

Date Palms for Australia – further developing the industry

**Establishment, management and production of
premium table dates**



by Dave Reilly

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Foreword

Given the large size of the international date trade, it is surprising that Australia has not utilized its hot, dry inland regions to establish a substantial date industry.

Australia's mainstream agricultural production systems are being challenged by climate variability, extreme temperatures, water scarcity and fluctuating commodity prices. The date palm thrives in harsh environments and offers economic diversity. Date palms produce high-value crops of highly nutritious food which can contribute to Australian and global food security.

Trials of date palms as far back as the 1890's and the ad-hoc distribution of date seeds by cameleers commencing earlier, has led to established populations of unmanaged date palms. These can still be seen around isolated springs and waterholes along outback transport routes.

Despite the long heritage of establishing date palms in Australia, our annual consumption of 5,000-7,000 metric tonne of date fruit is satisfied almost entirely by imports. Of the seven million metric tonnes produced annually (FAO, 2006), 98% is grown in the northern hemisphere by approximately 40 countries. At best there is very limited learning about date production available within Australia. This report addresses this shortcoming and aims to promote the adoption of world-best production methods essential in a globally competitive market place.

Countries visited on this scholarship include USA, Mexico, France, UK, Spain, Egypt, Kuwait, Oman, India and the United Arab Emirates. These countries were selected for specific aspects of their date industries. Visits to leading commercial plantations, processors, nurseries and research institutions allowed a close study of their management practices. In particular an identification of labour saving techniques including the use of mechanization aimed at reducing input costs for the Australian date producer.

Other objectives included a review of the high-value market segment focussing on product presentation, fruit size, quality standards and economic return. Examples of the use of inter-cropping between date palms with other crop species are documented along with uses for date palm fibre.

This tour was very successful in locating and documenting a broad range of innovations and management practices of value to the Australian date industry. Selected management practices and innovations will be implemented at the Gurra Downs Date Company Pty Ltd/RIRDC field trial demonstration site in South Australia's Riverland.

Information acquired through this Woolworths-sponsored Nuffield Farming Scholarship will assist in further developing the Australian date industry. This information will be shared amongst growers, research organizations, research funding agencies, policy-makers, scientists and industry organizations. The author is currently working on producing a separate booklet-sized 'grower manual' on how to care for a date garden.

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Abbreviations

ABS – Australian Bureau of Statistics

ADFSC – Abu Dhabi Farmers Services Centre

AQIS – Australian Quarantine and Inspection Service

DPD – Date Palm Developments, UK

EC units – Electrical Conductivity units

FAO – Food and Agriculture Organization

GDDC – Gurra Downs Date Company Pty Ltd

GFP – Global Focus Program

ICBA – International Centre for Bio-saline Agriculture

Kg – kilogram

m - metre

NT – Northern Territory

OH&S – Occupational Health & Safety

R&D – Research & Development

RIRDC – Rural Industries Research & Development Corporation

RPW – Red Palm Weevil

SA – South Australia

UAE – United Arab Emirates

USA – United States of America

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Executive Summary

Date production is a very important contributor to domestic food supply and the economies of date-growing countries. Accordingly, governments have made large investment in their respective industry. This investment has resulted in significant advancement in all aspects of their industries - from breeding plants, plantation management, fruit harvesting and processing through to storage of product and marketing.

As managing director of Gurra Downs Date Company Pty Ltd and operating a private and joint government funded research station, the author has, through practical experience, identified a number of date plantation management challenges for the Australian grower. These include high labour inputs, OH&S concerns, tool/equipment suitability and knowledge gaps relating to tree management.

The Woolworths sponsored Nuffield Farming Scholarship has allowed these industry impediments to be addressed by the author spending study time in major date-producing countries learning how other farmers farm. Much of the information within this report has been gratefully received from world-leading date producers, government institutions, research scientists, date grower associations, date technicians and date marketing and factory experts.

This report aims to bridge some knowledge gaps by providing detail on best practice plantation management for the production of premium date fruit. The focus is on reducing input costs and achieving labour savings, which will be of interest to industry participants, policy-makers, research funding agencies, research organizations, scientists and industry organizations. It may well assist in attracting new industry participants - innovative growers looking for a resilient crop for diversification.

Herein is fundamental information on best practices for date palm management - from plantation layout design through to management of trees, harvesting and post-harvest handling of fruit. Key aspects of date palm management which represent higher input costs such as labour-hours are prioritized.

With the limited knowledge we have of these practices in Australia it is fair to say that the degree to which we can make advances is profound. Perhaps the most benefit, in terms of finding better ways to do things, is in the area of plantation management. The Australian date industry can significantly reduce labour and input costs by adopting new techniques and introducing specialized equipment and tools. Better OH&S outcomes for plantation workers and owners will follow with the introduction of equipment such as mechanical lift cages for servicing tall palm trees.

The marketing of premium date products is addressed and identifies the need to steer the Australian date industry toward implementing a national date product grading standard. Inter-cropping, where space between commercial date palms is used for other agricultural activity, is discussed along with the utilization of date palm fibre. This fibre (mostly frond prunings) presents a substantial annual crop of biomass for potential value-adding.

The emerging Australian date industry's ability to adapt to world-best practice in terms of genetics and management practices will be essential to further innovation and investment by research organizations and to policy makers looking to strengthen food security.

Introduction

The date palm (*Phoenix dactylifera*) is cultivated in over 40 countries with approximately 930,000 hectares under production annually producing some seven million metric tonnes of fruit (FAO, 2006). The date palm is widespread in North Africa, the Near and Middle East and Southern Asia. During the last century, production has been introduced into some new world locations including the USA, South Africa, India and Australia.

In general, the geographical distribution of commercial date production is limited to areas which can be described as arid or semi-arid and where there is abundant water supply. The best date growing districts are characterized by having long, hot, dry summers with minimal summer/autumn rainfall. Date palms perform differently in different climates. Some varieties are better suited to coastal regions (Mediterranean) whilst other varieties have evolved in an inland desert setting and may require a higher winter chill factor to induce spring flowering or extremely dry heat for successful fruit production. This is of particular importance to the commercial date fruit producer who needs to understand which selections are best suited to their environment (www.gurradowns.com.au).

The market for date fruit in Australia is essentially based around imported fruit as the Australian date industry is still in its infancy in terms of production (Reilly, 2010). With perhaps only around 100 hectares planted, the industry is in a research and development stage and needing instruction in key aspects of plantation management.

Australian imports of dates have shown significant growth from 4,961 tonnes in 2003/04 to 7,222 tonnes in 2006/07 (ABS, 2010). Imported fruit is made up of approximately 85% of low-grade cooking dates and 15% high-quality/value table dates sold by variety name. The production of high-quality, high-value named varieties is the focus of this report.

There are significant benefits in developing a large-scale date industry in Australia. It would help diversify the economic base of participating rural communities and provide added value with import replacement and export earning as well as stimulating agri-tourism opportunities. This hardy plant species also provides a high tolerance to salinity, drought and extremes in temperature thus ensuring better food security outcomes.

Dates are highly nutritious and reputed to have many health benefits. They contain more natural sugar than any other fruit and deliver a substantial amount of dietary fibre and potassium. They are unique in supplying phosphorous as well as providing many vitamins and mineral salts.

Date palms can be grown from seed, however, the quality of the resulting plant is likely to be commercially undesirable. Date palms can also be grown from offshoots (suckers) which grow from the base of existing palms. These offshoots are genetically identical to the parent palm and therefore reliable copies of the characteristics displayed by the parent palm. In recent decades, micro-propagation through tissue culture has emerged as an efficient way of multiplying plant material.

Some of the factors limiting industry commercialization to date include:

- low industry investment in R&D programs to determine best economically and climatically suited varieties. There is now a key joint government/private project with RIRDC and information relating to this work is being made available to the public.
- lack of availability of plant genetics of suitable high value, named, pest and disease-free varieties. This has been remedied over the last decade with large numbers of tissue cultured nursery plants now available to growers.
- lack of skilled labourers assisting in running the trial site and the R&D program.
- lack of technical skills and knowledge on how to manage a commercial plantation.

The date palm is a challenging crop to manage as harvest is often carried out metres off the ground and the plant has sharp thorns. Numerous visits are required to each tree every year to perform pruning, pollination, thinning, bagging and harvesting. This report helps to address the lack of knowledge and technical skill in plantation know-how by describing aspects of plantation management observed in the countries visited.

This report summarizes current day techniques to demonstrate the value of reducing labour inputs and improving Occupational Health and Safety outcomes. The Gurra Downs (Riverland SA) farm demonstration site is committed to the in-situ implementation of best practice techniques and this will further enhance grower workshops.

Objectives

Date production is a high value crop which can also be highly labour intensive. A priority of this study tour was to identify ways of reducing labour significantly, so reducing input costs for the Australian producer enabling domestic producers to remain internationally competitive. This report is a summary of some of the major beneficial findings.

Other objectives included

- to learn about a broad range of industry practices and problem solving solutions which can be adopted by date growers where suitable
- review market segments
- observe product presentation
- observe fruit size, quality and standards
- determine which varieties achieve best economic return
- explore use of inter-cropping between date palms with other crop species
- explore uses for date palm fibre.

Chapter 1 – Background information on the date industry

The date is one of the world's oldest cultivated fruits, widespread throughout North Africa and the Middle East. Over the last century, distribution has extended to the Americas, Australia, South Africa and India. Dates come in a wide variety of fruit styles, which appeal to a range of tastes and are highly prized as a whole-food and food ingredient. They are a well packaged combination of nutrition, fibre and energy (Reilly, 2010).

Global date production is almost exclusively a northern hemisphere industry centred on North Africa and the Arab States. Egypt, Saudi Arabia, Iran, UAE, Pakistan and Algeria are the largest producers (FAOSTAT, 2007). Much of this production is for local consumption, however, Iran, Pakistan, Tunisia, Saudi Arabia, UAE, Iraq and Algeria are the major exporters by volume. The USA and Israel are smaller producers but achieve the highest export unit value (Reilly, 2010).

Each year Australia imports 5,000-7,000 tonnes of date fruit. Given that date palms have been successfully growing (in an unmanaged state) across a range of sites in Australia for over a century, there is potential for establishing a significant date industry in Australia.

In 1996, the Reilly's made a decision to commence production of premium eating dates. This decision was made after much research on salt tolerant crops. Their horticultural property 'Gurra Downs' is irrigated from the Gurra Gurra Wetlands adjacent to the Murray River in the Riverland of SA. Following a prolonged non-flood period, salinity levels rose and their irrigation water supply reached values of 5,000 EC units. This caused significant crop loss to vegetables and grape vines. Climatic conditions were another factor steering towards date production with hot summers causing sunburn in winegrapes.

Initially, establishment of a plantation was impeded due to limited pest and disease-free planting material being available in Australia. In subsequent years, this has resulted in Gurra Downs establishing a tissue culture date palm nursery, a Research and Development date palm field trial site and commercial date plantation. Among the challenges now inhibiting industry growth is the lack of knowledge on modern, best practice plantation management techniques which will ensure cost of production is minimized.

Chapter 2 - Planning a Plantation

Layout/plantation design

There are many configurations of row spacing. Typically, the most common is nine metres by nine metres (9m x 9m), although six, seven and eight metre spacings have been observed. It is important to plan ahead when establishing a plantation. At an eight metre row spacing the canopy on a mature palm will overlap the next row. This inter-connecting canopy can aid pest and disease transfer. It is also more difficult to manoeuvre machinery such as tractors and hydraulic platforms. A minimum of nine x nine metres (123 palms/hectare) is required for machinery picking and provides a small gap between canopies.

A UAE plantation was observed with 10m x 10m spacing and another at 12m x 12m. The owner who had allowed this generous spacing had a saying spoken from the perspective of the date palm, “*take away my neighbour and I will give you her fruit*”, meaning the palms produced higher yields if not competing against each other for water, nutrient and sunlight. Additional room needs to be allowed for, should other crop/animal species be accommodated inter-row.

Irrigation systems and scheduling

Modern new world plantations commonly use drip irrigation and low-throw bubblers whereas some older, traditional date gardens use flooding, high-flow bubblers and flooding of small basins at each palm.

There is considerable international debate on precisely how much water a date palm requires for maximum production. Estimations range between 300 and 700 litres of water required per day for a mature palm during the peak demand period.

When designing irrigation this value needs to be kept in mind so there is capacity to deliver these volumes of water during the period of heaviest demand in summer months. When determining individual site, peak-water requirements, factors such as localized evapo-transpiration rates, precipitation, soil types, leaching requirements and water quality need to be considered.

Irrigation design can be variable, however, bubblers are commonly used which disperse 2, 4 or 8 litres per minute. This system puts water out quickly in basins made around each palm. Drippers are also used and are suitable where extended irrigation shifts are possible. Pressure-compensating, filtered dripper systems allow even irrigation and fertigation throughout the plantation.

The author observed that where water is readily available and very reasonably priced, larger volumes are being applied. In water-poor areas lower volumes are applied. In the USA where water is cheap and readily available, typically around 600 litres per day is applied.

In Abu Dhabi, recent research has determined 350 litres per day is sufficient to achieve maximum yield whilst keeping the palm in good condition. Supplying more than 350 litres at the peak demand time resulted in greater vegetative growth but no more fruit production. The amount of water administered is largely dependent on the various locations and circumstances. Further research would be beneficial.

Water quality

Date palms are renowned for their ability to withstand high levels of salinity and during the study tour extremes were observed – from dates irrigated with desalinated water close to zero salinity through to those irrigated with 15,000 EC units. Observations at field trial sites at the International Centre for Bio-saline Agriculture in the UAE suggest some date palm varieties are more salt tolerant than others. Fruiting trials indicate productivity at 10,000 EC units, with good drainage being essential.



Figure 1: Salinity trials at ICBA, UAE 2012

Fruit yields and varieties

There are three basic fruit styles, each having different markets: Khalaal (semi-ripe or fresh), Rutab (fully ripe) and Tamar (dried or cured). The amount of fruit harvested from a date palm varies from variety to variety. Some rare varieties have the unique characteristic of being sweet and edible when semi-ripe. This fruit stage is known as 'khalaal'. The fruit is crunchy, firm and juicy with relatively low astringency, however this fruit has a short shelf life. For fresh dates at their highest moisture content, yields can go as high as 150kg from a mature palm whilst less than 100kg per palm is more commonly reported.



Figure 2: Khalaal (semi-ripe)

More typically, ripe dates (rutab) have a production range of 60-95kg per palm. These ripe dates are usually graded in to groups and packed according to fruit sensitivity which is usually variety differentiation.

Soft – soft flesh, high moisture, low sugar content

Semi-dry – firm flesh, low moisture, high sugar content

Dry – dry flesh, very low moisture, high sugar content



Figure 3: Rutab (fully ripe)



Figure 4: Tamar (dried or cured)

In the countries visited, it was noted that each country has their own favourite varieties to which their domestic market is accustomed. There are, however, some varieties common to almost all – Barhee, Khalas, Medjool, Dayri, Deglet Noor, Thoory, Khadrawy and Khunezi being the main ones. These varieties are sold and purchased on varietal name. The majority of dates produced, in fact on average 90% of all dates grown, are consumed within the country of origin (FAO, 2006) although the USA and Mexican industries visited had a strong export focus.



Figure 5: Colourful array of different date varieties, Liwa Date Festival, UAE 2012

Selection of easy management varieties

Some varieties require the hand-picking of individual ripe fruit. Ripening can be uneven so a tree may need to be picked five or six times before the harvest is completed. Some varieties, particularly khalaal varieties, lend themselves to whole bunch harvesting and these have a greatly reduced harvest cost. Khalaal varieties have been introduced to the Gurra Downs nursery.

Whole bunches of khalaal dates can also be hung and washed down to remove dirt etc. This has an advantage over trying to wash clean soft, delicate, individual rutab dates. It should be remembered that khalaal dates need chilling to extend their short, fresh shelf-life. These dates need to be marketed very efficiently as they are best when consumed soon after harvest. With the right storage, rutab dates can have a long shelf-life.

Chapter 3 - Plantation Management

Tree Management and Access

Most of the traditional date growing world still access taller trees by climbing. This method involves the labourer walking up the palm with a rope harness around the trunk for support. He shimmies up the palm by leaning back on the rope and stepping up the frond stumps. Date fronds are sawn off to create the steps and pruning to create these steps is time consuming but does allow for instant tree access and inspection. Sometimes it is faster to climb a tree than bring out a hydraulic platform. Whilst this method has been used for centuries, modern hydraulic lifting platforms and hydraulic pruning apparatus are a much better fit for the Australian grower due to our strict OH&S standards.



Figure 6: Traditional access to a date palm, Oman 2012



Figure 7: Modern access via hydraulic platform, Mexico 2012

Arizona date growers have developed a working platform cage complete with safety rails and racks for harvest trays. This platform is a ‘U’ shape with a sliding front side and is lifted into position by a forklift or extension lift. The platform surrounds the trunk with a sliding front gate locked in place allowing up to eight staff to work within the canopy at one time (Figure 6). Staff wear harnesses which can be attached to the safety rail. This platform has good OH&S standards. The main advantage with this method is people can be quickly and safely placed in position to perform tree operations. It also provides an efficient way of lowering heavy fruit to the ground and reduces pruning time as additional saw cuts to make the traditional steps are not required.

Canopy management

It is important to have the correct balance between number of fronds and number of fruit bunches. Over-pruning, which results in inadequate fronds, will delay ripening and may revert the palm to biennial bearing instead of annual bearing. Eight or more fronds per fruit bunch is recommended.

In countries visited where the insect pest Red Palm Weevil (RPW) is present, canopy management has largely been modified to only remove/prune older fronds after they have dried or died back and hang vertical. The reason for this practice is that to prune any green fronds creates a wound which attracts the RPW.

Where RPW is not present, older fronds are pruned when still green and horizontal to the ground. This allows for easier access for workers in hydraulic lift cages which can come up underneath the canopy to perform various management operations.



Figure 8: Bunches are tied to fronds to support weight, Oman 2012

Pruning

Tools and equipment differ significantly from country to country. In some old world traditional date growing districts, curved-blade knives are still the favoured tool. These vary in size, thickness of blade and are with or without serrations on the blade. These knives are used for de-thorning fronds, pruning fronds from the palm and cutting off last year's fruit stalks.



Figure 9: De-thorning knife with leather hand guard, USA 2012

In the USA and Mexico, the knife for de-thorning has a protective leather guard around the handle which protects the operator's hand from thorns. Hydraulic claw-style secateurs used from the end of an extension arm allows the operator to snip through large diameter fronds by using a trigger activated handgrip.



Figure 10: Hydraulic frond pruner, USA 2012

Pollen collection

Date palms are dioecious – pollen is harvested from the male flowers and applied in a timely manner to the female flowers. One male palm is sufficient to pollinate approximately 20-25 female palms.

Pollen may be stored for up to 12 months. It is always best to use fresh pollen but there may be times during the pollination season when there is insufficient fresh pollen available, hence, the need to store dried pollen for use at these times. Traditionally, the male flowers are hung in draught-proof rooms so the pollen can dry and be collected over several days.

Some growers have designed and engineered a pollen extracting machine where vacuum suction is used to instantly remove all pollen from the flower, speeding up the entire process and minimizing shed space needed to otherwise hang large numbers of male flowers for the natural drying process.



Figure 11: Pollen extractor, USA 2012

Pollination

Traditionally, pollination is highly labour-intensive involving manually dusting pollen over or inserting strands of the male flower within the female flower. This function requires access within the canopy to apply the pollen dust to each individual flower.

In Oman, growers are using a new technique which is proving very successful. Instead of manually applying, pollen is mixed at a prescribed ratio with water. Using a pressurized spray vat with agitator and a general purpose spray nozzle, the pollen/water solution is simply sprayed through the canopy onto the female flower.

This method makes it possible for a driver and one person to pollinate from the back of a utility at a slow driving or walking pace. Previously one man could pollinate around 50 trees in a day. This Omani method makes it possible to pollinate closer to 1,000 trees in a day, uses significantly less pollen and makes better use of valuable time.

In Yuma, Arizona, the date growers have perfected a method where pollen is administered by a blower broadcasting a pollen airstream over the female palm. Again, this task is performed from a mobile vehicle, eliminating the need to climb individual palms and, therefore, saving time. Applicators of different designs were seen, which activated when aimed at the female palm, projecting a plume of pollen. This method works well on easy pollinating female varieties and minimizes labour requirements against the traditional method of inserting part of the male flower in each female flower at bloom by hand.

Bunch management

Several different practices were observed, such as 'fruit thinning', where the philosophy is to minimize the number of pieces of fruit on each strand to enable a larger fruit size and more room for the remaining fruit. This practice is carried out to achieve premium fruit production. The most common form of thinning occurs at pollination where up to two thirds of the female flower can be removed and the remaining third is pollinated. The strands are cut back to the desired number of dates per strand thus removing the need for further thinning. A strong pollination of the remaining flower is carried out to ensure maximum setting.

Fruit thinning can also be done by returning to the developing bunch at the early 'kimri' (small, green) stage. Central strands are removed, creating a hollow or inverted vase, within

the bunch. This allows developing fruit to spread into this vacant space, minimizing rubbing and blemishes.

Medjool growers in the USA and Mexico thin alternate individual fruits on strands by hand. This thinning is done in such a way as to leave no more than 12 individual pieces of fruit per strand – a very labour intensive procedure accounting for around one third of all input costs for annual date production. In addition to this individual thinning of Medjool, separating rings are inserted into the bunch to prevent strands rubbing together. Whilst this operation is extremely labour intensive, the same growers are achieving better than an 80% pack-out of top quality fruit which is a high value product.



Figure 12: Bunch thinning, Mexico 2012

What suits the Australian grower in terms of bunch thinning is still to be determined. However, with higher labour costs than the countries visited, there will need to be a focus on methods that are cost-effective in terms of minimizing labour. The regulated cost of a labour unit in Australia is approximately three times that of other new world plantations. Australian growers must aim for production of high quality premium dates comparable to imported product. Basically there needs to be a focus on reducing labour but producing high quality product that will achieve high price per kilogram in the marketplace.

Date bunch covers

There are many types of bunch cover bags and some have been adapted to suit particular date palm varieties and climatic conditions. They provide protection to the growing dates from birds, insects, rain, dust-storms and can assist with fruit ripening.

Bags seen include tightly woven cotton, open weave mesh bags, nylon fine weave with Velcro straps top and bottom and brown waxed paper bags open at the base of the bunch. Some bags have a string tie at the base where this string or Velcro strip is loosened to allow ripened dates which have dropped to the bottom of the bag, to be collected in picker's trays.



Figure 13: Dr Glenn Wright, University of Arizona, showing date bunch covers used by Bard Valley growers, Yuma, Arizona 2012

There is much research on the effect of bunch covers – from what colour best assists early ripening fruit to which bag best protects fruit from insect infestation and the effects of humidity within the bunch covers. At this stage, it is not conclusive on which bunch cover will suit the Australian grower best. Trialling of different covers throughout a range of varieties will be essential to determine best local fit.



Figure 14: Bunch cover bags in use, Oman 2012

Offshoot removal

Offshoots or suckers grow at the base of the parent tree. They are genetically identical and therefore valued. Typically offshoots are removed and planted out to expand plantations. Removing an offshoot is hard work, requiring digging under the base to ensure some roots remain on it. The aerial part is then detached with the use of a large chisel and sledgehammer. It is generally a two-man job and limitations exist in how many offshoots can be manually removed in a day due to fatigue in swinging a crowbar or sledgehammer.

There is much discussion and difference of opinion from date grower to date grower as to exactly what is the ideal stage and size of offshoot for removal. Some recommend the offshoot should be a minimum of three years of age which makes for a large offshoot possibly weighing in excess of 50kg when removed. Other growers suggest the best time for removal is at a 15kg weight. The best weight for offshoot removal is debatable but so is the hard work and time needing to be invested in the removal process. Two men may take two hours to manually remove a large offshoot which could fruit in 2-3 years. Alternatively, a small 12-15kg offshoot may only take 30 minutes to remove but may not fruit for 4-5 years.



Figure 15: Preparing to remove a small offshoot, Oman 2012

Tools used for the removal of offshoots vary in design from plantation to plantation. The most common tools comprise a long crowbar with a flat chisel-like end as well as purpose-built specialized chisels. These are struck with a sledge hammer to excise the offshoot from the parent plant. Modern improvisations include hand operated jackhammers and a machine operated jackhammer mounted on a skid-steer (eg. a Bobcat). In Yuma, Arizona, a very large chisel attached to a jackhammer power-head on a bobcat (skid-steer tractor) was seen. The work of digging under the offshoot remained, however, this method replaced swinging a sledgehammer and resulted in many more offshoots being removed in a day.



**Figure 16: Jackhammer chisel attachment on bobcat ready for offshoot removal
Yuma, Arizona 2012**

Minimizing the size and number of offshoots is kinder on the parent tree as fruit productivity will be reduced if there is too much demand on the parent tree to support the offshoots. A manager from a very large date plantation says their management process is to eliminate all offshoots at an early stage of development. Economically, she believes it is more advantageous to purchase new, elite, tissue culture plantlets and allow her plantation to be trained straight into fruit production thereby saving substantial labour costs of ongoing offshoot removal.

Disposal of Biomass

Each date palm can produce over 100kg of prunings (fronds or leaves) per year which need to be pruned. The dry fronds are very fibrous and if left on the ground can become a nuisance for machinery. They can also harbour beetles, other insects and rodents. The author's own experience has been to load these prunings on a trailer and cart away for burning - a job which takes two people and only four palms to fill a trailer, so is very time consuming. Conventional mulchers and chippers do not handle this material easily due to its fibrous nature.

In Yuma, growers leave fronds to lie on the ground every second row then run over with a tractor-pulled flail shredder. This machine can cope with the fibrous material and shreds it into small pieces, allowing for easier machinery access. The material breaks down and builds organic matter in the soil. This system saves many man-hours and has better environmental outcomes.



Figure 17: Fronds breaking down after going through the flail shredder, Yuma 2012

There are many uses for date palm fronds. In fact some industries rely on the input. This is worth reporting because the opportunity could arise for similar uses in Australia. Some of the products include woven matting, brooms, brushes, furniture, livestock feed ration ingredients, compost and peat bricks. The most high-tech option is a building product made from palm fronds mixed and moulded with a polymer to produce a magnificent timber construction product for use in building houses, fences etc. The resulting moulded timber product is a clear and visionary example of carbon capture and storage.

Chapter 4 – Intercropping

The date palm has proved a valuable plant in combating desertification. Beneath the canopy of a mature date plantation is a unique microclimate offering protection from extreme temperatures and reducing evapotranspiration. This environment is beneficial for introducing a wide range of other crop and livestock species, facilitating a secondary food production system.

Whilst the date palms are young and the plantation is at an early establishment stage, it is beneficial to intercrop with other hardier species. Crops observed growing with date palms include lucerne (*Medicago sativa*), pomegranates, citrus, bananas, mangoes, stone fruit and vegetables, plus other date palms and Canary Island palms grown for later removal as ornamentals. The author is also aware of the use of artichokes, asparagus and aloe vera. All manner of livestock grazing and poultry have also been observed. This food production system adds diversity to diet and would not otherwise be possible without first establishing the date palm to buffer climate extremes.



Figure 18: Citrus growing beneath date palm canopy, California 2012



Figure 19: Pomegranates inter-planted in a young date plantation, India 2012



Figure 20: Intercropping in Egypt 2012

Species selected for intercropping need to be carefully thought out to ensure there is still access to the plantation by tractor, the crop is compatible with the irrigation system, and won't harbour insect pests or diseases which could put pressure on the date palms.

The shelter of the palm also creates excellent temperate habitation for mankind with date plantations being favoured to live in. Dwellings of many designs were seen throughout the authors travels, most commonly for workmen and landowners but also for luxury hotels and caravan tourist parks.



Figure 21: Dwelling in Egyptian date garden 2012



Figure 22: Landscape use at luxury hotel, Oman 2012

Chapter 5 – Pest and Disease Control

Disease Control

Leaf fungal disease is present in every date growing region internationally although it appears to be more apparent in wetter years. There are a number of fungal diseases but all seem to be controlled with use of a copper-based solution. Australian growers have been applying a preventative copper-based spray over the complete canopy with total canopy coverage being difficult to achieve on taller date palms. Other countries are simply applying five litres of copper solution into the crown of the mature palms and not bothering about complete foliage coverage. This makes it possible to apply copper solution from the back of a utility or trailer with a fire-fighting unit instead of using expensive pressurized spray-cart equipment.

Pests

It is worth mentioning that in nearly every date growing country, growers are having huge problems with the Red Palm Weevil. This insect originating from Asia has only been introduced in major date growing regions in the last decade or so but is devastating plantations. It lays its larvae in the trunk of the palm and proceeds to eat from the inside out.



Figure 23: Red Palm Weevil

This problem insect has attracted huge government and private investment but control is only moderately effective with trapping stations. Systemic insecticides are effective but can lead to chemical residues in fruit. Fortunately this insect, which is also attracted to the Canary Island

palm, is not yet in the Australian date industry. Hopefully industry and AQIS can prevent RPW from entering Australia. It is very important that growers are vigilant in ensuring they do not introduce or spread this weevil or any other insect pests in to their region.



Figure 24: Larvae of the Red Palm Weevil

Another potentially serious pest is *Parlatoria blanchardii* scale, which is present in the Northern Territory (NT). The most common method of spread of this scale is through infested offshoots or contaminated clothing and motor vehicles.



Figure 25: *Parlatoria blanchardii* scale

Chapter 6 – Processing and Handling

Marketing and grading

The majority of international packing houses sort dates by visual appearance with pieces of fruit hand packed into suitable quality standards. There are now very sophisticated factories which are highly automated. Dates are sorted by computer imaging using high pressure air jets to draft different sized fruit into the correct categories. This speeds up processing, improves volume output and creates large labour savings. Such a high-tech factory operation has a high capital investment cost. Working on a grower cooperative basis, efficiencies are possible with one common pack house, instead of many individual growers performing this task at home facilities.

Regardless of the method used to grade, select and package, there is an overall requirement to wash the fruit. Dates are generally grown in arid or semi-arid areas, usually associated with dust or storms and there is nothing more disappointing than biting into a date and crunching down on grit.



Figure 26: Dates for sale, Kuwait City 2012

Fruit needs to be washed, hygienically processed and stored to eliminate insect infestation and presence of mould. High grade, elite varieties of table dates are usually sold as entire pieces of fruit whereas lower grades, particularly the manufacturing class, are pitted, diced or used for paste which adds additional elements to the processing operation. Even among the highest

grade table dates there is a percentage of blemished which will not be packed as premium grade. The percentage of this lower grade fruit is largely dependent on the growing season with weather events sometimes causing skin separation.

Bunch management also affects the percentage of top grade as fruit can be damaged by knocking against fronds in the wind. Damaged fruit is often converted into chopped dates for cooking, paste or confectionery, while consumption of date syrup (honey) is growing in popularity.



Figure 27: Packaged dates for sale, Kuwait City 2012

With what was observed during the study tour it will be very advantageous to duplicate quality standards at an early stage in the Australian date industry. These would include size classifications such as Jumbo, Large, Fancy, Cooking, etc with reference to number of fruit pieces per kilogram as well as grading on skin blemishes. Grading can be done automatically using sophisticated software programs in sorting sheds, which is something for the Australian industry to aspire toward.

Chapter 7 – Travel

USA/Mexico

A decision was made to visit date enterprises in the Bard Valley and Yuma, Arizona areas; Coachella Valley, California; and San Luis, Mexico. The main reason was to look at production methods, in particular identifying aspects of date production which use mechanization. The USA and Mexico have a very strong export focus sending large volumes of Medjool dates around the world and to Australia. The majority of fruit is grown organically so it was a good opportunity to analyse production practices.

The opportunity to visit growers, researchers, date retail outlets and pack houses was invaluable. Production methods particularly in regard to the Medjool variety were impressive and instilled confidence for future expansion of the Australian industry.

http://davereilly.blogspot.com.au/2012_05_01_archive.html

Paris, France

Paris is interesting from a date growing perspective because the French have a historic involvement in the date industry via their Sahara desert colonies. French date consumption per capita is large and this domestic market pays amongst the highest price per kilo anywhere in the world. These peak when dates are at their freshest but decrease for stored dates.

The presentation of dates in the market place, product packaging and display, and pricing were of considerable interest.

<http://davereilly.blogspot.com.au/2012/06/june-11-13-paris.html>

UK

A visit to Baltonsborough (Somerset) was highlighted with an introduction to staff from Date Palm Developments (DPD). Gurra Downs Date Company (GDDC) has had a close working relationship with DPD for a dozen years. They are pioneers in the tissue culturing of date palms, with more than 25 years experience.

With enormous support from DPD, GDDC has managed to obtain and introduce new date palm genetics with which to further develop the Australian date industry. Much was learned

about the processes DPD uses to tissue culture and handle the sensitive nursery stock along with plant health management.

The staff provided demonstrations of their techniques. There are definitely improvements GDDC can make in processing methods in Australia - a very valuable exchange of information and ideas.

<http://davereilly.blogspot.com.au/2012/06/june-14-16-london-to-baltonsborough.html>

Spain

The Spanish date industry producing commercial fruit is located 38 degrees north of the equator on the Mediterranean Sea at Elche. This location is affected by sea breezes which cool the summer heat, equating to a significantly cooler climate than all other date regions including the Riverland.

This visit was hosted by Dr Michel Ferry and Suzi Gomez. The area of interest here was in varieties being successfully ripened and management methods adapted for commercial fruit production in this region.

Research findings show that this old date growing area grows many seedling varieties but also Medjool and Confitera. Methods for artificially ripening fruit by the use of temperature variation have been developed. Red Palm Weevil has been introduced to Spain from Egypt in recent times and this has infected wide regions. It has killed many date palms and seriously shaken the confidence of participants in both commercial fruit production and ornamental tree sales.

<http://davereilly.blogspot.com.au/2012/06/june-21-26-spain.html>

Egypt

The original plan was to spend 10 days in Egypt travelling along the Nile visiting date plantations and seeing something of the huge Egyptian date industry. These travel plans were disrupted by civil unrest surrounding the revolution and overthrow of the president.

The itinerary was revised to looking around Cairo and plantations on the outskirts. The main attraction was to look at traditional old-world methods of intercropping with other plant and animal systems among fruiting date palms.

It was interesting to see the different crops being grown beneath the palm canopies - mangoes, bananas, corn, cotton, vegetables and livestock. It all made for an attractive landscape and gave a few ideas to implement back home.

<http://davereilly.blogspot.com.au/2012/06/june-27-cairo-egypt.html>

Kuwait

The reason for visiting Kuwait was purely to meet again with Dr. Sudhersan who works for the Kuwait Institute of Scientific Research, having previously met him following a presentation he delivered to the Fourth International Date Palm Conference in Abu Dhabi in 2010. The topic was his work on date palm hybridization where he is achieving interesting varietal traits.

Dr. Sudhersan shared insights into date palm management. He was able to provide some explanations to questions and solutions to teething problems in relation to date palm management. There was opportunity to inspect the Institute's tissue culture and nursery facilities before walking through his date palm trial sites.

Dr. Sudhersan's projects are amazing. He is one of the most creative thinkers and his trial plantation is full of different useful plant species. His collection features many medicinal trees and shrubs plus edible fruits. Dr. Sudhersan has successfully acclimatized some tropical species, cleverly grown beneath the shade of date palms. His date breeding projects include a dwarf date palm and a seedless date palm variety. Dr. Sudhersan has also implemented a pilot scheme using a range of indigenous plant species to green the desert and combat desertification.

Nursery markets were visited where fruiting and ornamental palms are available for sale. Thanks to Dr. Sudhersan for hosting this visit. The author very much looks forward to staying in contact and following his most impressive work.

<http://davereilly.blogspot.com.au/2012/07/june-28-29-kuwait-city.html>

Oman

GDDC has a number of Omani varieties in its Australian date palm collection so there was interest to see how these are managed in their home environment.

This visit was hosted by staff within the Ministry of Agriculture who kindly arranged a visit to the interior to see the major date growing region and government research station at Nizwa. The gene bank repository there has about 260 Omani varieties.

Oman appears to be the home of the earliest varieties of dates to be harvested including the very earliest - Nagal. These are of particular interest to the Australian collection as early ripening varieties reduce the risk associated with rainfall events and extend the geographical footprint in which dates can be grown on a new continent.

<http://davereilly.blogspot.com.au/2012/07/june-30-july-3-muscat-oman.html>

India

India was chosen to travel to because of its similarities with Australia. Both countries are in the early stages of developing date industries so it was interesting to see the strategic approach adopted by Indian participants and determine how we can learn from them.

It was amazing to see the momentum of this new world date growing country. There is major date palm project development work co-partnered by Indian company Atul Ltd. and the Rajasthan Government. This involves establishing large date palm tissue culture facilities and nurseries, commercial plantations and demonstration sites at strategic locations to assist other growers to participate in the industry. Atul Ltd. were most agreeable in playing host for several days beginning in Jodhpur and arranging travel to plantations in the western desert.

Date palms normally require a hot, dry climate so it was surprising to see date plantations 300km from Mumbai in a tropical, wet season environment. Enterprising growers are using the dry season to grow dates and harvesting fresh (semi-ripe) prior to monsoon rains. In this area date palms are being intercropped with pomegranates, limes, gooseberries, Chinese dates, gumball fruit, cucumber, aloe vera and peanuts.

<http://davereilly.blogspot.com.au/2012/07/july-4-11-incredible-india.html>

UAE

The main reason for the visit to UAE was to attend the Liwa Date Festival which coincides with the start of the date harvest. Great excitement surrounds the arrival of the new season fruit. This showcase gave opportunity to review varieties, fruit standards and date palm by-products.

Time was spent with Tony Portman and staff from the Abu Dhabi Farmers Centre (ADFSC) with useful discussions on the latest irrigation recommendations. His work involves assisting local date growers to become better farmers through education, providing materials and contract labour to improve irrigation, fertilization and pest and disease control services.

The marketing of fresh dates into high value markets was discussed and how Australian counter-seasonal fruit could be presented when little northern hemisphere product is available.

There was opportunity to visit the International Centre for Biosaline Agriculture (ICBA). This centre focuses on production practices in saline environments. ICBA employs a wide range of scientists, economists, researchers and irrigation specialists. Their well respected work is mostly on fodder crops for livestock grazing systems such as grasses, legumes, shrubs and trees. Many Australian native plants feature in their working collection.

This centre also conducts well established salinity trial work on date palms. It has been observed that some varieties are more salt tolerant than others and date palms can generally tolerate up to 10,000 EC units without significant yield loss.

<http://davereilly.blogspot.com.au/2012/07/july-12-20-uae.html>

Conclusions

There is significant opportunity to advance management methods of the date palm by using modern techniques, tools and equipment which minimize labour hours and enhances production of premium table dates. With strong international competition through cheap labour, the Australian date grower will need to specialize in producing a high quality product. It will be important to look for niche markets and capitalize on the competitive advantage of providing Australian grown product to the Australian marketplace. There is also advantage in providing a fresh counter-seasonal product when there is little international competition for a perishable product.

Much of the date growing world is still using traditional methods of managing date plantations. There are, however, some operations that can be mechanized with the use of modern equipment to reduce input costs and aid in commercializing Australian plantations.

The Gurra Downs plantation will be adopting the hydraulic working platform to access taller palms. This mobile platform/workstation increases time efficiency, eliminates much heavy lifting of fruit at harvest time and improves OH&S standards. Hydraulic snips for pruning and the use of a tractor-mounted jackhammer for offshoot removal will reduce the heavy workload. Pollination can be time consuming and using traditional methods can require high labour inputs. Pollen blower and pollen/water spray methods are well worth adopting to look for labour savings.

It will be important for the Australian date industry to adopt a national fruit standard. This should be based on international standards to ensure consistent description of product in the marketplace.

Recommendations

1. Distribute information to date growers and researchers on new and improved management practices including utilization of equipment and tools which have labour saving application.

Steps to achieve this:

- implement these practices at the Gurra Downs date farm demonstration site and use for training
 - publish a grower manual detailing improved management techniques, tools and equipment
 - distribute information to an existing network of growers and facilitate workshops.
2. Continue to foster a strong research partnership with Government policy makers and private sector interests to underwrite industry expansion. RIRDC and DAFF (Federal Government) have provided invaluable assistance.
 3. Continue to interact with international industry stakeholders to encourage exchange of information and ideas.
 4. Make the necessary arrangements to obtain and import new date palm genetics which were identified during the study tour as having a promising commercial outlook.

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Gurra Downs Date Company Pty. Ltd. www.gurradowns.com.au

All photography in this report by Dave, Anita and Jonte Reilly.

Plain English Compendium Summary

Project Title:	Date Palms for Australia – further developing the industry Establishment, management and production of premium table dates
Nuffield Australia Project No.:	
Scholar:	Dave Reilly
Organisation:	Gurra Downs Date Company Pty Ltd
Phone:	(08) 8583 8314
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Email:	reilly@gurradowns.com.au
Objectives	<ol style="list-style-type: none">1. To identify ways of reducing labour and input costs for the Australian producer, enabling them to remain internationally competitive.2. To review high-value market segments in regard to product presentation, fruit size, quality and standards, and determine which varieties achieve best economic return;3. To explore use of inter-cropping between date palms with other crop species along with uses for date palm fibre.
Background	Dates are one of the world's oldest cultivated fruits, grown almost exclusively in the northern hemisphere. Each year Australia imports 5000-7000 tonnes of dates. Given that Australia has many locations suited to date growing there is potential for establishing a significant industry in Australia. Among the problems inhibiting industry growth is the lack of knowledge on modern, best practice plantation management techniques. This report aims to bridge some knowledge gaps. The focus is on reducing input costs and achieving labour savings while producing a premium product.
Research	More than four months of travel to the USA/Mexico, Europe, North Africa, India and the Middle East throughout 2012. Visits to date growers, researchers, tissue culture laboratories, research stations, pack houses and retail outlets provided information for this report.
Outcomes	Reference to the report will allow the Australian date producer to reduce input costs by adopting improved management techniques and introducing specialized equipment and tools. This will also help identify the need for and steer the Australian date grower toward implementing a national date product grading standard. Better OH&S outcomes for plantation workers and owners will follow with the introduction of mechanical lift cages for servicing tall palm trees.
Implications	The emerging Australian Date Industry's ability to adapt to world-best practice in terms of genetics and management practices will be essential to further innovation and investment by research organizations and to policy makers looking to strengthen food security.
Publications	Nuffield Australia