

## Cultivation

### CHRONICLE OF A NEW DATE PALM GROWER

## Developing a date industry in Australia

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### Abstract

The date palm was introduced into Australia by seed in the late nineteenth century. Despite favourable conditions in several parts of the country, plantation scale date fruit production did not occur. Later introductions of offshoots and more recently tissue cultured plantlets set the stage for a new effort to establish a date industry. The Riverland region of South Australia is suitable for commercial production, although the climate may not be ideally hot enough to ripen late ripening varieties. The Gurra Downs Date Company was created in 1996 with a focus on early maturing tissue-cultured varieties bearing fruits which can be consumed fresh at khalal and at rutab (ripe) stage. Light commercial production of Barhee and Medjool fruits began in 2010 and continues to expand and will include other cultivars in the coming years. Success of the venture could stimulate plantation date growing in other parts of the country and Australia could become self-sufficient in date fruits and enter the international markets taking advantage of counter-seasonal production.

*Key words:* Australia, Barhee, Commercial production, Date palm, Gurra Downs, Medjool, *Phoenix dactylifera*

### Introduction

Given the magnitude of the international trade in date palm (*Phoenix dactylifera* L.) fruit, 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 climatic 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 and nutritious fruit which can contribute to Australian and global food security.

Trials of date palms in Australia go back to the 1890s but the distribution of date seeds by cameleers commenced even earlier, leading to established populations of unmanaged seedling date palms. These can still be seen around isolated springs and waterholes along historic outback transport routes. Despite the long heritage of

growing date palms in Australia, the country's annual consumption of 5,000-7,000 mt of date fruit is almost entirely from imports (ABS, 2010). Of the 7.3 million mt of dates produced worldwide in 2012 (FAOSTAT, 2014), nearly all are grown in the Northern Hemisphere by around 20 countries. Australia has less than 100 ha of date plantations (Reilly et al., 2010). Major impediments to developing a date industry in Australia have been:

- a) Lack of availability of pest and disease free elite planting material
- b) Lack of knowledge/experience of where to grow date palms with regard to suitable climatic districts
- c) Shortage of leadership and date plantation skills
- d) Inadequate government funding
- e) Strict quarantine regulations

### Gurra Downs

The starting point for the authors' dedication to the date palm began in 1996 when it was decided to diversify the horticultural business of growing wine-grapes, pomegranates and figs. Gurra Downs is located in the Riverland of South Australia and irrigation water is pumped from the Gurra Gurra Wetland of the River Murray. Water quality had become increasingly saline over a 17-year drought. Being salt tolerant made the date palm an appealing choice for cultivation. In the decision to grow dates, favorable prospects for import replacement in Australia and the export of counter-seasonal fruit

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into key Northern Hemisphere markets were considered.

Gurra Downs planted the first commercial date plantation in the entire Murray-Darling river system. Dates had been grown in some remote arid northern lands of the country 700 km to the north, but not in the River Murray areas. One of the first questions that needed to be addressed was whether the climate was suitable for date production. With no previous examples of past or present date farms in the district from which to learn, considerable research was needed to show that it was feasible. Research began by investigating all documentation about attempted date palm cultivation in Australia, from the palm's introduction in the nineteenth century through to the present day. The key question was why, some 150 years after date palms had been introduced, to Australia, had no one particular geographic location been found suitable to establish a commercial industry.

### Historical date growing in Australia

The first known Central Australian date palm garden was established at Hermannsburg Lutheran Mission in the 1880s, 130 km west of Alice Springs in the Northern Territory (Figure 1). This garden was started from seeds sent by Baron Von Mueller of the Botanic Gardens in Adelaide. A small number of date palms still remain at the Hermannsburg site, where they are enjoyed as ornamentals but are not managed for fruit production.

Limited date production occurs in Alice Springs, where there are two date farms with a total area of approximately 20 ha. The Arid Zone Research Institute, Alice Springs, a government research facility, introduced several cultivars in the 1980s when it was anticipated this region would emerge as a major date center. Medjool and Barhee cvs. are being grown, the latter aimed at marketing khalal stage fruit. Some years Central Australia does produce very good quality fruit. However, summer rainfall patterns influenced by the monsoon in the tropical north causes a high percentage of fruit spoilage in other years. Rainfall patterns are erratic from one year to another but as a long-term average Central Australia receives some 152 mm of rainfall during the four months leading up to the date harvest. Insect pests such as date scale are also a problem in the region. It may be that specialist management techniques and cultivar selections can be adopted to minimize fruit losses, but summer rainfall has stifled investment in this district.

In South Australia's arid interior some 700 km north of Gurra Downs, dates were successfully produced at Lake Harry/Marree during a

government run project from the 1880s to 1916. Over 3,000 seedling dates plus a small importation of Deglet Noor cv. offshoots were planted with very good results (Figure 2). Fruit was successfully produced for 24 consecutive years, with Deglet Noor emerging as the dominant cultivar. After the project had run for more than a quarter of a century, violent sandstorms, high fruit predation by large flocks of birds and deteriorating soil and water conditions were documented as reasons why the government withdrew from the location. The date plantations were abandoned and no further commercial attempts at cultivation have occurred in that region. Other limitations to this location for modern date production include great isolation, hostile climate, sparse population from which to draw labor, poor road infrastructure, high energy costs, distance from markets and water allocation restrictions.

In the annual report of 1914 made to the South Australian parliament, it was recommended that the future of the date industry would be more suited to the Riverland District. During 1914-1915 the surviving 66 Deglet Noor palms were transplanted from Lake Harry (Maree) to the Riverland and planted near Barmera on government land (Figure 3). Further support for date growing in the Riverland was voiced by the South Australian Premier, on a visit to the United Kingdom in 1915, who recommended purchase of an additional 1,000 Deglet Noor offshoots via the French/Algerian connection. However, they could not be secured due to the disruptions in Europe caused by World War I (South Aust., 1884-1916). Coincidentally in the same time period large numbers of Deglet Noor offshoots were purchased in North Africa and transported directly to date growers in California and Arizona to initiate the US date industry.



Figure 1. Men and boys in the Hermannsburg date garden, circa 1900.  
Courtesy: Hermannsburg Archival Collection.



Figure 2. Deglet Noor cv. date palms, Lake Harry, South Australia 1912. The plantings were established in 1894 from Algerian offshoots donated by the French Government.

Courtesy: South Australian Parliamentary Papers 1884-1916.

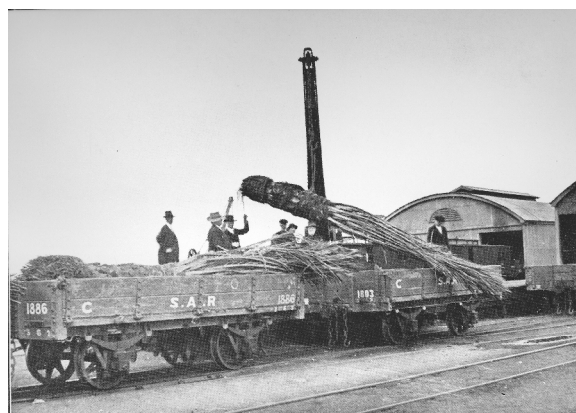


Figure 3. Transferring Deglet Noor cv. palms from Lake Harry to the Riverland.

Courtesy: South Australian Parliamentary Papers 1884-1916.

Apparently no serious attempt was made to produce dates from the palms transported to the Riverland a century ago. This was possibly due to the worldwide impact of World War I and the ending of government funding for the project. All that remains today from the effort are four Deglet Noor cv. palms standing tall and proud at the entrance to the town of Barmera. The story of these well-travelled palms is largely unknown to passers-by.

The site of the Barmera date palms is only some 20 km from the Gurra Downs date plantation. Learning of this amazing project was an encouragement to growing dates in the Riverland. However, the Deglet Noor cv., although suited to the Sahara-like climate of Lake Harry, requires much more heat and is too rain sensitive to be suitable for the Gurra Downs site.

### Assessing Gurra Downs for date palm

To further research the suitability of the climate at Gurra Downs (34° S), a comparison was done of the latitude to date growing areas of the Northern Hemisphere to provide some general similarities such as sun angles and temperatures etc. The map of Australia (Figure 4) shows the overlay of selected well known Northern Hemisphere date growing districts based on latitude alone. This provides a rough approximation of possible climatic similarities of Northern Hemisphere latitudes/locations to the Australian continent. However, it does not provide longitudinal assessment or consider rainfall patterns and is intended to give only general information.

Determination of heat units is commonly used to provide climatic information on the suitability of new districts/new cultivars for dates. The calculation is the sum of daily average temperatures above 18° C, from flowering to harvest, expressed as total heat units (Swingle, 1904). Based on this formula Gurra Downs has 2,250 heat units. This assessment is a generalization for it does not take into account many variations that are likely to influence results. For example, the calculation of heat units alone does not consider number of daylight hours, minimum overnight temperatures, number of hours at daily maximum temperatures, sea breeze influences, relative humidity, elevation, number of cloudy days, winter chill regime, evaporation/transpiration rates, UV light index, soil temperature and, importantly, temperature of the irrigation water when applied.

Some research papers suggest a minimum of 1,800 heat units are required to ripen early bearing cultivars (Al Banna, 2007) whereas 2,600 heat units are ideal to successfully ripen many cultivars. Certain very early cultivars like Nagal from Oman may require as few as 1,500 heat units to ripen fruit. It was concluded that, taking into account all of these variables, there is no substitute for empirical on-ground testing of cultivars under local conditions.

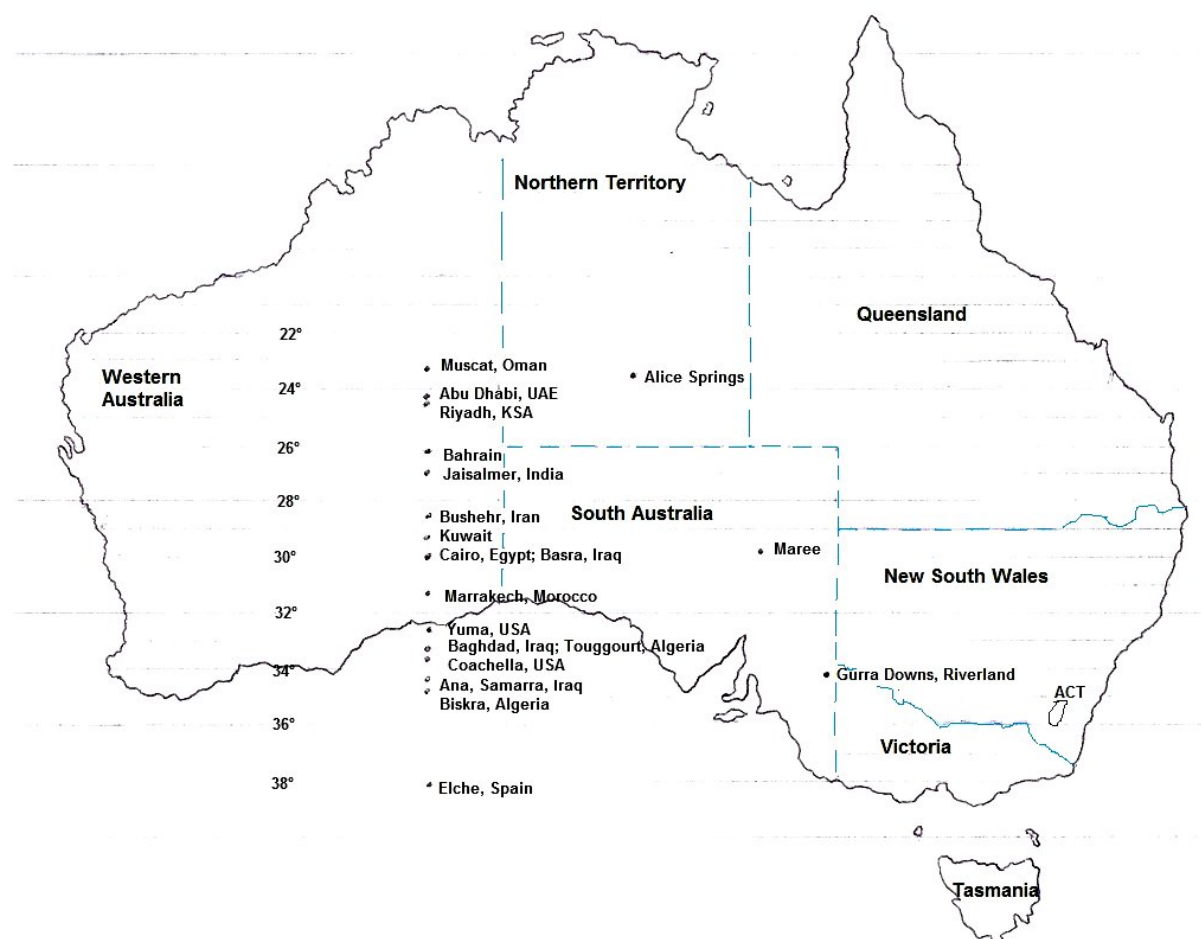


Figure 4. Australia superimposed with Northern Hemisphere latitudes and locations of date growing areas, and location of Gurra Downs, Riverland, South Australia.

### Riverland location

Gurra Downs takes its name from the Gurra Gurra Wetland which adjoins the property. Gurra Gurra is an aboriginal name meaning plenty plenty, in reference to the abundance of traditional food sources. Riverland is a regional designation in the State of South Australia (Figure 4). This region is made up of six towns some 15 km apart along the River Murray; it is a horticultural area of approximately 35,000 ha. The closest town to Gurra Downs is Berri; the nearest large city is the state capital, Adelaide on the coast some 250 km to the south west.

Gurra Downs is located at 34.1° south latitude, 140° west longitude at an elevation of 20 m. The hottest month is January when maximum temperatures can reach 48°C. Relative humidity at 3 pm averages 27% with 16 hours of sunshine

during the longest day. The coldest night temperature recorded is -7° with around 8 nights per year at zero degrees or below. Average annual rainfall is 270 mm, mostly in winter with an average of 68 mm in the 4 months leading up to fruit harvest. Soil type is sandy loam with a pH of 8–9.5. Although it would be preferable if Gurra Downs were hotter to permit successful ripening of a greater number of date cultivars, the best prospects lay with the selection of fresh/semi-ripe khalal and early ripening cultivars. Some advantages of producing dates in the Riverland include:

- a) An existing horticultural district growing wine grapes, almonds, citrus, olives, pomegranates, stone fruits and vegetables



- b) Presence of a good infrastructure including irrigation systems and road transport, and close proximity to cities and airports
- c) Good water security
- d) A population of 35,000 from which to draw employees
- e) No introduced date palm insect pests including red palm weevil, date scale or fruit fly
- f) Counter-seasonal fruit production to the Northern Hemisphere; harvest is February–June

### Establishing a date palm plantation

Upon deciding in 1996 to grow dates in the Riverland, a major challenge was to obtain planting stock of elite cultivars. The only elite cultivars in the country were located in Central Australia; however, offshoots were unavailable because of strict quarantine regulations due to the palms being infested with date scale (*Parlatoria blanchardii*), a declared pest of the Northern Territory, and interstate plant shipments were prohibited. Based on information from Australian Quarantine officials, it was impossible or impractical to import foreign offshoots, but in vitro plantlets in aseptic containers from nondate growing countries could enter Australia. Date Palm Developments (D.P.D.) (<http://www.date-palm.co.uk/>), a leader in tissue culture of date palms in the UK, was identified and able to supply plantlets. However the necessary skills and facilities at Gurra Downs to handle in vitro plantlets were lacking, creating another impediment.

Recognizing the imperative to learn these skills, private instruction was commissioned from a professor at the University of Adelaide, and the authors made a 500 km round trip to Adelaide weekly over two years to learn tissue culture techniques. Practice with tobacco plants and learning how to use essential equipment ultimately led to the establishment of a facility at Gurra Downs.

The next step was to build, on a limited budget, a laboratory at Gurra Downs suitable for subculturing and hardening of in vitro date plantlets. It was decided to construct an underground facility, creating a cellar-like environment which maintained temperatures around 24°C (+/- 2°) the year round. This required little temperature controlling and protects valuable stock during periods of electricity outage when temperatures in above ground sheds reach extremes without air conditioning.

In August 2001 the first in vitro shipment was received, consisting of Barhee, Medjool, Thoory, Dayri, Zahidi and Sultana cvs. The initial shipments

suffered some high plant losses but it was soon learned how to deal with fungal and insect attacks. Over the subsequent years the weaning rates improved and confidence rose.

In 2004, and after 8 years of planning, the first date palms of Gurra Downs were transplanted into the field (Figure 5). This was a momentous occasion. Seeing the first date palms in the ground brought with it realization that it was then necessary to learn in detail how to grow date palms in this new environment. In many regards the process was just beginning!



Figure 5. Newly planted date palm 2004.  
Photo: Dave Reilly

### Climate

The Riverland climate is classified as semiarid, BSh, according to the Köpen-Geiger system. World climatic classifications do not, however, take into account that irrigation can overcome water deficiencies. Historical climatic data for the Riverland are available at Commonwealth Bureau of Meteorology (CBM, 2014) and Elders Weather (2014).

At Gurra Downs, winter overnight temperatures often hover around zero degrees Centigrade and on occasion go as low as -7°C. Summer temperatures reach 48°C; however, the immediate issue was to protect the newly planted tissue cultured date palms from extreme cold, with temperatures around -4°C or colder, threatening losses.

A technique was devised to protect the young palm from freezing temperatures by using a shade cloth guard with a roof flap for the first winter (Figure 6). The roof flap is removed after one year and the palm allowed to grow through (Figure 7). The guard is removed entirely after the second year when the palm is completely hardened.

Mulch is also applied, sourced from a local winery. Black grape seed mulch absorbs heat

through the day and releases it throughout the night which helps insulate the palm from extremes in temperature. Palms are able to tolerate extreme chill factors unassisted after their second winter.



Figure 6. Protecting young date palms from frost. Note adjustable drip irrigation system using bubblers.

Photo: Dave Reilly



Figure 7. Date palm growing through the frost guard.

Photo: Anita Reilly

### Pests and diseases

Australia has very strict quarantine rules in place which are designed to protect the agricultural

industries and natural environment from harmful introduced pests and disease. At this stage, Australia has been successful in keeping out the devastating red palm weevil.

The Riverland region is known as a fruit fly free zone. Fresh produce like citrus, stone fruits, table grapes, and almonds are exported. Being free from the Mediterranean and Queensland fruit fly ensures continuation of trade to important international markets. Inspection stations exist at the state border where all vehicles entering are inspected and any fruit found is confiscated.

Date scale (*Parlatoria blanchardii*) is present in most states and territories in Australia. It is almost impossible to eradicate due to populations of ornamental palms co-existing in towns and gardens. Chemical treatments have to this point only provided temporary population decrease so this scale insect does present a challenge to production of premium table dates. Gurra Downs plantation is currently free from this insect and strict protocols are in place; however, it is of industry wide benefit to find effective options to manage this pest in the event it does invade the Riverland.

The main insect pest at Gurra Downs is the black ant which attacks the sweet fruit; as a certified organic grower control options are limited. An effective approach to control ants and beetles has been the use of insect proof fruit bunch covers made of woven monofilament polyethylene yarn 40 mesh, UV stabilized material. The woven mesh bags have very small holes that exclude all insects including ants, beetles, flies and birds. These fruit bags are more expensive than other loose net bags but without them it would be very difficult to maintain an organic production system.

Kangaroos enjoy eating the leaf ends of the fronds (Figure 8). Damage in older palms is usually acceptable but newly planted palms need to be protected by guards. Kangaroos also enjoy eating yellow dates and have learned to rip the bags from the bunches to expose the fruit and eat them. Kangaroos are a protected species limiting control measures; to minimize losses, fruit bunches are tied high in the canopy to prevent kangaroos from reaching them.

Gurra Downs has experienced episodic pest problems. In 2008 a massive and widespread mouse plague took place. This resulted in some palm fatalities as mice discovered palm hearts as a food source. A locust plague which followed resulted only in superficial damage but was of concern at the time.





Figure 8. Kangaroos enjoy eating date palm leaves and fruits.  
 Photo: Dave Reilly

The main disease problem is *Diplodia*, which is a fungal infection that attacks palms of all ages. It causes small lesions on the underside of the leaf and if left untreated for a prolonged period progressively becomes worse and eventually can kill the palm. Control is achieved by preventative spraying twice per year in spring and autumn. Copper hydroxide and sulfur solution is sprayed into the canopy so it runs down into the center of the plant where the leaves emerge. Application amounts are 5 liters of solution on mature, 3 on medium-sized and 1 on newly-planted palms. The copper hydroxide provides a protective residue that is reactivated with rainfall. The use of copper and sulfur is permitted in organic farming.

### Harvest

Gurra Downs' date palms have begun to bear fruit and support for the endeavor has increased, even among early sceptics of the idea of producing dates in the Riverland. The so-called blessed tree, as it is referred to in Arabia, is earning the respect it deserves in Australia.

The Gurra Downs Date Company has been fortunate to receive financial assistance from the Rural Industries Research & Development Corporation, a federal government agency, over several years. This has assisted in importing cultivars new to Australia; extending the Riverland trial/demonstration site; running data collection; increasing support service to other growers including training and supplying plant stock; establishing field trial sites in other states and territories; and writing industry reports.

Australian government support for research and development funding is very competitive for emerging agricultural industries. Applications for

support far exceed available funds and Gurra Downs recently learned that further research and development support for date growing in the Riverland has been terminated. Consequently the company will no longer receive funding support. This represents a major setback to development of a date fruit industry and Gurra Downs is still coming to terms with this new situation.

Initially with the importation of in vitro date palms in 2001, it was primarily to obtain stock for Gurra Downs' requirements and the focus was purely on fruit production. However, it was taken into account that there could be other farmers interested in also planting date palms if there was available good planting material. Therefore, greater numbers of plantlets were imported than needed, based on speculation that in the future they might be in demand (Figure 9).

Gurra Downs created a website and very slowly but steadily began distributing date palms to prospective growers in many locations throughout Australia. Some buyers like home owners wanted date palms for suburban gardens and a number of farmers wanted to try producing fruit. Interest continues to build and Gurra Downs is proud to be able to spread this amazing palm tree to new places. Many new friends have been made among the more than 180 Australian farmers who purchased date palms, as well as an increasing number of customers to whom Gurra Downs supply fruit.

Gurra Downs has been involved in some interesting date-related projects, which have helped to publicize and promote the crop in Australia. These activities have represented teaching and learning experiences and included:

- a) Establishing a demonstration and training site at SuniTAFE Horticultural College in Mildura, Victoria, where students get the opportunity to work with date palms
- b) Evaluation project at the Arid Zone Research Institute at Alice Springs, Northern Territory (Figure 10) where new date cultivars are being evaluated alongside those imported in the 1980s
- c) Worked with indigenous Aboriginal communities in remote parts of inland Australia
- d) Waste water reuse projects to manage date palms and to utilize waste water streams from large wine-making facilities in the Riverland and Perth, Western Australia
- e) Irrigation waste water reuse project
- f) Trials of the application of silica on date palms for increased plant performance (Phillips, 2014)

### Gurra Downs field trials

In total there are 3,000 date palms planted in the field, at spacing distances of 9 x 9 m and 10 x 10 m. (Figure 11). Gurra Downs field trials currently consist of a program to determine which cultivars will be the best commercial selection for the Riverland by obtaining as many internationally important commercial cultivars as possible for inclusion in the trials. A representation of each cultivar is planted in rows alongside each other for accurate evaluation. These same cultivars have also been introduced to privately owned farms and government research facilities in other locations including Northern Territory, Victoria, Western Australia, Queensland and New South Wales to measure suitable geographical footprint for each selection.

The current list of cultivars includes 23 female cultivars: Ajwah, Anbarah, Ashal Al Hassa, Barhee, Dayri, Fard, Ghanami type, Iraqi type, Khadrawy, Khalas, Khiyara, Lulu; Medjool, Nabut Saif, Nagal, Nemeishi, Sagaii, ShiShi, Sultana type, Sultana (Saudi Arabia), Thoory, Zahidi and Zambli. In addition, 2 male cultivars: Fard and Jarvis.

The main objective of Gurra Downs is to produce Certified Organic date fruit for sale. Given the long-term nature of field trials and a desire for commercial fruit production it was decided to also plant larger numbers of cvs. Barhee, Medjool, Khalas and Khadrawy, which are believed to be suitable for large-scale production. Selection of these four was based on research from the Northern Hemisphere. There is the risk of failure associated with planting commercial numbers of untested cultivars in a new location but if one or more of these four selections prove to be successful, achieving the objective will be within sight.

Many of the 25 cultivars at Gurra Downs have been sequentially planted in the field over several years and are yet to bear fruit. A significant variation in vigor has been observed between the fastest and the slowest growing. Some of the new cultivars are expected to fruit in 2015.

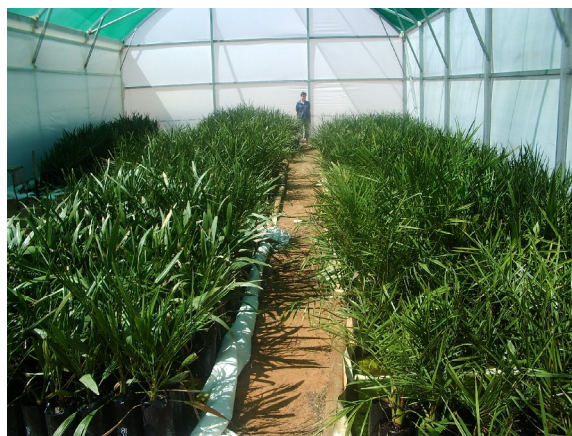


Figure 9. Gurra Downs shade house nursery stock.  
Photo: Dave Reilly



Figure 10. Establishing new cultivar evaluation site at Arid Zone Research Institute, Alice Springs, Northern Territory, March 2013.  
Photo: Anita Reilly



Figure 11. Gurra Downs field trials site, April 2014.  
Photo: Dave Reilly



### **Primary cultivars under trial**

**Barhee:** In the beginning, the primary concern was whether the Riverland environment had enough heat to ripen the fruit of this Iraqi cultivar. Barhee was a prime selection based on the ability to harvest fresh dates in the semi-ripe khalal stage. This minimizes the need for more heat to fully ripen fruit to the rutab/tamar stages. A similar strategy is followed by growers around the Mediterranean Sea where comparable climatic limitations are found. Semi-ripe fruit also appear less prone to spoilage during rain events than rutab fruit so the ability to harvest semi-ripe fruit minimizes risk. Another advantage is that Barhee can be whole-bunch harvested and is comparatively quick to grade and pack. This point cannot be overstated considering Australian labor costs. A disadvantage is that fresh khalal dates are virtually unknown in the Australian domestic market place and given their perishable nature, fruit marketing and logistics are a challenge. There may as well be opportunities to export counter-seasonal fruit to the Northern Hemisphere.

**Medjool:** This is the only premium table date stocked in major Australian supermarkets and by fruit and vegetable retailers. It is well known to consumers and commands a high price (USD 20/kg). Currently, retailers rely on imported Medjool fruit, chiefly from the US. Import replacement is a key reason for growing Medjools. The early ripening of this cultivar also influenced the choice.

**Khalas:** This cultivar was included as one of the premium cultivars because it is a highly esteemed date in its homeland in Saudi Arabia. It also has the advantage of having sweetness at the khalal/fresh stage so may be suitable for sale at this point if there is difficulty ripening it fully. Published information about this cultivar suggests it is not early ripening, but if it can be successfully ripened, Khalas fruit may be suitable for export.

**Khadrawy:** This Iraqi cultivar was added in 2006 because at that time, based on research, it was the earliest cultivar to ripen in the collection. More recently cultivar Nagal from Oman was imported which may be an even earlier cultivar so its performance will be closely watched.

### **Fruit results**

Medjool was the first cultivar to bear fruit and produced a light crop in 2010 and yield has increased each year since. There is now proof from the field that Medjool will ripen in the Riverland, but only just (Figure 12). Picking of this cultivar begins in late autumn when the weather is

becoming cool. It is anticipated that as these trees age and all offshoots are removed, fruit will ripen earlier than at present. These palms produce numerous offshoots which are kept for further planting as it has been very difficult to obtain tissue-cultured Medjool.

Gurra Downs has been selling Medjool fruit for three seasons with favorable feedback about fruit quality. The advantages of this cultivar in the Riverland include: strong pollination success, easy to set fruit, highly vigorous growth and early initial fruiting. The disadvantages include high number of offshoots, particularly aerial offshoots which are difficult to manage; a high percentage of skin separation on fruit resulting in price reduction; and some fruit cracking (pinched nose) occurs during high rainfall years.

Plans have been made to expand this cultivar area but there is the need to implement management methods to induce fruit to ripen earlier. In addition, to determine the cause of the skin separation and possible treatment for it. Experience with Medjool thus far has been a good confidence builder although production techniques still need refinement.

Barhee cultivation has required patience. Under Riverland climate conditions it has grown vigorously and without being over burdened with numerous offshoots; however, has taken a long time to begin flowering. When the palms have finally flowered there has been a modest fruit set which has improved annually with age of tree. Several pollination methods and combinations of placing bags over flowers to increase temperature have been attempted to promote a better fruit set. A stronger fruit setting percentage has been observed on older palms. Seasonality also has an effect on success of pollination with inflorescences produced/pollinated in October giving better results than those produced in cooler September.

Fruit produced is of very good quality. It is a delight to sell khalal fruits to Islamic and Indian communities around Australia who really enjoy fresh yellow dates and amazing praise has been received for producing this fruit. Gurra Downs has now been selling fresh Barhee dates for two seasons and begun distributing the fruit in mainstream domestic markets, giving Australians unfamiliar with this fruit style, the opportunity to try this exceptional date.



Figure 12. Medjool dates produced by Gurra Downs, April 2014.  
Photo: Anita Reilly



Figure 13. Dave and Anita Reilly with fruiting Barhee cv., April 2014.  
Courtesy: Shaun Reilly

One of the most surprising discoveries about growing Barhee in the Riverland climate is that it can bear fruit twice a year. There are two flowering events per year - the first as expected in spring (September/October). This fruit ripens and is harvested over several weeks in autumn (April/May). On the same palm there is another flowering event, although lesser in flower numbers, in April/May when new flowers emerge.

When this phenomenon was first observed several seasons ago, the autumn flowering was ignored and not pollinated; it was assumed that the trees were still adjusting to their new Southern

Hemisphere location. The majority of trees continued to flower again in autumn each year so it was decided to pollinate the flowers even though the palms were at the same time carrying a crop that was being harvested (Figure 14).

Pollen was applied and a brown paper bag placed over the flowers however it was expected that fruits would fail due to the onset of the approaching cold winter when temperatures would go below zero. Amazingly, four months later the small kimri dates protected in their brown paper bags had survived through the winter months at temperatures down to  $-5^{\circ}\text{C}$  (Figure 15). This resulted in the harvest of fresh yellow Barhee dates for sale in February and March from the autumn flowering. This was followed by fresh yellow Barhee dates in April and May from the spring flowering.

In the 2014 season Gurra Downs has had a continuous line of fresh yellow Barhee khalal dates for sale over four months, making it possible to keep retail shops and customers stocked with fruit over a surprisingly long period, which is very advantageous.

Although the Medjool cv. does not exhibit this double flowering trait it has been observed that many other cultivars do, whether it be a wild seedling date or ornamental suburban date palms. In particular, male palms flower twice per year in spring and autumn which is beneficial.

This double-flowering phenomenon is attributed to Riverland climatic conditions where temperatures fluctuate, effectively tricking the palm into flowering. In autumn, temperatures can be  $15^{\circ}\text{C}$  one day and  $30^{\circ}\text{C}$  the next, depending largely on wind direction. From the south come cool breezes, while north winds bring a warm air mass from the desert.

### Rainfall

Rainfall during fruit ripening is a critical factor in the quality and quantity of marketable date production. Although the Riverland is a low rainfall region, from time to time heavy summer storms occur throughout the district. For example, the average rainfall during February is 20 mm but in 2014, a single rainfall event brought 102 mm. In fact the 2014 season has delivered the majority of the annual rainfall in the mid February to early May period. It is the wettest year since 1974 and has been very challenging.

The majority of the 270 mm annual rainfall is received during winter. Gurra Downs has experienced both decade-long droughts with little



rainfall and also seasons with record-breaking flood events.

As a result of the risk of summer storms and the potential for crop damage, trials are being conducted with a number of methods to protect the fruit from spoilage. Trials are underway using white tightly woven mesh bunch covers, green loose mesh covers, plastic covers, cotton covers, large paper bags, brown Kraft paper wraps and no covers.



Figure 14. Two crops of Barhee cv. on one tree: kimri fruit from autumn flowering and newly emerged spring flowers.  
Photo: Dave Reilly

The degree of damage on uncovered bunches depends on the stage of maturation, but the more advanced the sugar levels, the more severe the damage. Green Barhee dates are largely unaffected but advanced khalal stage suffer from splitting and marking. Barhee seems to be more tolerant of prolonged rain events than Medjool, which suffers from skin cracking and pinched nose.

Results during the very wet 2014 season were that any fruit exposed for long periods to contact with rain sustained considerable damage. This included uncovered fruit and fruit in mesh bags with good ventilation. The least damaged fruit came from fruit bunches protected by brown paper wraps (Figure 16). Fortunately, most fruit bunches had been previously wrapped with paper. Following a massive 220 mm of rainfall throughout the four harvest months an estimated overall 40% fruit loss was experienced due to marked skin and spoilage. Of this almost 100 % of uncovered fruit and ventilated mesh covers were totally spoiled and approximately 15 % bunch damage occurred on paper wrapped bunches.



Figure 15. Two crops on Barhee cv. on one tree.  
Photo: Dave Reilly

Had it been known at the beginning of the season that 220 mm of rain would fall, the expectation would have been for a total crop loss. To come through this very wet season with an approximately 60% pack out rate was surprising. Experience has shown that the best results in wet years come from using brown Kraft paper to wrap fruit bunches. In an average rainfall season this management action is not required but does bring some peace of mind. Gurra Downs is well above average rainfall for 2014 and it is hoped there are some well below average years approaching.

### Economic challenges

Australian farmers have a saying: if it can't be done with a machine, it can't be done. The reason for this saying is mainly because of the very high compulsory minimum wage rate. For Australian farm laborers this is around USD 20/hour. This is the driving factor to find efficiencies in managing farming operations. Industries which can mechanize are successful and industries which overly rely on high labor inputs have difficulty competing against imported products.





Figure 16. Date bunches covered in paper wrap.  
Photo: Dave Reilly

The Gurra Downs approach has been to aim to produce a high value product which helps offset high input costs. Medjool retails for USD 20–30/kg and yellow Barhee around USD 18/kg. To gain new outlets, export markets for fresh yellow Barhee dates are being explored during the months of February through June. At this stage there is strong domestic demand for Australian grown dates but labor-saving options are still needed to run the plantation and make a profit.

Traditional methods of pollination where each flower is individually hand pollinated requires a high input of labor. Pollination has been identified as a management operation in which labor-saving techniques are required. A number of treatments have been tested including the pollen dust blowing method and pollen in a water solution which is sprayed onto flowers. Initial results are encouraging and with some early success with both methods.

The pollen blower method of directing a stream of pollen towards the flower from ground level works well but wind speed on the day can be problematic, whereas a pollen and water suspension provides better coverage in windy conditions. Field trials still need to be run over a second season but at this stage it appears labor savings will be realized.

Offshoot removal is also a high labor input. It takes two fit men and much hard work swinging a sledge hammer, large chisels and digging to remove offshoots. Progress is slow and often physical demands limit the work program. The preference at

Gurra Downs is to expand use of tissue culture plants and to eliminate offshoots. However, sometimes offshoots are desirable on cultivars difficult to obtain through tissue culture.

In 2012, while on a Nuffield Australia Farming Scholarship, the senior author travelled to many countries and watched how offshoot removal is practiced. Almost everywhere the task is performed by hand. In Arizona some enterprising farmers have developed a jackhammer chisel mounted on a skid steer tractor (Bobcat). This speeds up the process but still requires two men, one to operate the machine and the other to rotate the angle of the cutting tip (Reilly, 2012).

Gurra Downs has since purchased a skid steer/tractor and made modifications to the design (Figure 17). The perfected machine cuts into soil to ensure suitable root mass remains on the offshoot then chisels the offshoot from the palm and lifts it from the ground for loading. All this is done from one machine by a single operator. Many offshoots can now be removed quickly in a day with minimum fatigue while significantly reducing labor costs.

There are no doubt other management operations needing to be reviewed and labor savings techniques adopted to be internationally competitive. It may be that cultivar selection will be an important factor in this regard with whole bunch harvesting and minimizing postharvest processing.

In terms of where Gurra Downs is as an emerging industry in a new district, there are still many questions to be answered. There is good reason to feel a level of confidence with production results from cvs. Barhee and Medjool, and prospects are good for some of the other 20 cultivars which are due to begin fruiting in the next season or two.

### **Future research and development program**

A key factor for successful production over the longer term in the Riverland region will be in developing management methods to advance fruit maturation. One of the limiting factors is the total accumulated seasonal heat units which although suitable for fresh and early ripening cultivars, may not be sufficient to fully ripen late and dry date cultivars. As is the case with all agricultural crops, the longer the crop takes to fully ripen the more exposure to risk from extreme weather events, pest and disease etc.



Figure 17. Skid-steer tractor modified for offshoot removal.  
 Photo: Anita Reilly

A major focus in the coming seasons will be to find management methods to assist in ripening the crop earlier and faster. Areas of attention will include:

- a) Trials of a wide range of female cultivars
- b) Screening of different Phoenix male pollen for early ripening traits
- c) Trials of different bunch covers to facilitate early ripening
- d) Management of ground covers to raise soil temperature
- e) Reduction in irrigation volumes leading up to harvest
- f) Artificial fruit ripening/dehydration methods to finish fruit.
- g) Trials to determine reasons for, and treatment of skin separation on fruit

### Conclusion

Growing dates, especially in a new area and country where the crop is not commercially produced, represents a daunting but exciting challenge. The experiences described in this article demonstrate that a slow careful deliberate process is the best approach. In this way, many of the common reasons for failure in the course of a project can be overcome to increase the odds of

success in creating a sustainable date palm plantation.

### Acknowledgements

The invitation to prepare this account of the experiences at Gurra Downs is greatly appreciated. We have learned so much about date production from friends and colleagues during our many visits to UAE. Attending the last three international date palm conferences in Abu Dhabi and two Liwa date festivals, along with other study tours, we have learned how to effectively pollinate, prune, harvest and process fruits, as well as how to evaluate different date cultivars for suitability to Riverland conditions. The truly international approach of the Emirati date industry and the willingness to exchange ideas and information are greatly valued. It is our hope we can return some of the great generosity in learning that has helped us so greatly.

Special mention must go to Mr Ali Mustafa Mohammad al Tajalli and Mrs Bosseineh Khazal (Figure 18) to whom we are greatly indebted for sharing their great knowledge and wisdom about growing date palms. Many thanks also to Dr Avril Brackpool and the team from D.P.D. (UK); without whom our achievements with date palms would not be possible. We are most grateful as well to our extended family for their faithful support and encouragement over many years.

Finally, we wish to gratefully acknowledge the honor bestowed upon our efforts to create a date industry in Australia by the Khalifa International Date Palm Award in 2010 for the best development project (Figure 19). This recognition is a continuing inspiration to us.



Figure 18. Mrs Bosseineh Khazal, Mr Ali Mustafa Mohammad al Tajalli and Dave Reilly at Green Coast Nurseries, Fujairah, UAE.  
 Courtesy: Shaun Reilly





Figure 19. Dave and Anita Reilly receiving the Khalifa International Date Palm Award in 2010 from H.H. Sheikh Nahayan Mubarak Al Nahayan, Minister of Higher Education and Scientific Research, in Abu Dhabi, UAE.  
Courtesy: KIDPA, UAE

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