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TECHNO-ECONOMIC PROFILE

ON

DATE DIBIS AND DATE HONEY

Project No: UC/RAB/90/011

AUGUST 1991

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TECHNO-ECONOMIC PROFILE ON DATE DIBIS AND DATE HONEY

1.0 EXECUTIVE SUMMARY

Date Syrup.

The main use of date syrup in manufacturing is as a sweetner for soft drinks and as a sugar additive to the manufacture of bread, biscuits and cereals. An additional market for syrup as a caramel replacement could develop in the USA following restriction in the use of caramel.

Date Honey

No specific use for date honey other than as a concentrated syrup for manufacturing purposes has been established, although a niche market exists for selective honies in Europe and the USA.

Date Pulp

Residual pulp and stone are not listed as being suitable for animal feed, but a limited local market may exist if suitable supplements are added.

The estimated investment costs for design, construction and commissioning a plant with an output of 5,000 tons of date syrup per year is US$ 5.33 m plus site costs. The additional cost of a honey processing plant and pulp plant is estimated at US$ 3.07 m plus site costs.

An annual production of 5,000 tons of date syrup could turnover US$ 10.25m depending on the geography of sales outlets relative to the production area, the ability of the market to absorb this quantity, the quality of the product and its wholesale price.

The estimated profit on syrup alone on this turnover is US$ 1.44m, but this is contingent on raw material, finance and labour costs.

2.0 PRODUCT DEFINITION

2.1 Date Syrup

Date syrup is used in bulk form as a sweetener for the manufacture of soft drinks, confectionery and the production of bread and biscuits.

Date syrup extract of varying browning colour and viscosity is used as a sugar substitute in bread making; 3% to 10% of date syrup can replace sugar without materially changing bread quality. 3% date syrup is recommended as the commercial level for ingredient use.

Date syrup can also be used as an ingredient in the manufacture of breakfast cereals, providing both the colour and level of sweetness.

In these applications, bulk packaging of the product is necessary for use by the food industry, the sterile syrup product being stored in 10kg drums to 300 kg aluminium pressurised containers. These pressurised containers are standard containers for sterile fruit juices and fruit pulps etc.

Consumer Use

It is doubtful that within Europe, date syrup will be in demand as a consumer product.

In Iraq and Iran the use of date syrup for domestic bread, biscuits and other bakery products is increasing. Also the growing demand for table sugar provides a market opportunity for a sugar substitute.

Iraq being a major date producing country with an estimated annual production of 450,000 tons per year has stimulated the use of date sugar sold to the consumer as a replacement for table sugar at a subsidised manufacturing cost. Subsequently, in Middle Eastern countries, a market exists for consumer product of date syrup in 1 kg can packs.

2.2 Date Honey

No specific use for date honey, other than as concentrated syrup for manufacturing purposes, has been established. As a caramel replacement, concentrated date syrup compares well with commercial caramel. Subsequently, requirements of the manufacturing sector for a more concentrated solution in bulk packs is estimated to be similar to that of date syrup.

Consumer Use

Consumer interest for date honey, marketed within Europe and the USA may well provide the opportunity of small 0.5kg consumer packs.

The USA has an established Californian date industry, which is primarily the processing of eating quality dates.

3.0 TECHNOLOGICAL REVIEW

3.1 Raw Material

There are numerous types of date cultivar. Quality of raw material is dependent both upon variety, growing location, temperature and maturity.

An approximate comparison of sugar content of dried dates compared with other fruits is given in Figure 1 (see page 5).

The regional production of all dates assessed on a world wide basis taken from the Food and Agricultural Organisation of the United Nations indicates production levels by country given in figure 2 (see page 5).

Research relating to the sugar extraction potential of various date varieties, indicate that the growing region, harvesting time relative to maturity, temperature and variety of date, are all critical to the sugar content and subsequent extraction yield.

In Libya, the Ministry of Agriculture policy has established a 4 million palm tree production level, which yields approximately 87,000 tons of dates per year, approximately 5% of the total world production. Of these the main cultivars grown in Libya are:-

Bikriari
Khadhrai
Taasfirt

The Bikriari variety is the most popular in Libya for the manufacture of date syrup.

No	Food	Description and number of samples	Edible matter, proportion of weight purchased	Water g	Sugars g	Starch g	Dietary fibre g	Total nitrogen g
722	Damsons stewed with sugar	Fruit and juice, no stones	1.19	72.0	17.8	0	3.1	0.05
723	stewed with sugar (weighed with stones)	Calculated from the previous item	1.19	67.0	16.6	0	2.9	0.05
724	Dates dried	Flesh and skin, no stones	0.86	14.6	63.9	0	8.7	0.32
725	dried (weighed with stones)	Calculated from the previous item	0.86	12.6	54.9	0	7.5	0.28
726	Figs, green raw	Whole fruit, no stalks	0.98	84.6	9.5	0	2.5	0.21
727	dried raw	Whole fruit	1.00	18.8	52.9	0	18.5	0.57
728	stewed without sugar	Fruit and juice	1.80	53.8	29.4	0	10.3	0.32
729	stewed with sugar	Fruit and juice	1.91	50.7	34.3	0	9.7	0.30
730	Fruit pie filling canned	10 cans, blackcurrant, blackberry and apple, gooseberry, apple, cherry	1.00	72.6	23.2	1.9	(1.8)	0.04
731	Fruit salad canned	Fruit and syrup	1.00	71.1	25.0	0	1.1	0.04
732	Gooseberries, green raw	Flesh, skin and pips, no 'tops' or 'tails'	0.99	89.9	3.4	0	3.2	0.18
733	stewed without sugar	Fruit and juice	1.16	91.4	2.9	0	2.4	0.15
734	stewed with sugar	Fruit and juice	1.27	82.7	12.5	0	2.5	0.14
735	ripe raw	Flesh, skin and pips, no 'tops' or 'tails'	0.99	83.7	9.2	0	3.5	0.09
736	Grapes, black raw	Flesh only, no skin, pips or stalks	0.81	80.7	15.5	0	0.4	0.08
737	raw (whole grapes weighed)	Calculated from the previous item	0.81	65.2	13.0	0	0.3	0.08

FIGURE 1

Continent	Production (1000 Metric Tons)	Percent of World Total
Africa	963	39.5
North and Central America	15	0.6
South America	1	0.1
Asia	1,439	59.7
Europe	17	0.7
Total	2,435	100.0
Country		
Iraq	498	20.5
Egypt	409	16.8
Iran	310	12.7
Saudi Arabia	262	10.8
Pakistan	186	7.6
Algeria	185	7.6
Sudan	105	4.3
Morocco	102	4.2
Yemen Arab Republic	70	2.9
Libya	65	2.7
Oman	50	2.1
Tunisia	46	1.9
Yemen Democratic	42	1.7
Chad	25	1.0
United States	20	0.8
Spain	16	0.7
Bahrain	16	0.7
Mauritania	13	0.5
Niger	6	0.2
Somaliland	6	0.2
All others	3	0.1
Total	2,435	100.0

FIGURE 2

Iraq was the major date producing country until recently and the principle variety grown is Zadhi.

Data is not available indicating the proportion of variety within the total crop, harvested within Iraq and Libya.

However, analysis of varieties has been carried out relating to the nutritional quality and characteristics of dates:-

Bodaywala dates contained the highest average weight (8.9g) per date.
Jhajri date stone contained the highest average weight (1.0g) per stone.
Dona was the sweetest date with 83% total soluble solids.
Bodaywala and Waniwala, provided maximum pulp (91%) and date stone (24%) respectively.
Basra yielded the best quality date syrup (72 degree Brix).

Principal varieties of dates commercially grown are indicated in Appendix A.

3.2 Date Production

The increase in sugar content from young dates through to maturity prior to harvest is briefly described as:-

Khalal Stage
The date is pink, yellow or red, depending upon the variety and this is the growth stage of the date, where invert sugar accumulates slowly, and sucrose much more rapidly.

Rutab Stage

Rutab is the period during the ripening of the date, where the fruit softens. Little or no sugar accumulates during this stage. Dates continue to lose water, but retain sufficient water to make them self-preserving.

Tamar Stage

The date is dried to a fairly firm constituency and the sugar to water ratio is such that the dates do not ferment. Young dates contain as much as 85% water, invert sugar ranging from 40% to 97% of total sugar in the early stages of growth, but decreasing in percentage as sucrose accumulates after the fruit has obtained full size. No other sugar has been detected in dates, once they have approached full development. At full development sucrose constitutes 80% of the sugar present for soft, semi-dry and dry kinds of dates.

The variety Degletnoor has a sucrose level of 85% of the total sugar content and this is determined by the temperature, humidity and rainfall during the ripening period.

As indicated in the comparison table, the sugar content is approximately 60% of date composition per 100 g sample for dried dates.

3.3 Date Processing Technology Options

Holland and the UK are the main manufacturers of process equipment for the preparation of date syrups, honey and pulps.

Holland have submitted to Iraq processes and installed

one known plant for the purpose of producing date syrup.

The technology highlighted in this profile is that designed, manufactured and sold by APV Baker, the UK international food process plant manufacturer.

APV Baker
Westfield Road
Peterborough PE3 6TA
England
Tel: 0733 26200 Fax: 0733 263570

The process technology is very similar to that of sugar extraction from beet and could be used for similar processing technologies.

The processing principles are quite simple in that raw material is macerated inclusive of stone, skin etc., blended with hot water to extract sugars and other dissolved compounds which leave the residual fibrous structure which is then dried and processed for animal feed, the liquid extraction being condensed by use of low temperature vacuum condensers with further clarification, if required of the resulting concentrate syrup.

This process is a conventional extraction method.

3.4 Plant Capacity

Plant capacity is a function of market demand for finished product and not availability of raw material.

A process system capable of processing raw date at the rate of 3000kg per hour will, if operated on an 8 hour shift, 6 days per week, produce approximately 2000 tons of date dibis per year.

Operation of this plant on a 7 day week, 3 shift working, will improve the utilisation of the plant facility and provide an approximate level of 6000 tons of finished date dibis per year.

Therefore, a plant of the capacity 3000kg per hour, raw date processing is considered the optimum size of processing facility.

3.5 Harvesting Contracts

The control of raw material product for central processing is one of the most difficult aspects of a project.

Dependent on the location of the plant, the collection of large quantities of date will require either a co-operative contract agreement, or free-market trading based upon intake of sugar content and weight against a structured payment scale.

It is essential that the dates have matured to the maximum sugar level, suitable for processing and if harvesting is not carried out by controlled contract and field work, the processor can only resort to payment on volume and average sugar content by load as is practised in Europe.

Generally, dates are collected in crates of 25kg weight and further such standardised transportation systems would be necessary for the process plant as both fumigation and long-term storage is required enabling the plant to operate over a much longer period after harvesting.

Dates after harvesting must be handled carefully and not be subject to dropping and crushing by stacking loads. Therefore, the crates must be self stacking without detriment to the quality of date.

Processing requirements of only 2,000 tons per year will require storage capacity and intake for a minimum of 80,000 trays during the harvesting period.

Extraction is approximately 50% of intake weight which would require therefore 150,000 crates of raw material per year at an output of only 2,000 tons of date dibis per year.

4.0 PROCESS

4.1 Process Description

To operate the process continually requires the intake raw material to be fumigated, removing surface bacteria and insect growth and the storage of clean dates at a temperature of 0°C which will enable the process to continue after harvest collection.

The storage temperature of dates relative to the maintenance of sugar levels requires evaluation as variations occur to each cultivar and regional growing area.

In approximate terms, the storage of cleaned dates at a temperature of 0°C enables the product to be kept for up to 1 year before processing.

The process is defined as:-

Intake during harvest over Weighbridge and sugar content test.

↓

Fumigation and cleaning.

↓

Store with adequate air-flow in 0°C chill store.

↓

Feed raw material to process line via infeed conveyor and feed hoppers.

↓

Mix with hot water and macerate.

↓

Filtration.

↓

Clarification.

↓

Evaporation.

↓

Cooling.

↓

Bulk packaging of product for commercial sale and repackaging into consumer packs.

↓

Finished goods, bulk storage warehouse.

↓

Consumer packaging process.

↓

Distribution.

Services required are:-

Steam boiler

Cooling water plant

Portable water consumption

Compressed air for processing

Power consumption for total site and processing.

4.2 The following is an approximate requirement for the process plant:-

Feed Rate of Dates	-	3,000 kg/hr
Product Rate for Weak Syrup	-	7,500 kg/hr at 20°Brix
Product Rate for Final Syrup	-	2,080 kg/hr at 72°Brix
Total Steam Requirement	-	1,250 kg/hr at 7 Bar g
Cooling Water Requirement	-	75m/hr at 2 bar g
Potable Water Requirement	-	5,000 1/hr
Electricity Requirement	-	100kw 3 phase 400/440V
Air Requirement	-	2m /hr at 4 bar g of clean, dry, oil free instrument air.

4.3 An estimate of the maximum capacity for this type of plant based upon a 50% yield is:-

@ 3,000 kg/hr feed rate
@ 6 day/wk 24 hr/shift operation
= 24 x 3 x 6 = 430 ton/raw material/wk
@ approximately 50% yield
date pulp residual = 200 tons/wk (before drying)
date syrup = 290 tons/wk
Maximum annual capacity is therefore
50 x 430 = 21600 tons raw material/year
= 14,500 tons/yr date syrup
= 10,000 tons/yr date pulp (before drying)

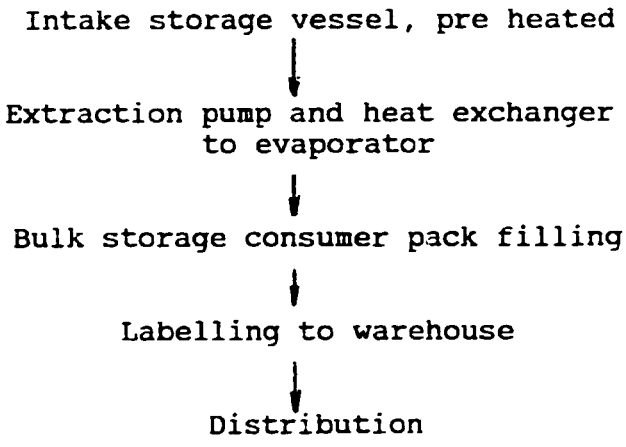
Further to this process which is the extraction of date syrup, it is necessary to:-

(a) Further process and package the residual date pulp for animal feed purposes.
(b) Further refinement of syrup and packaging of syrup as date honey.

4.4 Date Honey Production

The date honey production proces requires a further extraction from date syrup at a higher concentration, which will be different in texture and colour to honey naturally collected.

Following is an outline of the processing stages:-

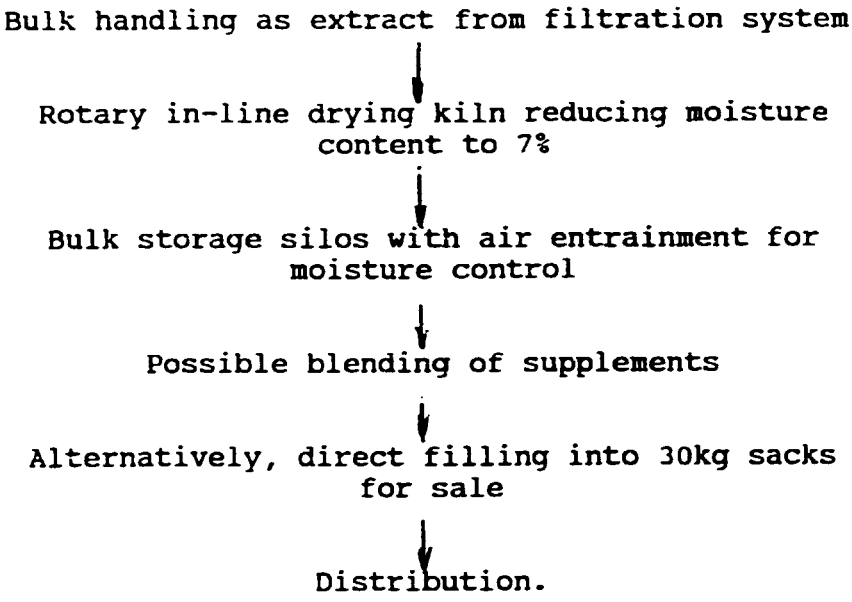


4.5 Date Pulp Production

Date pulp, if extracted to a level of 7% moisture content, can be bulk stored in ventilated silos or bulk packaged in sacks for use as an animal feed supplement.

If product is not extracted at 7% moisture level, then a rotary kiln drier is required to further reduce the moisture level.

The process for handling date pulp is:-



Whilst these are the elements of handling pulp as an alternative animal feed, location and environment are critical for the storage of dried pulp. If pulp is not reduced to the level of 7% moisture content, then fermentation commences within several hours after processing and the product will no longer be suitable for animal feed.

The commercial benefits of pulp feed are dependent upon the residual protein level within the pulp.

4.6 Process Plant Estimates

A process plant of this capacity incorporating all of the various sub processes is estimated both in capital cost and building area as:-

Plant Requirement @ 5000 tons date syrup capacity/year

4.6.1

Date Syrup	$	Area
Intake scale and test house	56,000	200 sq.m
Date Cleaning Shed	48,000	450 sq.m
Date Chill Store	1,040,000	3,000 sq.m
Intake elevator & hoppers	40,000	(50 sq.m)
Macerate Filtration Clarification Evaporation Cooling	800,000	(120 sq.m)
Bulk storage tanks & pumps	96,000	(100 sq.m)
Overall Area Process Room	240,000	450 sq.m
	$ 2.32 M	4,100 sq.m

4.6.2

Date Syrup Packing	$	Area
Overall Area Packing Room	160,000	300 sq.m
1 - Bulk packing m/c	136,000	(25 sq.m)
2 - Consumer packing m/c	256,000	(50 sq.m)
Packaging Washer	48,000	(30 sq.m)
Packaging material store	160,000	1,000 sq.m
Conveyors	96,000	(60 sq.m)
Distribution store	320,000	1000 sq.m
	$1.176 M	2,300 sq.m

4.6.3

Date Pulp Processing	$	Area
Rotary kiln drier	400,000	(50 sq.m)
Bulk storage	320,000	250 sq.m
Weigh & bag	96,000	(50 sq.m)
Supplement additions	80,000	(30 sq.m)
Supplement storage	96,000	(200 sq.m)
Overall Area process room	200,000	400 sq.m
Distribution store	480,000	1500 sq.m
	$ 1.67M	2150 sq.m

4.6.4

Date Honey Processing & Packaging	$	Area
Intake pumps and tank)		
Filtration)		
Evaporation)	400,000	(75 sq.m)
Cooling)		
Storage	96,000	(40sq.m)
Filling & Packaging	192,000	(30 sq.m)
Packaging Material Store	72,000	150 sq.m
Distribution Store	72,000	150 sq.m
Overall Area Process Room	160,000	200 sq.m
	$992,000	500 sq.m

4.6.5

Services		
Boiler plant, equipment and mains	136,000)	
Compressed air	56,000)	
Cooling water tower & mains	72,000)	
Portable water source	80,000)	
Elec. power & feeders	128,000)	240 sq.m
Gas Feeder for Dryer	64,000)	
Admin. facility	120,000	200 sq.m
Access road and surrounds	480,000	500 sq.m
	$ 1.136M	940 sq.m

Project Estimated Totals	$ 7.3 M	9990sq.m
Training & Commissioning @ 10%	$ 0.727 M	
Shipping @ 5%	$ 0.363 M	
Estimated Total	$ 8.4 M	9990sq.m site

These estimates are dependent upon the region of construction and sourcing of raw materials. Costings are current UK estimates. The costs include erection of buildings and the supply and erection of plant.

4.6.6 Plant Operation

If the construction of the chill store achieves up to 1 year storage facilities for processing raw date without detrimental effect to sugar content and quality, then plant capacity operating on a 6 day week, 12 hour shift can be used continuously throughout the year to achieve an approximate output of 6500 tons per year of finished product.

The process could be used for similar maceration and extraction products, but as the location is unknown, details of alternatives cannot be given.

4.7 Buildings & Special Civil Works

A level site of approximately 9,990m² is required.

The major civil works will be to provide slabs for the principal process units together with warehouses and administration buildings, connected by heavy duty access roads.

The only special civil requirement will be the chill store which requires insulation and associated refrigeration facilities to maintain a minimum internal temperature of 0°C under the prevailing maximum ambient conditions. The refrigeration plant specification will depend on the site location and the rate of accumulation of raw material for processing.

4.8 Annual Mintenance Costs

The plant amortisation period should be assumed to be 15 years, the annual repair and maintenance cost is 15% of the initial plant and building cost.

4.9 Initial Production Levels

Year	Tonnes per Year
1	2,000
2	4,000
3	5,000

4.10 Construction Period

Initial Design & Purchase	24 weeks
Supply of Process Plant	36 weeks
Shipping	6 weeks
Site Installation	26 weeks
Commissioning	12 weeks
Total time for Project Implementation	**104 weeks** (2 years)

4.11 Environmental Aspects

There should be no adverse environmental affects from this project.

5.0 PRODUCTION COSTS

Manufacturing costs are very dependent upon regional source of energy, water and utility services.

Production, labour costs are a function of regional pay structures.

An estimate of manufacturing costs as a percentage of finished product providing 2,000kg per hour of date syrup must include costs defined as:-

must include costs defined as:-

Direct labour	-	20 man hour cost/2000kg (assume to be $1.5 per man hour)
Utility services of steam, gas, electricity, water and effluent	-	$235 per hour/2000kg
Intake and distribution costs	-	6% of selling price
Packaging	-	9% of selling price
Overall yield of raw material intake for the purposes of conversion intake	-	95% of raw material

Raw material costs are difficult to generalise (being entirely dependant on local conditions). The best example is to take Sayer variety at US$ 660 per ton and a conversion rate to syrup of 67% is assumed.

If the regional market price of raw material is assessed, then these percentages and additions including that of yield conversion can be adopted to determine the minimum date syrup selling price at the capacity of 3000kg per hour raw material intake.

6.0 MARKET FOR PRODUCTS & INTERNATIONAL PRICES

Date Syrup

Granulated sugar is produced from sugar cane or beet, both having a natural carbohydrate content, which is high in sucrose and is fairly easy to refine.

Dates contain a mixture of sugars with a high proportion of glucose and fructose as well as some sucrose. The

Whilst it may be possible to make a powdered granular product for use as a sweetener, this would not be a true substitute for granulated sugar and the processing would be expensive.

Date syrup is a useful sweetener, which can be produced at low cost and is suitable for industrial use as its sweetening power is high with a higher solubility then sucrose.

Date syrup in bulk can be marketed for manufacturing purposes within Europe, Japan and the USA.

The consideration of caramel replacement, particularly in the USA should be reviewed.

Consumer pack of date syrup appear only suitable for the retail market within the established Middle Eastern areas, particularly Iraq and Libya.

The selling price of syrup is assumed at US$ 2,050 per ton based on the UK retail selling price of US$ 3,080 per ton with a 50% mark up.

Date Pulp

The sale of date pulp, processed for animal feed, is restricted to local sales within 100 mile radius of the processing plant due to the low sale value and bulk unit relative to distribution costs. Sugar beet pulp is often rejected due to the small market demand. This may be different in Middle Eastern countries, particularly Turkey, where cheap animal feed is required.

The addition of supplements to the pulp during the blending and packaging process may enhance the market value.

No figures are available for the selling price of date pulp.

Date Honey

The product of date honey could be marketed in Europe if correctly presented in glass jars with appropriate labelling conforming to the various market health requirements as a health ingredient product, prepared without the use of insecticides, artificial fertilisers etc.

A niche market for honeys exists throughout Europe and the USA.

No figures are available for the selling price of date honey.

APPENDIX A

PRINCIPAL VARIETIES OF DATES COMMERCIALLY GROWN

Barhee — Soft date. Origin is Iraq. Small to medium, ovate to nearly round fruit. Yellow becoming amber upon ripening and deep golden brown when cured. Fruit has relatively little astringency in the khalal state as compared with other varieties. Ripens late. Yield is heavy: 300 pounds (136 kilograms) per tree.

Dayri — Semidry date. Origin is Iraq. Medium to large, oblong to oblong-elliptical fruit. Dull rose over a deep-chrome yellow colour. Ripens and cures to a dark reddish brown, usually with a deeper colour, almost black, at the base. The softer fruit is more attractive. The drier fruit is a light dull-red with a distinctive purplish tint. Yield is variable because of frequent failures to get a good set of fruit. Yield, under favourable conditions: 150 to 200 pounds (68 to 91 kilograms).

Deglet Noor — Semidry date. Origin is Algeria. Medium to large, oblong-ovate fruit. Coral red colour, becoming amber upon ripening and a deeper brown when cured. Ripens late. Very important commercial variety in California: less so in Arizona because of fruit's susceptibility to damage from rain and high humidity. Yield, under favourable conditions: 200 to 300 pounds (91 to 136 kilograms) per tree.

Halawy — Soft date. Origin is Iraq. Small to medium, oblong with rounded apex. Yellow colour, becoming light amber upon ripening and translucent golden brown when cured. Ripens early. Widely grown. Trees have shown little damage from occasional rains and high humidity. Main disadvantage is tendency for fruit to shrivel during ripening, but this can be largely avoided by planting tree in heavy soil with adequate irrigation. Average yield: 150 to 200 pounds (68 to 91 kilograms) per tree.

Hayany — Soft date. Origin is Egypt. Large oblong-elliptical fruit. Deep red colour, ripening to purplish black. Ripens in midseason. Less extensively planted than leading varieties. Heavy losses of fruit have occurred during wet, unfavourable ripening seasons. Fruit does not cure readily and is best adapted to handling as a fresh date. Average yield: 250 to 300 pounds (113 to 136 kilograms) per tree.

Iteema — Soft date. Origin is Algeria. Medium to large, oblong-ovate fruit. Yellow colour, becoming amber upon ripening and darker brown when cured. Ripens in midseason. Fruit is subject to serious spoilage when it ripens in wet weather. Not as extensively planted as some leading varieties. Average yield: 200 to 250 pounds (91 to 133 kilograms) per tree.

Khadrawy — Soft date. Origin is Iraq. Small to medium oblong-ovate fruit. Light yellow colour, becoming greenish-amber upon ripening and reddish-brown when cured. Ripens early. An important commercial variety in California and Arizona. The tree is smaller than commercial varieties, but is well adapted to a rather wide range of conditions. Comparatively light yield: 100 to 120 pounds (45 to 54 kilograms) per tree.

Khalasa — Soft date. Origin is eastern Arabia. Small to medium, oblong-ovate fruit, with an oblique base and somewhat irregular outline. Yellow colour, becoming amber upon ripening and reddish brown when cured. Ripens in midseason. Relatively limited commercial plants. Average yield: 120 to 150 pounds (54 to 68 kilograms).

Khustawy — Soft date. Origin is Iraq. Small oblong-ovate fruit. Yellow colour, becoming amber upon ripening and brownish red when cured. Ripens in midseason. Widely planted, with exception of Coachella Valley, where skin of fruit has had a tendency to separate from the flesh. Trees prefer heavy soils. Tree has good record for withstanding occasional damp weather during ripening. Average yield: 150 to 200 pounds (68 to 91 kilograms) per tree.

Maktoom — Soft date. Origin is Iraq. Medium to large, broadly oblong-oval fruit. Yellow colour, becoming amber upon ripening and deep chestnut brown when cured. Ripens late. Variety is best adapted to handling as a fresh date. Few plantings in the Coachella Valley; less limited plantings in Salt River Valley. The fruit has some tolerance to high humidity. Average yield: 175 to 225 pounds (79 to 102 kilograms) per tree.

Medjool — Soft date. Origin is Morocco. Characteristically very large, but varies considerably in size. Broadly oblong-oval to somewhat ovate. Irregularities in shape are common and are associated with ridges on the seed. Colour is orange yellow with a fine reddish-brown stippling, becoming amber upon ripening, and reddish brown when cured. Ripens early. Populations were greatly reduced because of the ravages of the bayoud disease to which it is particularly susceptible. In California, yields average: 150 to 200 pounds (68 to 91 kilograms) per tree.

Khars — Soft date. Origin is Algeria. An excellent variety. Fruit is large, narrowly oblong-ovate. Yellow colour, becoming amber upon ripening and reddish brown when cured. Ripens very early. Very limited plantings in California and Arizona because fruit is extremely susceptible to damage from rain and high humidity. Average yield: 200 to 250 pounds (91 to 113 kilograms) per tree.

Saidy — Soft date. Origin is Egypt. Large, broadly oblong-oval fruit with flattened base. Orange yellow colour, becoming dull-brown upon ripening and deeper shades when cured. Ripens late. Limited plantings in Imperial Valley, California. Considerable losses experienced during humid weather. Yield: 175 to 250 pounds (79 to 113 kilograms) per tree.

Sayer — Soft date. Origin is Iraq. Medium to rather large, oblong to oblong-oval fruit. Yellow colour with faint longitudinal streaks of red near the base. Becomes amber upon ripening and deep reddish-brown when cured. Ripens in midseason. Plantings are relatively limited, mostly in Salt River valley. Fruit has medium tolerance to high humidity. Yield: 175 to 200 pounds (79 to 91 kilograms) per tree.

Tazizoot — Soft date. Origin is Algeria. Large, oblong-elliptical fruit. Colour is yellow, becoming amber upon ripening and reddish-brown when cured. Ripens early. Growers no longer prefer because of lack of quality and heavy losses of fruit from occasional rains and high humidity. Yield: 200 to 250 pounds (91 to 113 kilograms) per tree.

Thoory — Dry date. Origins in Algeria. Medium to large, oblong fruit with rounded apex. Colour is yellow, ripening and curing to a light greyish brown or straw colour with apical parts frequently dull brown. Ripens late. One of the few varieties of dry date planted in United States. Yield: 200 to 250 pounds (91 to 113 kilograms) per tree.

Zahidi — Semidry date. Origin is Iraq. Small to medium size, obovate fruit. Yellow colour, becoming amber upon ripening and reddish-brown when cured, except for dull yellow or straw coloured areas on dry flesh retained at the base of many fruits. Ripens in midseason. Limited plantings in Arizona and California. The fruit lends itself to relatively easy handling by grower, but quality is somewhat lacking. Fruit is somewhat less tolerant to rain and high humidity than the Halawy and Khadrawy fruits: 200 to 300 pounds (91 to 136 kilograms) per tree.