventilation at the top and bottom.

Photos by David Karp
Time needed for sun drying of Medjool dates in 2 m high pallets covered by a shrink film with ventilation strips at top and bottom

Time necessary for ripening of mature Mejdool dates at various temperatures

A bin of dates at the packinghouse
Stored Products Insects cause Qualitative and Quantitative Losses

- Navel orangeworm
- Indian meal moth
- Dried fruit beetles
- Saw tooth grain beetle
- Merchant grain beetle
- Raisin moth
- Fruit fly

Insect Control Procedures for Dates

- Fumigation (methyl bromide or phosphine)
- Irradiation at 750 Gy
- Freezing at -18 °C for longer than 2 days
- Use of heat treatments (50-55 °C)
- Exposure to 100% carbon dioxide for longer than 2 days
- Storage at temperatures below 5 °C reduces insect activity
- Storage in 0.5% oxygen (balance nitrogen) atmosphere reduces insect activity

Experimental Insect Control Treatments

- Fumigation with carbonyl sulfide, methyl iodide, or sulfuryl fluoride
- Insecticidal atmospheres (below 0.5% O₂ and/or 40-60% CO₂)
- Heat treatments (radiofrequency)
- Ultraviolet radiation
- Vacuum treatments
Fumigation chambers for insect control in dates

Relative Cost of Insect Control
Methods for Raisins
(c/LB)

- 0.33¢ METHYL BROMIDE
- 0.60¢ PHOSPHINE
- 0.50¢ CONTROLLED ATMOSPHERES
- 0.43 to 1.40¢ IONIZING RADIATION

Cooling Rates to Freeze Dates
Effect of temperature on insect disinestation

![Graphs showing percent mortality vs. temperature](image)

Preparation of Dates for Market-1

- Initial sorting to remove defective dates and foreign materials.
- Cleaning to remove dust, dirt, and other foreign materials using air pressure and water followed by air drying to remove surface moisture. Damp towels may be used in cleaning the dates.
- Sorting by quality and size into grades.

Dumping dates at the packinghouse
Sorting of dates to remove defects

Sorting dates by quality

**CODEX Standard for Dates-1**

<table>
<thead>
<tr>
<th>CODEX STANDARD FOR DATES</th>
</tr>
</thead>
<tbody>
<tr>
<td>CODEX STAN 143-1985</td>
</tr>
</tbody>
</table>

1. **SCOPE**
   - This standard applies to commercially prepared whole dates in pitted or un-pitted styles packed ready for direct consumption. It does not apply to other forms such as flakes or blended dates or dates intended for industrial purposes.

2. **DESCRIPTION**
   2.1 **Product Definition**
   - Dates are the product prepared from sound fruit of the date tree (*Phoenix dactylifera* L.), which fruit:
     1. is harvested at the appropriate stage of maturity;
     2. is sorted and cleaned to remove defective fruit and extraneous material;
     3. may be pitted and cased;
     4. may be dried or hydrated to adjust moisture content;
     5. may be smoked and/or pasteurized; and
     6. is packaged in suitable containers to assure preservation and protection of the product.
CODEX Standard for Dates-2

2.2 Varietal Types

Varietal types are classified as:

(a) Grown sugar varieties (containing many sugars) such as Deglet Nour (Deglet Nour) and Deglet Bouda (Deglet Bouda).

(b) Invert sugar varieties (containing mainly invert sugar - glucose and fructose) such as Bath (Bames), Black (Gloxy), Kheithraya (Kheithraya), Hulmam (Holmam), Samir (Samar), and Deglet (Bouya).

2.3 Styles

Styles may be classified as:

(a) Pitted:

(b) Unpitted:

2.4 Sub-styles

Sub-styles are as follows:

(a) Pressed - dates which are compressed into loaves using mechanical force.

(b) Unpressed or Loose - dates which are free-flowing or packaged without mechanical force or compression.

(c) Clusters - dates with the main bunch still attached.

CODEX Standard for Dates-3

2.5 Size Classification (Optional)

Dates may be designated as to size names in accordance with the following charts:

(a) Unpitted dates

Size

<table>
<thead>
<tr>
<th>Size</th>
<th>No. of dates in 500 g</th>
</tr>
</thead>
<tbody>
<tr>
<td>Small</td>
<td>More than 100</td>
</tr>
<tr>
<td>Medium</td>
<td>101 to 150</td>
</tr>
<tr>
<td>Large</td>
<td>Less than 80</td>
</tr>
</tbody>
</table>

(b) Pitted dates

Size

<table>
<thead>
<tr>
<th>Size</th>
<th>No. of dates in 500 g</th>
</tr>
</thead>
<tbody>
<tr>
<td>Small</td>
<td>More than 110</td>
</tr>
<tr>
<td>Medium</td>
<td>111 to 160</td>
</tr>
<tr>
<td>Large</td>
<td>Less than 90</td>
</tr>
</tbody>
</table>

CODEX Standard for Dates-4

5. ESSENTIAL COMPOSITION AND QUALITY FACTORS

5.1 Composition

5.1.1 Basic Ingredients

Dates (fruits), sugar, flour, vegetable oil.

5.2 Quality Factors

5.2.1 General Requirements

Dates shall be prepared from such fruits and under such practices that the finished product shall possess a characteristic colour and flaws for the variety and type. Be of proper shape of stranded, free of any insects and must be free and meet the following additional requirements:

(a) Moisture content: Minimum

Dates shall be processed in accordance with the following:

- 28% cane sugar varieties
- 28% invert sugar varieties
- 58% (not processed in accordance with invert sugar varieties)

(b) Size (minimum):

- United Dates (pitted)
  - More than 7 g
  - 4.5 g
- United Dates (non-pitted)
  - Not more than 7 g per piece of 100 dates
- United Dates (pitted)
  - Not more than 1.6 g per piece of 100 dates

(c) External impurities:

- Not more than 1 g/kg
CODEX Standard for Dates-5

3.2.2 Definition of Defects

(a) Deformed - Scars, discolouration, sorbent, dark spots, blackened or similar abnormalities in surface appearance affecting an aggregate area greater than that of a circle 7 mm in diameter.

(b) Damaged - (Unrefined dates only) - dates, affected by misshapen and/or foreign bodies of the flesh exposing the pit or to such an extent that it significantly detracts from the visual appearance of the date.

(c) Uneven Dates - Dates which may be light in weight, light in colour, have an amorphous or tinge flesh or a decidedly rubbery texture.

(d) Underdeveloped Dates - Dates not ripened as evidenced by thin flesh, immature characteristics and no pit in unpitted dates.

(e) Dirt - Dates having embedded organic or inorganic material similar to dirt or sand in character and affecting an aggregate area greater than that of a circle 3 mm in diameter.

CODEX Standard for Dates-6

(a) Insects and Mites - Dates damaged by insects or mites or contaminated by their damage and contamination thus presence of dead insects or mites, fragments of insects or mites or their excreta.

(b) Scorching - Breakdown of the sugars into alcohol and acetic acid by yeasts and/or bacteria.

(c) Mould - Presence of mould filaments visible to the naked eye.

(d) Decay - Dates that are in a state of decomposition and very objectionable in appearance.

3.2.3 Allowance for Defects

The maximum allowances for the defects defined in 3.2.2 shall be:

- A total of 3% by count of dates with defect (a)
- A total of 5% by count of dates with defects (b), (c) and (d)
- A total of 4% by count of dates with defects (e) and (f)
- A total of 1% by count of dates with defects (g), (h) and (i)

CODEX Standard for Dates-7

4. FOOD ADDITIVES

4.1 Glycerol

Maximum Level

In accordance with GMP (see also Section 3.1.1)

4.2 Sorbitol

Maximum Level

5. HYGIENE

It is recommended that the product covered by the provisions of this standard be prepared and handled in accordance with the appropriate sections of the Recommended International Code of Practice - General Principles of Food Hygiene (CAC/RCP 1-1969, Rev. 2 (1989) Codex Alimentarius Volume 3), and other Codes of Practice recommended by the Codex Alimentarius Commission which are relevant to this product.

To the extent possible in Good Manufacturing Practice, the product shall be free from objectionable matter.

5.3 When tested by appropriate methods of sampling and examination, the product:

- shall be free from microorganisms in amounts which may represent a hazard to health;
- shall be free from parasites which may represent a hazard to health; and
- shall not contain any substance originating from microorganisms in amounts which may represent a hazard to health.
**US Standards for Grades**

U.S. Fancy = Premium quality  
U.S. No. 1 = Good quality (chief trading grade)  
U.S. No. 2 = Intermediate between No.1 and No. 3  
U.S. No. 3 = Lowest marketable quality

---

**U.S. Standards for Grades of Dates-1**

§2.1001  Ascertaining the Grade.

In addition to considering other requirements outlined in the standards, the following quality factors are evaluated:

(a) Factor not rated by score points.

(b) Factors rated by score points. The relative importance of each factor which is scored is expressed numerically on a scale of 100. The maximum number of points that may be given such factors are:

<table>
<thead>
<tr>
<th>Factors</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Color</td>
<td>20</td>
</tr>
<tr>
<td>Uniformity of size</td>
<td>10</td>
</tr>
<tr>
<td>Absence of defects</td>
<td>30</td>
</tr>
<tr>
<td>Character</td>
<td>40</td>
</tr>
<tr>
<td>Total Score</td>
<td>100</td>
</tr>
</tbody>
</table>

---

**U.S. Standards for Grades of Dates-2**

§2.1011  Score Sheet.

<table>
<thead>
<tr>
<th>Size and kind of container</th>
<th>Score points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Size of container</td>
<td>Score points</td>
</tr>
<tr>
<td>Uniformity of size</td>
<td>Score points</td>
</tr>
<tr>
<td>Absence of defects</td>
<td>Score points</td>
</tr>
<tr>
<td>Character</td>
<td>Score points</td>
</tr>
</tbody>
</table>

---

14
### Quality Grades of Medjool dates

<table>
<thead>
<tr>
<th>Grade</th>
<th>Dates/pound</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jumbo</td>
<td>16-19</td>
<td>No blemishes, skin separation, or dryness</td>
</tr>
<tr>
<td>Large</td>
<td>20-23</td>
<td>No blemishes, skin separation, or dryness</td>
</tr>
<tr>
<td>Extra-Fancy</td>
<td>20-24</td>
<td>Minor blemishes, packed all sizes together</td>
</tr>
<tr>
<td>Fancy</td>
<td>20-26</td>
<td>Some dryness and skin separation, packed all sizes together</td>
</tr>
</tbody>
</table>

### Preparation of Dates for Market-2

- Surface coating with wax or other materials to reduce stickiness and improve appearance (gloss).
- In some cases, the dates are pitted and may be stuffed with nuts. Other products include date pieces that are used in cereals and other foods and macerated dates that are used in backed products.

### Preparation of Dates for Market-3

- Packaging to protect the dates from physical damage and moisture absorption if moisture-proof packaging material is used. Use of insect-proof packaging is highly recommended to prevent reinestation of the dates with insects during their subsequent storage and handling step.
Packaging of dates

Date packages

Trends in Consumer Packages

- More products are packaged in resealable bags or clamshell plastic containers.
- Greater use of packages made from recyclable materials.
- Increased use of modified atmosphere packaging (MAP).
- Consumer packages can help in reducing product contamination during handling, but can slow down cooling rate.
Plastic package for dates

Package of organic, pitted dates

Examples of gift packages available by mail, telephone, or web-based order
Examples of gift packages available by mail, telephone, or web-based order
Shipping Containers for Produce

Fiberboard  Styrofoam  Plastic

Preparation of Dates for Market-4

Forced-air cooling to below 10C (preferably to 0C) before transportation or storage under the same temperatures and 65-75% relative humidity.
Storage Factors

- Moisture content of the dates
- Relative humidity of storage
- Storage temperature
- Oxygen concentration
- Effective insect control

Moisture content of Majdool dates vs air relative humidity at 26°C
Relationship between water activity and mold growth on dried fruits and nuts

![Graph showing the relationship between water activity and mold growth on dried fruits and nuts.](image)

Optimum Storage Relative Humidity

<table>
<thead>
<tr>
<th>% RH</th>
<th>Commodities</th>
</tr>
</thead>
<tbody>
<tr>
<td>100</td>
<td>Leafy vegetables</td>
</tr>
<tr>
<td>95</td>
<td>Cool-season root vegetables, most cut flowers</td>
</tr>
<tr>
<td>90</td>
<td>Fruits &amp; fruit vegetables</td>
</tr>
<tr>
<td>85</td>
<td>Sweet potato, cassava</td>
</tr>
<tr>
<td>80</td>
<td>Dates</td>
</tr>
<tr>
<td>75</td>
<td>Dry onion &amp; garlic, yams</td>
</tr>
<tr>
<td>70</td>
<td>Ginger, pumpkin &amp; winter squash</td>
</tr>
<tr>
<td>65</td>
<td>Tree nuts</td>
</tr>
<tr>
<td>55</td>
<td>Dried fruits &amp; vegetables</td>
</tr>
</tbody>
</table>

Effects of temperature and moisture content on storage life of Deglet Noor dates

![Graph showing the effects of temperature and moisture content on storage life of Deglet Noor dates.](image)
Physical and Physiological Disorders-1

• **Darkening.** Both enzymatic and non-enzymatic browning occur in dates and increase with higher moisture content and higher temperatures. Enzymatic browning can be inhibited at low oxygen concentrations.

• **Souring.** Yeasty fermentation results in souring of dates with moisture content above 25%.

Maximum moisture content that permitted retention of acceptable color in stored Deglet Noor dates

Typical color of fresh Deglet Noor dates and of those with various moisture contents after storage at -18, 4.4, and 24 C (0, 40, and 75 F)
Physical and Physiological Disorders-2

- Sugar Spotting (sugaring): Crystallization of sugars below the skin and in the flesh of soft date cultivars. Although it does not influence taste it alters fruit texture and appearance. Incidence and severity of sugar spotting increases with storage temperature and time. Storage at recommended temperatures minimizes this disorder, which occurs mainly in cultivars in which glucose and fructose are the main sugars. Sugaring may be reduced by gentle heating of the affected dates.

Date Sugaring (sugar spots) Symptoms

Pathological Disorders

Microbial spoilage can be caused by yeasts (most important), molds and bacteria. Yeast species of Zygosaccharomyces are more tolerant of high sugar content than others found in dates. Yeast-infected dates develop an alcoholic odor (become fermented). Acetobacter bacteria may convert the alcohol into acetic acid (vinegar). Fungi (Aspergillus, Alternaria, and Penicillium spp) may grow on high-moisture dates, especially when harvested following rain or high humidity period.
Disease Control Strategies

- Dry the dates to 20% moisture or lower to greatly reduce incidence of molds and yeasts.
- Maintain recommended temperature and relative humidity ranges throughout the handling system.
- Avoid temperature fluctuations to prevent moisture condensation on dates, which may encourage growth of decay-causing microorganisms.
- Use adequate sanitation procedures in the packinghouse and storage rooms.

Date Storage Conditions

| Semi-Sweet Dates (Bojeet Noor, Khaledy and Zaidin) |
|---|---|---|---|---|
| Temperature | 70°F (21°C)| 66°F (19°C)| 60°F (16°C)| 32°F (-0°C)| 32°F (-1°C)| 10°F (-23°C)|
| Storage Period | 1 month | 3 months | 6 months | 1 year | over 1 year |
| Relative Humidity | 75% or less |

| Soft Dates (Medjool, Barhee, Khairawy, Makwoo, Sayer, and Baytur) |
|---|---|---|
| Temperature | 59°F (15°C)| 55°F (13°C)|
| Storage Period | 6 months | More than 6 months |
| Relative Humidity | 75% or less |

Modified Atmospheres as a Supplement to Temperature Management

- Optimum CA/MA
- Air Control
- CA/MA
- Air