



# Advances in Date Palm Cultivar improvement in the Sudan

Dr. Mohamed M.A. Khairi  
Sudan

khairy5@hotmail.com

## ABSTRACT

Sudan's date industry is based on dry dates which are easy to handle after harvest. But the coarse texture of these dates need to be softened to make it more palatable for grinding and digestion. The industry has also been based on six commercial varieties which requires broadening the gene base by adding more cultivars. In the last two decades, about twenty varieties were introduced from Saudi Arabia, United Arab Emirates and Iran tissue culture laboratories. Because Sudan's main date production areas fall in summer rain zones with more precipitation in the southern edge of the growing belt and diminishing northward, the distribution of introductions was planned to target success under the diverse climatic zones. Varieties that would be edible and harvested in Khalal stage prior to rain damage were planted in the southern fringes of the belt. Of the varieties tested there, Barhi dominated as a novel Khalal date. Khinaizy and Khadrawy may pick up and add to the success of khalal harvests. Introductions that require longer duration for reaching harvest stage were distributed to the

northern areas where rain damage risk is less. A wide range of these introductions are showing high yield of good quality dates in these zones. Anbara, Barhi, Khalas, Mejhool, Sagaee and more varieties are promising to adapt well in Abu Hamad - Wadi- Halfa reach. Parallel with introductions, a local selection program to pick date palms of seed origin with outstanding merits for evaluation and recommendation as candidate cultivars has been initiated. The exotic introductions and local selection programs are envisaged to contribute well towards improvement of date palm cultivars in Sudan.

Key words: Climatic graph, Cultivars, Foreign introduction, local selection, Zonation.

## 1 - Commercial Date Cultivars of Sudan

For centuries, Sudan's date industry has been based on six commercial cultivars only, with hardly any improvement programs. Barakawy ( Nubian Abatta) is predominantly the most widespread commercial cultivar, followed by the relatively softer and higher price fetching Abatta Moda and Gondaila. The hard texture of these cultivars

Fig 1: Commercial date cultivars of the Sudan



A-BARAKAWY



B-ABATTANODA



C-MISHRIG WAD LAGGAI

makes the product less popular to consumers compared to the semi dry cultivars of which Mishrig Wad Laggi and Mishrig Wad Khateeb exist as local cultivars. Together with the only soft commercial cultivar Madina, these cultivars form the six commercial dates of Sudan ( Fig 1 ( a - f )

The origin and history of introduction of dry varieties is obscure. But the existence of these cultivars in Upper Egypt is an indication that they are originally from North Africa and spread south. Personal communication with Major General Mubarak Abbas, who is an inhabitant of Abu Hamad, the predominantly semi-dry date palm region, informs that judging from the nature of spread out of cultivar Mishrig Walaggai , it is an indigenous cultivar that originated in Atmour and that the parent sources for the cultivar still exist as old lopsided palms free from leaf bases. He also informs that Mishrig Wad Khateeb originated in the garden of late Mohamed Khateeb at Mokrat island around the year 1840 AC.

Less important cultivars also exist in various date production areas, the main being Kolma, Abid Rahim, Braira, Gargoda and Kursha. Asada, Hassan Koje, and Gol Bojo cultivars exist in the Gaab oases. Seedling date palms, of which the high yielding and fruit quality date bearing palms form the bases for local selection, are also common. Khalifa and Osman (1988) analyzed the sugar content of some Sudanese cultivars.

## 2 - Zonation in Date Palm Cultivar Distribution

Cultivar distribution in Sudan shows a smooth transition from dry dates in the northern border of the country to semi-dry and soft dates southwards. These dry cultivars, which have to be kept



D-GONDAILA



E-MADINA



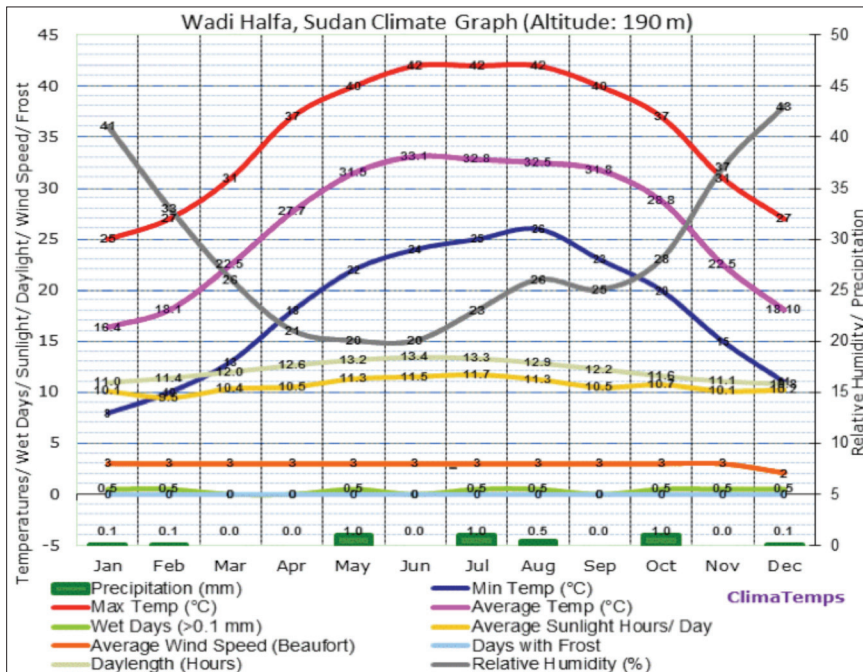
F-MISHRIG WAD KHATEEB

on the palm to reach the final maturity stage, dominate the dry environment zone of Wadi Halfa - Merowe and diminish gradually southwards. Examination of environmental conditions of the region indicate that dry dates can only be grown in low rainfall and relative humidity areas. The climate of Wadi Halfa, located at 21°49'N, 31°21'E, elevation 190 meters is a subtropical desert / low-latitude arid, that is hot year round ((Köppen-Geiger classification: BWh). According to the Holdridge life zones system of bioclimatic classification, Wadi Halfa is close to the subtropical desert biome. The mean temperature of Wadi Halfa is 26.3 degrees Celsius and total annual precipitation averages 4.6 mm (0. 2 in). Annual sunshine averages 3964 hours (fig 2):

Abu Hamed, located upstream at 19°32'N, 33°19'E, 312 meter elevation and has a tropical wet and dry/ savanna climate (Köppen-Geiger classification: Aw) with a pronounced dry season in the low-sun months, no cold season, wet season is in the high-sun months. According to the Holdridge life zones system of bioclimatic classification, Abu Hamed is close to the tropical desert biome. The average annual temperature in Abu Hamad is 29.2 degrees Celsius. Total annual precipitation averages 12.6 mm.

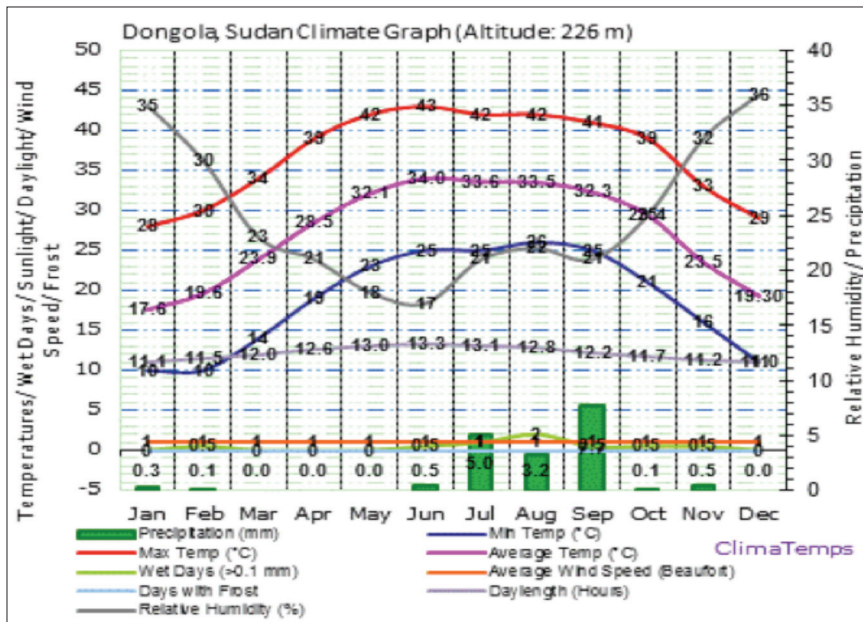
Khartoum, located at 15°36'N, 32°32'E, 380 meter elevation has a tropical wet and dry/ savanna climate (Köppen-Geiger classification: Aw) with a pronounced dry season in the low-sun months, no cold season, wet season is in the high-sun months. According to the Holdridge life zones system of bioclimatic classification Khartoum is close to the tropical desert scrub biome. The mean annual temperature of Khartoum is 29.9 degrees Celsius

Fig 2 : Wadi Halfa climate graph



Dongola, located at 19°10'N, 30°29'E, 226 meter elevation has a subtropical desert / low-latitude arid climate that is hot year round (Köppen-Geiger classification: BWh). According to the Holdridge life zones system of bioclimatic classification, Dongola is close to the tropical desert biome. The mean temperature of Dongola is 27.3 degrees Celsius and annual precipitation averages 17.8 mm.( Fig 3):

Fig 3: Dongola climate graph



and total annual precipitation averages 162.2 mm ( Fig 4):

Down south upstream from Abu Hamad, semi dry and soft cultivars dominate the region till eventually high rainfall and relative humidity limit the zone of date production in the country at about 12 N latitude. While the northern parts of date production areas of Sudan are environmentally suitable for a wide range of date palm cultivars, the southern end is suitable only for cultivars that mature to an edible stage ahead of the summer rains which coincide with date maturity stages.

### 3 - Cultivar Improvement

#### 3-1 Exotic Introductions

Early introductions of date palms were initiated by British administrators who used to offer date palm offshoots to national dignitaries and tribe chiefs living in date palm growing areas as special gifts. Some tribe chiefs were offered Tunisi (Deglet Noor) offshoots from North Africa. In the 1950s, 50 more Deglet Noor offshoots were introduced by the Ministry of Agriculture from Algeria and planted at Gurair Government nursery. When left to dry to tamar stage on the palm the traditional way of handling dry dates under Northern Region conditions, this renowned variety matures to a very coarse textured date. Special handling of the date by harvest in an earlier tamar stage improves the quality to a softer fancy date. But the variety did not gain popularity to be propagated commercially in this region. The variety itself produces very few offshoots. Further south in Khartoum, the author observed that Deglet Noor is damaged by summer rains (Fig 5). Success of Deglet Noor in Sudan therefore, awaits further testing and special

Fig 4 : Khartoum climate graph

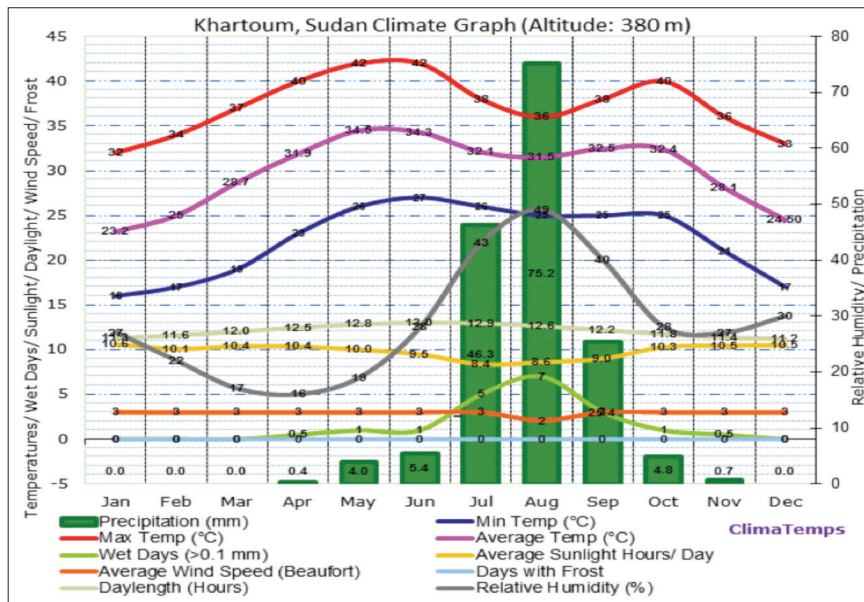


Fig. 5 - Deget Noor in Silait Scheme, Khartoum



handling under Sudan's diverse environmental conditions.

Few palms of the Iraqi Digil Maktoom and Tabarzal varieties are also growing in Gurair Government nursery, but no information is available about history of introduction and performance of these varieties. While these

palms show good fruit set, there has been no attention for utilizing these introductions.

In 1975, seeds of date palm varieties pollinated with their own back crossed male progenies were introduced from Indio Research station in California by Dr Awad Osman and sown at

Hudaiba research station. The resulting seedling palms, that included Barhi, fruited dates that were close to the characters of the parent variety. But these trials did not materialize to any sizeable cultivar improvement by seed propagation. Traditional cultivars and seedlings of seed origin continue to dominate the date production areas of Sudan. Success of date palm propagation by tissue culture opened the room for date palm variety improvement by foreign introductions. Taking the advantage of availability of tissue culture propagated material, an influx of tissue culture propagated introductions was initiated by date production companies and interested individuals. The main sources of these introductions is laboratories in Saudi Arabia (Elrajih), United Arab Emirates (UAE University and Alwathba nurseries), and Iran. First nurseries and import trials started mainly in Khartoum area where major companies are located (Fig 6 a,b,c).

These were the first introductions of these varieties to the country and no prior research data to guide the distribution process of the introductions to the climatic zones was available. Distribution to growing localities was therefore based on available information about the fruit development nature of the varieties. Accordingly, varieties that are known to have low tannin content and edible in the early khalal stage of fruit development were envisaged to succeed in summer rain damage prone southern areas of the date palm growing belt. Varieties with high tannin content that are consumed in the late fruit development tamr stage were planted further north in dry areas where there is hardly any risk of rain damage. At least

Fig 6 a- Zadna Nursery, Kadaro, Khartoum North



Fig. 6- b : Elshamil ( Zadna) nursery, Kadaro, Khartoum North



Fig. 6-c: Lieutenant General Mahgoub's Barhi date garden, Khartoum North



twenty varieties were introduced, including the following:

- 1- Agwat Elmadina
- 2-Anbara
- 3-Barhi
- 4-Boo Fuggoose
- 5-Boo Sukkary
- 6-Khadrawy
- 7-Khalass
- 8-Khinaizy
- 9-Khudary
- 10-Mejhool
- 11-Nebboot Ali
- 12-Nebboot Saif
- 13-Nebboot Sultan
- 14-Rizaiz
- 15-Sagaee
- 16-Sindy
- 17-Sukkary
- 18-Sukkary Red
- 19-Sullig
- 20-Wannana

Yield and fruit analysis data of these introductions are not yet available, but some introductions have gained popularity very quickly. Already fresh Barhi khalal dates have dominated Khartoum markets as a high novel date. Barhi sells readily at high price while local cultivars Mishrig and Madin encounter low demand and sell for less (Fig 7 a, b).

Other introductions like Khadrawy and Khinaizy which mature to edible Khalal stage ahead of summer rains are also picking up to gain popularity in high summer rain areas. In years of low rainfall, the internationally renowned Mejhool variety shows some success in Khartoum area. But its quality is deteriorated by rains.

Fig 7 a Nifaidy Barhi garden, Khartoum



Fig 8- a : Anbara showing rain damage, Silait scheme



Varieties like Anbara, which are usually harvested in tamar stage, are damaged by rains in Khartoum area at Rutab stage ( Fig 8 )

Anbara, Khalas, Khudary, Mejhool, Sagaae and Sukkary are showing great success in drier areas where no rain damage is encountered ( Fig 9 a-b ). The further north, the better is performance of introduced dates. As more introductions come into bearing, a wider range of exotic cultivars may replace the outgoing local cultivars.

Morphologically, tissue culture propagated introductions show outstanding structures apart from very few odd

Fig 7 b- Dr. Abdel Rahman Ali 's Barhi, Khartoum North.



Fig 9- a : Khalas in Dongola, Silaim Basin



looking abnormalities which are uprooted and discarded (Fig 10 )

To complement with variety introductions, the Iraqi Gannamy male was introduced from Alwathba nursery in Abu Dhabi ; and Fahl Alain male was introduced from University of UAE , (Fig 11).

### 3-2 Local selection

In several date palm growing areas worldwide, there are some rare seedling palms that have outstanding merits of impressive canopy, high yield and fancy fruit quality. Because there are few of them, access to these

Fig 9-b: Khudary; Hashim Hussein Garden , Atbara, River Nile State



Fig 10: Abnormal tissue culture propagated date palms, Khartoum.



palms is usually limited to the owners and related families. Being indigenous, these candidates for local selection are already adapted to the environment while exotic introductions are subject to external climatic interactions. This rare material is therefore worth

studying, evaluation and promotion for wider use. The evaluation process requires surveys to spot the locations of these palms and evaluation for yield, fruit quality and other parameters. Prominent selections are recommended candidates for potential varieties.

Fig 11-: Ghannamy male introductions



Fig 12 : Exhibition of Collection of dates for local selection



Commercial varieties originated as such and multiplied by humans. Local selection programs have been initiated in Sudan and candidate palms are being evaluated (Fig 12). Local selection programs complement with foreign introductions for variety improvement.

## REFERENCES

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