Harvesting and Postharvest Handling of Dates

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Developmental Stages of Dates

Khimri Stage of Development

Khalal Stage of Development

Tamar (Tamr) Stage of Development

Morphology of dates

137a: Seed, side with one deep furrow
137b: Seed, opposite side marking the embryo by a deep furrow
137c: Seed, T.S. passing through the embryo
137d: DATE (Phoenix dactylifera)
Fruit (x0.5)

One of the dates shown in L. S.
A. Flabelliform cup
B. Seed of the berry
C. Deep furrow of the seed
Barhi Date Khalal Stage of Development

Ripening of Barhi Dates from Khalal to Rutab

Khalal  Partially-rutab  Rutab

Rutab Stage of Development of Hayany Dates

Tamar Stage of Development of Deglet Noor Dates

Physical and compositional changes during growth and development of dates-1

Physical and compositional changes during growth and development of dates-2
Physical and compositional changes during growth and development of dates-3

Maturity Indices for Dates
- Size and shape
- Skin color
- Flesh color
- Flesh firmness
- Soluble solids content

Genotypic differences in color of khalal stage dates

Genotypic differences in color and size of tamar stage dates

Composition of Deglet Noor Dates

<table>
<thead>
<tr>
<th>Nutrient</th>
<th>Unit</th>
<th>Value per 100 grams</th>
</tr>
</thead>
<tbody>
<tr>
<td>Protein</td>
<td>g</td>
<td>29.18</td>
</tr>
<tr>
<td>Fat</td>
<td>g</td>
<td>15.53</td>
</tr>
<tr>
<td>Carbohydrates</td>
<td>g</td>
<td>73.72</td>
</tr>
<tr>
<td>Fibre</td>
<td>g</td>
<td>0.68</td>
</tr>
<tr>
<td>Ash</td>
<td>g</td>
<td>1.72</td>
</tr>
<tr>
<td>Ca</td>
<td>mg</td>
<td>357</td>
</tr>
<tr>
<td>Mg</td>
<td>mg</td>
<td>201</td>
</tr>
<tr>
<td>Na</td>
<td>mg</td>
<td>136</td>
</tr>
<tr>
<td>Zn</td>
<td>mg</td>
<td>1.55</td>
</tr>
<tr>
<td>K</td>
<td>mg</td>
<td>18.7</td>
</tr>
<tr>
<td>Water</td>
<td>%</td>
<td>68.16</td>
</tr>
</tbody>
</table>

Composition of Madjool Dates

<table>
<thead>
<tr>
<th>Nutrient</th>
<th>Unit</th>
<th>Value per 100 grams</th>
</tr>
</thead>
<tbody>
<tr>
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<td>29.18</td>
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<td>mg</td>
<td>1.55</td>
</tr>
<tr>
<td>K</td>
<td>mg</td>
<td>18.7</td>
</tr>
<tr>
<td>Water</td>
<td>%</td>
<td>68.16</td>
</tr>
</tbody>
</table>
Total phenolics in 6 date cultivars

<table>
<thead>
<tr>
<th>Cultivar</th>
<th>Total phenolics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abada</td>
<td>65.1±0.4</td>
</tr>
<tr>
<td>Barhee</td>
<td>53.1±4.5</td>
</tr>
<tr>
<td>Deglet noor</td>
<td>52.6±0.6</td>
</tr>
<tr>
<td>Honey</td>
<td>53.1±0.3</td>
</tr>
<tr>
<td>Khadrawy</td>
<td>77.0±2.7</td>
</tr>
<tr>
<td>Medjool</td>
<td>54.8±1.2</td>
</tr>
</tbody>
</table>

Antioxidant Activity of 6 Date Cultivars Compared with 100 ml of red wine

CODEX Standard for Dates-1

CODEX STANDARD FOR DATES
CODEX STAN 143-1985

1. SCOPE
This standard applies to commercially prepared whole dates in pitted or un-pitted styles (preserved for dried or dehydrated). It does not apply to other forms such as slices or mashed 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:
(a) Is harvested at the appropriate stage of maturity;
(b) Is sorted and graded to remove defective fruit and extraneous material;
(c) May be dried and cracked;
(d) May be dried or hydrated to adjust moisture content;
(e) May be washed and/or pasteurized; and
(f) 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) Cargo sugar varieties (containing mainly sucrose) such as Deglet Nour (Deglet noor) and Deglet Berbe (Deglet berbe);
(b) Invert sugar varieties (containing mainly invert sugar - glucose and fructose) such as Damin (Barhi), Sahani (Sahani), Karansieh (Koakale), Holube (Holube), Zerat (Zaratt), and Deglet (Degrat).

2.3 Styles
Styles may be classified as:
(a) Unpitted; and
(b) Pitted.

2.4 Sub-styles
Sub-styles are as follows:
(a) Pressed - dates which are compressed into layers 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 bursa 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 chart:

(a) Unpitted dates

<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>90 to 100</td>
</tr>
<tr>
<td>Large</td>
<td>40 to 90</td>
</tr>
</tbody>
</table>

(b) Pitted dates

<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>90 to 110</td>
</tr>
<tr>
<td>Large</td>
<td>80 to 90</td>
</tr>
</tbody>
</table>

CODEX Standard for Dates-4

5. ESSENTIAL COMPOSITION AND QUALITY FACTORS
5.1 Composition

5.1.1 Optional Ingredients
Glucose or other sugars, flour, vegetable wax.

5.2 Quality Factors

5.2.1 General Requirements
Dates shall be packaged in such a way and under such practices that the finished product shall possess a characteristic color and flavor for the variety and type. Such proper stage of ripeness, free of live insects, and mass lesions and mold and meet the following additional requirements:
(a) Moisture content

<table>
<thead>
<tr>
<th>Date Type</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cargo Sugar</td>
<td>28%</td>
</tr>
<tr>
<td>Invert Sugar</td>
<td>30%</td>
</tr>
</tbody>
</table>

2.2 Nutritional content
Not more than two pits or 4 pieces of pit per 100 dates.

3.2.2 Microbiological Requirements
Not more than 10 g per 100 dates.
CODEX Standard for Dates-5

3.2.2 Definition of Defects

(a) Diluences - Stones, crystallization, salt, dark spots, black spots or similar abnormalities in surface appearance affecting an aggregate area greater than that of a circle 7 mm in diameter.

(b) Liimaged - Unpolished dates only - dates affected by mashing and/or heating of the flesh exposing the pit or to such an extent that it significantly detracts from the visual appearance of the date.

(c) Uneeq Dates - Dates which may be light in weight, light in colour, bluish-green or dull flesh or a dehydrated rubbery texture.

(d) Unpolulated Dates - Dates not polished as evidenced by thin flesh, immature characteristics and no pit in unpolished dates.

(e) Dint - 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

3.2.3 Allowance for Defects

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

- A total of 1% by count of dates with defect (a).
- A total of 6% by count of dates with defects (b), (c), and (d).
- A total of 5% by count of dates with defects (a) and (b).
- A total of 1% by count of dates with defects (b), (c), and (d).

CODEX Standard for Dates-7

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

US Standards for Grades of Dates-1

§52.1010 Ascertainment of 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 assigned a numerical value is on the score of (a). The maximum number of points that may be given such factors are:

Factors | Points
--- | ---
Color | 20
Uniformity of size | 10
Abundance of defects | 30
Character | 40
Total Score | 100

US Standards for Grades of Dates-2

| Score Sheet. |
| --- | ---
| Class | Score points |
| Color | 20 |
| Uniformity of size | 10 |
| Abundance of defects | 30 |
| Character | 40 |
| Total score | 100 |

Percentage for factor: 18 - 20 = 50% (Class A), 16 - 18 = 50% (Class B), 14 - 16 = 50% (Class C), 12 - 14 = 50% (Class D), 10 - 12 = 50% (Class E), 8 - 10 = 50% (Class F), 6 - 8 = 50% (Class G), 4 - 6 = 50% (Class H), 2 - 4 = 50% (Class I), 0 - 2 = 50% (Class J), 0 = 50% (Class K)

Grade Limiting rule: 20 - 23 = 50% (50 - 45), 17 - 19 = 50% (19 - 15), 14 - 16 = 50% (16 - 12), 11 - 13 = 50% (13 - 9), 8 - 10 = 50% (10 - 6), 5 - 7 = 50% (7 - 3), 2 - 4 = 50% (4 - 0), 0 - 2 = 50% (2 - 0), 0 = 50% (0 - 0).
## 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>

Date Orchard in Coachella Valley

Date Harvesting in California-1

Date Orchard in Coachella Valley, California

Date Harvesting in California-2

Date Harvesting in California-3
Sun drying of Majdool dates in a pallet wrapped with shrink wrap with ventilation at the top and bottom.

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

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

- Methyl bromide: 0.33¢
- Phosphine: 0.60¢
- Controlled atmospheres: 0.50¢
- Ionizing radiation: 0.43 to 1.40¢

Cooling Rates to Freeze Dates

[Graph showing cooling rates with different temperatures and times]
Effect of temperature on insect disinfection

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.

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 reinfestation of the dates with insects during their subsequent storage and handling step.

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.
Examples of gift packages available by mail, telephone, or web-based order

Fatty acids composition of nuts influences their storage potential

Shipping Containers for Produce

Fibberboard  Styrofoam  Plastic
Preparation of Dates for Market-4

Forced-air cooling to below 10°C (preferably to 0°C) 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

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

**Temperature vs Deterioration Rate**

<table>
<thead>
<tr>
<th>Temperature (°C)</th>
<th>% Loss per day</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0.5</td>
</tr>
<tr>
<td>10</td>
<td>1.0</td>
</tr>
<tr>
<td>20</td>
<td>2.0</td>
</tr>
<tr>
<td>30</td>
<td>3.0</td>
</tr>
<tr>
<td>40</td>
<td>4.0</td>
</tr>
</tbody>
</table>

**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

<table>
<thead>
<tr>
<th>PERCENT MOISTURE</th>
<th>40°F</th>
<th>75°F</th>
<th>24°C</th>
</tr>
</thead>
<tbody>
<tr>
<td>15</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>25</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
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).

**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**

**Physical and Physiological Disorders**

- 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.