Harvesting and Postharvest Handling of Dates

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Khimri Stage of Development

Khalal Stage of Development

Date Orchard in Coachella Valley

Date Orchard in Coachella Valley, California

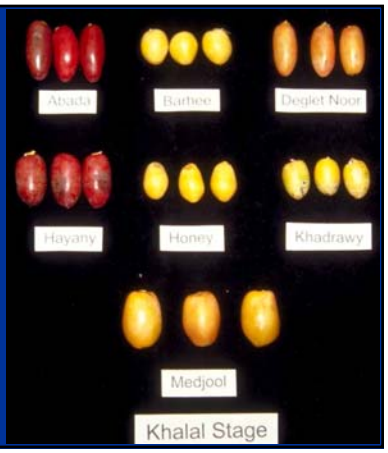
Tamar Stage of Development

Harvesting Khalal Stage Dates

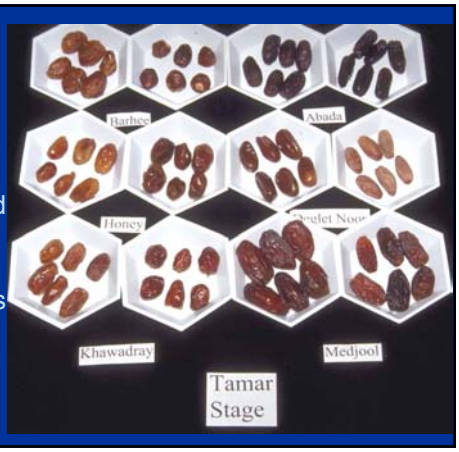
Ripening of Barhi Dates from Khalal to Rutab

Khalal | Partially-rutab | Rutab

Genotypic differences in color of khalal stage dates



Genotypic differences in color and size of tamar stage dates



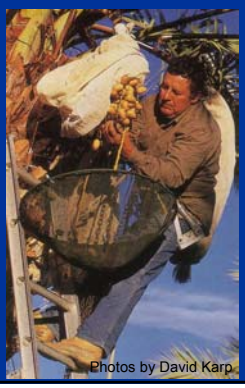
Rutab Stage of Development of Hayany Dates

Tamar Stage of Development of Deglet Noor Dates

Date Harvesting in California-1

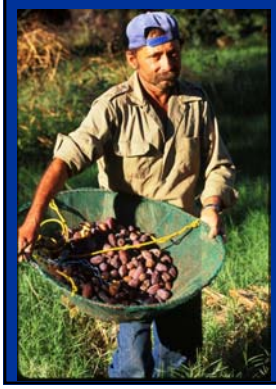
Photos by David Karp

Date Harvesting in California-2



Photos by David Karp

Date Harvesting in California-3



Photos by David Karp

Date Harvesting in California-4

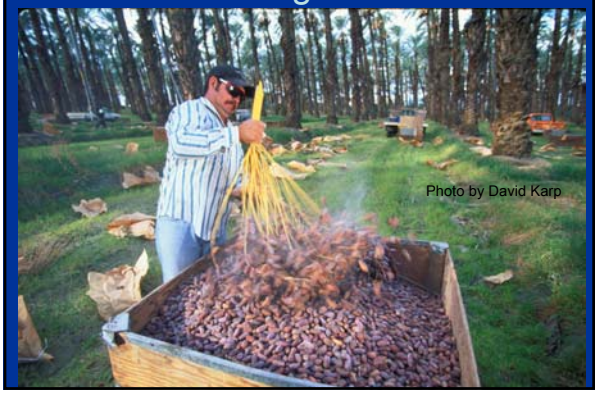
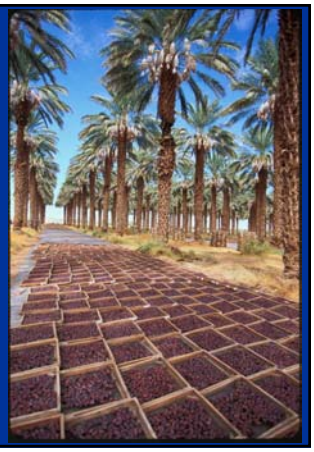


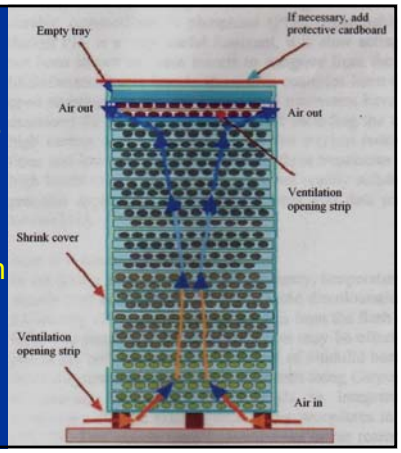
Photo by David Karp

Sun Drying of Dates



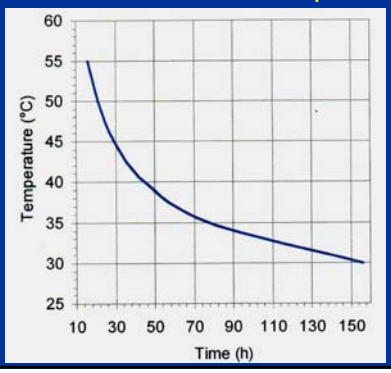
Photos by David Karp

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 ºC for longer than 2 days
- Use of heat treatments (50-55 ºC)
- Exposure to 100% carbon dioxide for longer than 2 days
- Storage at temperatures below 5 ºC reduces insect activity
- Storage in 0.5% oxygen (balance nitrogen) atmosphere reduces insect activity

Experimental Insect Control Treatments

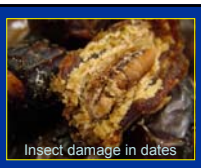
–Fumigation with carbonyl sulfide, methyl iodide, or sulfuryl fluoride

–Insecticidal atmospheres (below 0.5% O_2 and/or 40-60% CO_2)

–Heat treatments (radiofrequency)

–Ultraviolet radiation

–Vacuum treatments



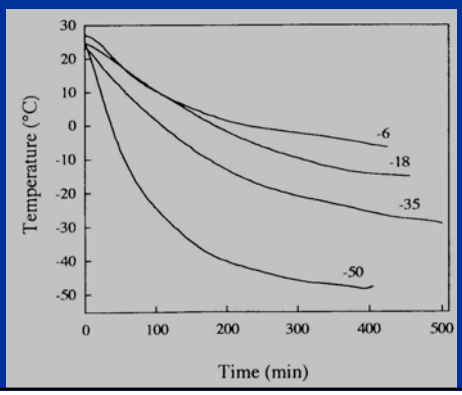
Insect damage in dates

Fumigation chambers for insect control in dates

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

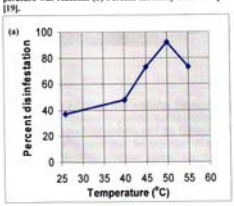
0.33¢	METHYL BROMIDE
0.60¢	PHOSPHINE
0.50¢	CONTROLLED ATMOSPHERES
0.43 to 1.40¢	IONIZING RADIATION

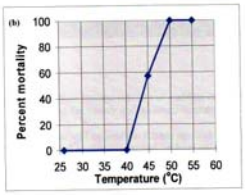
Cooling Rates to Freeze Dates



Effect of temperature on insect disinfestation

Figure 6. (a) Percent disinfestation of *C. hemipterus* larvae from artificial feeding sites at various temperatures for 2 h of exposure after the test temperature was reached. (b) Percent mortality of *C. hemipterus* larvae exposed to various temperatures for 2 h after the test temperature was reached [19].





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

CODEX STANDARD FOR DATES

CODEX STAN 143-1985

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 pieces or mashed 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:

(a) is harvested at the appropriate stage of maturity;
(b) is sorted and cleaned to remove defective fruit and extraneous material;
(c) may be pitted and capped;
(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) **Cane sugar varieties** (containing mainly sucrose) such as Daglat Nuur (Deglet Noor) and Daglat Beidha (Deglet Beidha).

(b) **Invert Sugar varieties** (containing mainly invert sugar - glucose, and fructose) such as Barhi (Barhee), Saiidi (Saidy), Khadhraawi (Khadrawy), Hallaawi (Halawy), Zahdi (Zahidi), and Sayir (Sayer).

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 bunch stem 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	No. of dates in 500 g
Small	More than 100
Medium	80 to 100
Large	less than 80

(b) **Pitted dates**

Size	No. of dates in 500 g
Small	More than 110
Medium	90 to 110
Large	less than 90

CODEX Standard for Dates-4

3. **ESSENTIAL COMPOSITION AND QUALITY FACTORS**

3.1 **Composition**

3.1.1 **Optional Ingredients**

Glucose syrup, sugars, flour, vegetable oils.

3.2 **Quality factors**

3.2.1 **General Requirements**

Dates shall be prepared from such fruit and under such practices that the finished product shall possess a characteristic colour and flavour for the variety and type, be of proper stage of ripeness, be free of live insects and insect eggs and mites and meet the following additional requirements:

(a)	**Moisture content**	**Maximum**
	Cane Sugar varieties	26%
	Daglat Nuur	30% (not processed in accordance with 2.1(d)(e))
	Invert Sugar varieties	30%
(b)	**Size (minimum)**	
	Unpitted Dates	- 4.75 grammes
	Pitted Dates	- 4.0 grammes
(c)	Pits (Stones) (in Pitted Style)	- Not more than two pits or 4 pieces of pit per 100 dates
(d)	**Mineral impurities**	- Not more than 1 g/kg

CODEX Standard for Dates-5

3.2.2 **Definition of Defects**

(a)	**Blemishes**	-	Scars, discoloration, sunburn, dark spots, blacknose or similar abnormalities in surface appearance affecting an aggregate area greater than that of a circle 7 mm in diameter.
(b)	**Damaged**	-	(Unpitted dates only) - dates affected by mashing and/or tearing of the flesh exposing the pit or to such an extent that it significantly detracts from the visual appearance of the date.
(c)	**Unripe Dates**	-	Dates which may be light in weight, light in colour, have shrivelled or little flesh or a decidedly rubbery texture.
(d)	**Unpollinated Dates**	-	Dates not pollinated 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

(f)	**Insects and mites**	-	Dates damaged by insects or mites or contaminated by **damage and contamination** the presence of dead insects or mites, fragments of insects or mites or their excreta.
(g)	**Scouring**	-	Breakdown of the sugars into alcohol and acetic acid by yeasts and bacteria.
(h)	**Mould**	-	Presence of mould filaments visible to the naked eye.
(i)	**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 7% by count of dates with defect (a)
A total of 6% by count of dates with defects (b), (c) and (d)
A total of 6% 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**

		Maximum Level
4.1	Glycerol)	In accordance with GMP (see also Section 3.1.1)
4.2	Sorbitol)	

5. **HYGIENE**

5.1 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 (1985) Codex Alimentarius Volume 1), and other Codes of Practice recommended by the Codex Alimentarius Commission which are relevant to this product.

5.2 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

§52.1004 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.

(1) Varietal requirement.

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

Factors	Points
Color	20
Uniformity of size	10
Absence of defects	30
Character	40
Total Score	100

U.S. Standards for Grades of Dates-2

§52.1011 Score Sheet.

Size and kind of container
Container marks or identification
Label or brand
Net weight
Style
Count (per lb.)
Moisture content (if determined)
One variety ( ) Yes ( ) No

Factors	Score points		
Color	20	(A) (B) (B-Dry) (C) (C-Dry) (SStd)	18 - 20 16 - 17 1/ 14 - 15 1/ 0 - 13 1/
Uniformity of size	10	(A) (B) (B-Dry) (C) (C-Dry) (SStd)	9 - 10 8 1/ 7 1/ 0 - 6 1/
Absence of defects	30	(A) (B) (B-Dry) (C) (C-Dry) (SStd)	27 - 30 24 - 26 1/ 21 - 23 1/ 0 - 20 1/
Character	40	(A) (B) (B-Dry) (C) (C-Dry) (SStd)	36 - 40 32 - 35 1/ 28 - 31 1/ 0 - 27 1/
Total score	100		

Grade

1/ Limiting rule.

Quality Grades of Medjool dates

Grade	Dates/pound	Description
Jumbo	16-19	No blemishes, skin separation, or dryness
Large	20-23	No blemishes, skin separation, or dryness
Extra-Fancy	20-24	Minor blemishes, packed all sizes together
Fancy	20-26	Some dryness and skin separation, packed all sizes together

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

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 recycleable 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

Front

Back

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

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

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

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

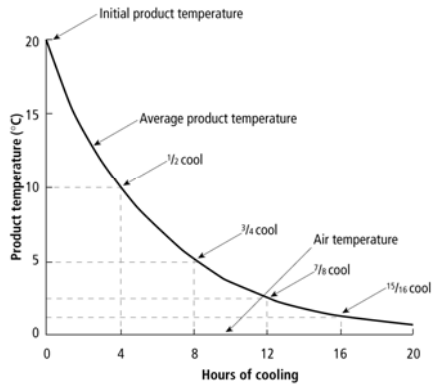
Shipping Containers for Produce

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.

Typical cooling curve for perishable products. Cooling times are typical for large fruit, like peaches, exposed to moderate amounts of airflow.

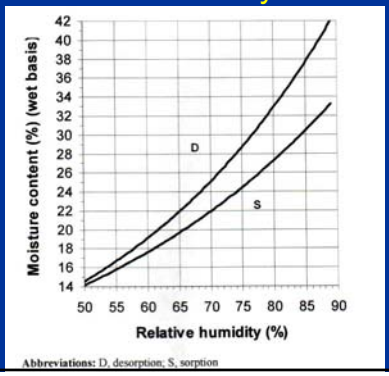


Loading dates into refrigerated trucks for transport to market

Storage Factors

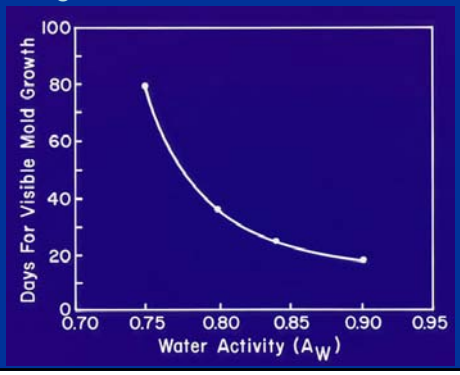
- *Moisture content of the dates*
- *Relative humidity of storage*
- *Storage temperature*
- *Oxygen concentration*
- *Effective insect control*

Moisture content of Majdool dates vs air relative humidity at 26C



Abbreviations: D, desorption; S, sorption

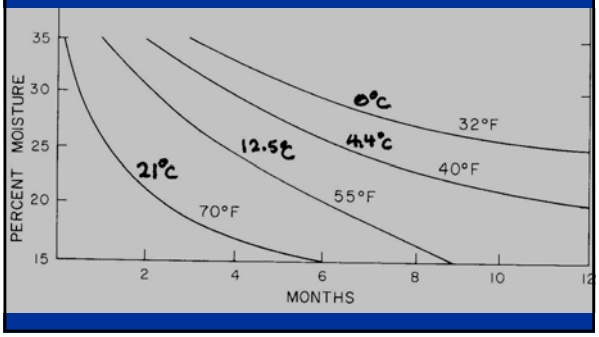
Relationship between water activity and mold growth on dried fruits and nuts



Optimum Storage Relative Humidity

% RH	Commodities
100	Leafy vegetables
	Cool-season root vegetables (98)
95	Flower vegetables, most cut flowers
90	Fruits & fruit vegetables
85	Sweet potato, cassava
80	
75	Dates
70	Dry onion & garlic, yams
65	Ginger, pumpkin & winter squash
60	Tree nuts
55	Dried fruits & vegetables

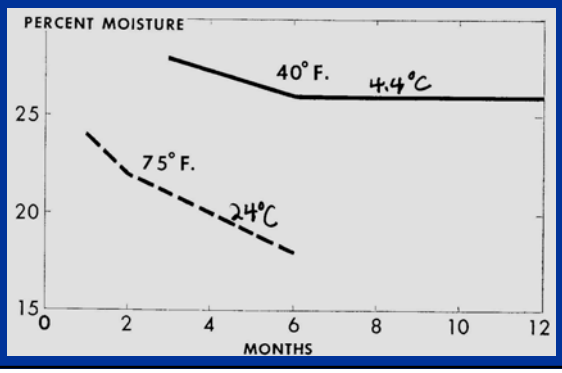
Effects of temperature and moisture content on storage life of Deglet Noor dates



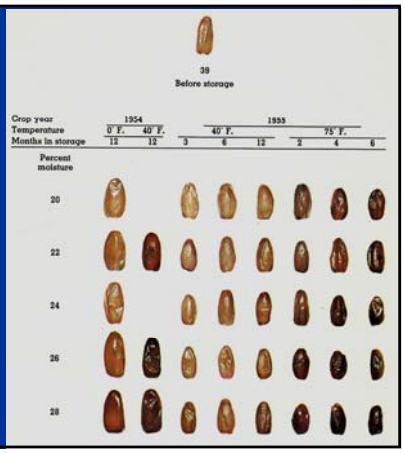
Physical and Physiological Disorders-1

- **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-Soft Dates (Deglet Noor, Halawy and Zahidi)					
Temperature	70°F (21°C)	60°F (15°C)	40°F (4°C)	32°F (0°C)	0°F (-18°C)
Storage Period	1 month	3 months	8 months	1 year	over 1 year
Relative Humidity	75% or less				

Soft Dates (Medjool, Barhee, Khadrawy, Maktoom, Sayer, and Dayri)		
Temperature	32°F (0°C)	0°C (-18°C)
Storage Period	6 months	More than 6 months
Relative Humidity	75% or less	

Modified Atmospheres as a Supplement to Temperature Management