RANA AGRO – INDUSTRY CORPORATION

TISSUE CULTURED DATE PALM AFTER-CARE MANUAL

AFTER-CARE OF TISSUE CULTURE DATE PALMS

INTRODUCTION:

Micropropagation using tissue culture technology in its broadest sense consists of placing specific plant tissues in nutrient media under highly optimised conditions to allow for the multiplication of plants on a mass scale. The aim is to produce highly uniform plants completely free of pathogens, fungi or viruses which could lead to disease.

Date palms are notoriously difficult to propagate as the number of clonal offshoot material is very limited and so micropropagation technology helps address the issue of mass propagation in a relatively short span of time.

Tissue cultured plants follow a rigorous schedule of development and acclimatisation in the lab, high humidity incubators and glasshouses before they are ready for despatch. The plants are constantly quality controlled at various stages of their development until they are acclimatised to their natural environment. It is therefore, quite important to continue this regime of quality control and after-care until the plants are ready to be planted in the field.

The first step towards the full acclimatisation and care is the establishment of suitable glasshouses/shade house facilities. Other key parameters must also be taken into consideration at this stage including good glasshouse/shade house management which involves the careful controlling of factors such as the provision of suitable substrate(s), proper irrigation, optimisation of light intensities, proper use of fertiliser, good pest management and etc in order to ready the plants for field establishment.

GLASSHOUSE / SHADE HOUSE ESTABLISHMENT:

1. The Facility:

   The choice of material used for the building of a glasshouse or indeed the choice of opting for shade house very much depends on the environmental conditions of the region where the plants will be kept and the size of the plants being cared for, for example, for plants greater than 30 cm in size, the use of shade houses will suffice. For plants less than 30 cm in height, RANA does not recommend the use of shade houses (please see below for a more suitable system of care for these plants). Prior to the building of the correct after-care facility, it is important to account for these environmental factors such as temperature, humidity, wind velocity, snow fall and etc. during the coldest and hottest seasons. In effect, the facility must be able to withstand the most extreme of conditions prevalent in the region.

   Also, the building site must be orientated in such a way so as to account for the maximum amount of required light that must enter the facility.

2. Glasshouse/Shade house flooring:

It is recommended that the floor, where the plants will be placed for after-care, should consist of compacted soil and covered with a 10 – 15 cm layer of gravel (stone chippings) (See Appendix Picture 1, 5). Use of gravel allows for good drainage, particularly for plants in torpedo plants.

3. Access Corridors

It is important to create access corridors around the area where the plants are placed to allow for irrigation and general care.

4. Size of the glasshouse/ Shade house:

The size of the glasshouse / Shade house is based on the size of the torpedo trays and / or plastic bags. For example a space of 5.5 m^2 x 3.5 m^2 can accommodate 220 torpedo trays (each containing 25 torpedo pots) or 1000 plastic bags.

5. Light Conditions:

The newly received palms perform well under **indirect** light of between 10,000 and 20,000 Lux and the intensity of the light should be increased gradually over time. This gradual increase should be such that prior to transfer to the date palm grove; the plants are kept under indirect (shade) sunlight. The creation of shade can be achieved by the covering of the facility's roof and sides with a layer of washable paint, the attachment of shade covers or special shade netting.

6. Air conditioning:

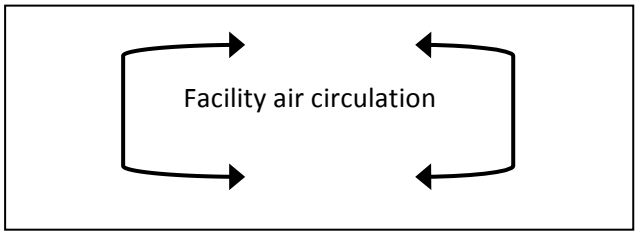
The design of the air conditioning system including its thermostatic control mechanisms is a very important consideration in the establishment of the facility. Given the fact that temperature uniformity must be maintained throughout the year, it is possible to make use of fans (See Appendix picture 3) in the walls or ceiling of the facility and adjustable air inlet/outlets can also be installed. The use of fans that are automatically operated based on fluctuations in temperature and humidity are the best way to create continuous temperature/humidity uniformity throughout the facility.

7. Temperature:

The temperature range of 20 – 35 °C constitutes the minimum and maximum temperatures that are safe for the palms to be stored under. Sudden fluxes in temperature (either increase or decrease) may cause heat (or cold) shocks to the plants that in turn may have inhibitory effects on their growth and development. Therefore, the design of temperature controls must be such that the system prevents fluxes outside the specified temperature range. The use of thermometers (with a max and min scale) installed in various points of the facility are recommended. The measurement of temperature must be as close to the level where the plants are stored as possible. This can be achieved by installing the temperature sensors as close to the plants as possible.

During the summer, for the purpose of maintaining temperature uniformity the use of the pad and fan system is highly recommended. This system can help in

the maintenance of humidity to a certain degree. During the winter months, if regional temperatures fall below 20 °C, the use of installed unit heaters are recommended. The unit heaters contain blowers that help in the establishment of temperature uniformity. Otherwise, additional fans must be installed to help with the air circulation process. These fans are installed on facing corners in the facility to facilitate air circulation.



For energy conservation purposes, in cold climates, the insulation of the facility is highly recommended.

8. Irrigation:

The date palm's water requirement is very much dependent on its local environment. Irrigation must be performed in such a manner that the compost remains moist constantly. It is suggested that the volume of total dissolved solids contained in the irrigation water should not exceed 2000 ppm. If the irrigation water dissolved solid content is above this, it is recommended to mix the water with the city's mains water to dilute the level of dissolved solids.

9. Humidity:

Relative humidity for the compost should be 30% by volume and for the ambient (immediate environment) humidity is in the range of 50 to 60%. If dryness is observed on the surface of the compost, some surface watering is recommended. In the event of a fall in the ambient humidity level, the spraying of water on the surrounding ground of the plants can help alleviate the fall in humidity.

Humidity gauges can help in deciding when is a good time to spray water in the surrounding areas of the plants to regulate humidity. Please note that the experience of skilled glasshouse/ shade house managers and their knowledge of the local climate greatly outweigh the guidelines provided by humidity gauges.

10. Fertiliser Use:

For the first 3 to 4 weeks of the acclimatisation period, the use of a high quality Fertiliser is essential. RANA recommends KRISTALON to provide N:P:K at 19-6-19 and other trace elements as follows:

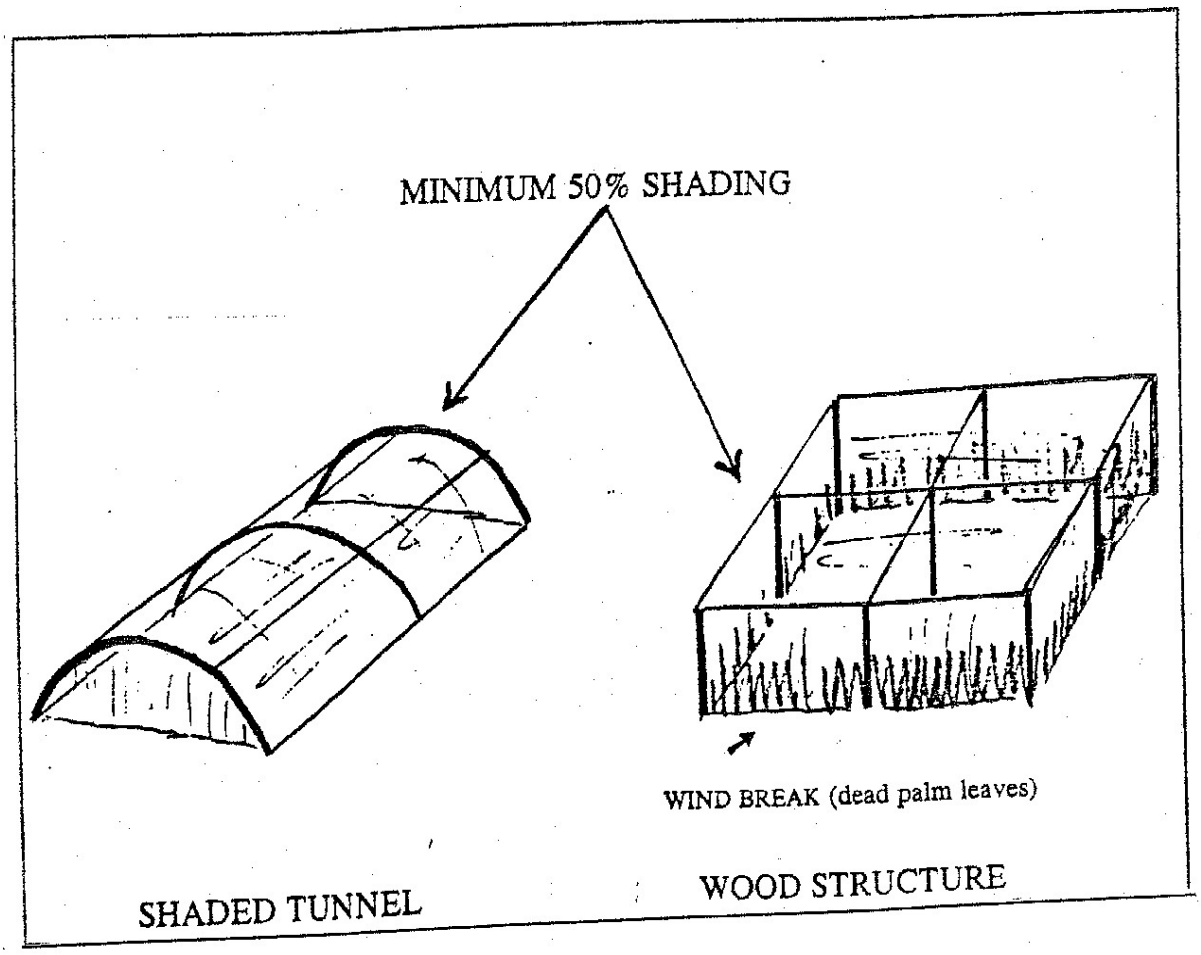
- KRISTALON with a concentration of 1 g/l (in water) by way of irrigation twice a week.
- Iron (Fe) with a concentration of 0.1g/l (in water) by way of irrigation twice a week.

The manufacturer's recommendations should be closely followed and care taken not to over-feed the plants.

UPON ARRIVAL:

Plants should be cleared from airport customs as soon as possible. If the plants are delayed for a few days, they must be kept in a cool, shaded area. For plants greater than 30 cm in length, the establishment of a shade house is satisfactory. For plants smaller than 30 cm, please see pages 1 – 4.

It is important that the plants are removed from their boxes without delay, given a good watering using sweet water (i.e. salinity not more than 2000 ppm total dissolved solids) and placed in shaded tunnels or houses, with wind protection (see diagram below):



Commercially available nets which cut out 50% of direct sunlight are satisfactory.

The average number of pots per square metre = 225.

It is important that the plants are kept in the pots and under shade for approximately 4 – 12 weeks to gradually acclimatise them to local conditions. The number of weeks required under shade will depend upon the local environment and the age and size of the tissue cultured plants.

Sweet water (i.e. salinity not more than 2000 ppm total dissolve solids) must be used. If local water is more than 2000 ppm, it must be diluted with city water.

GROWING ON:

RANA recommends one of the following options:

1. Torpedo plants:

If the plants are received in a size range smaller than 30 cm, then they **must** be kept in the torpedo pots until such time that they are at least 30 cm in length and have 3 well-developed leaves. The irrigation, fertilisation and lighting regimes are as previously described (see Glasshouse/shade house section for more details). For plants less than 30 cm, a more careful regime is required to grow them to a size greater than 30 cm (see pages 2-4).

2. Repotting in 3 litre bags

Plants repotted into 3L pots have completed their growth schedule in the torpedo pots and are ready to be transferred to larger 3L bags. They are often 30 – 40 cm in length and the roots are clearly protruding from the bottom of the torpedo pot. By transferring them to the larger 3L bags, the plants are allowed to grow further.

Care must be taken during repotting to ensure that after irrigation and soil settling, the roots are not exposed above the soil line at the root/shoot junction (see examples of poorly planted palms in the Appendix, pictures 2 and 7).

Planting in 3L bags will allow the plants to achieve further growth up to a height of approximately 50 cm and will possess at least 1 pinnate leaf. One can be confident that the plant is ready to be planted in the field when it possesses at least 1 pinnate leaf. Usually these plants are approximately 50 cm in height although this differs across various date palm varieties.

A suitable potting mixture is one that provides an open structure for good drainage, e.g. one third peat moss, one third local soil, one third composted bark (Cambrak). The containers must be placed on loose stone chippings, 10 – 15 cm deep, to allow for drainage.

If temperatures exceed 35 ºC, some cooling and humidifying will be required during the first 3 to 4 months of growing on. This can easily be achieved by spraying the plants and surrounding chippings/soil with water twice daily. Free drainage is essential at all stages.

At the growing on stage, we recommend the use of a liquid feed such as “Kristalon” to provide N:P:K at 19:6:19 and trace elements. The manufacturer’s recommendations should be closely followed and care taken not to over-feed the plants.

3. Repotting into 8 litre pots/bags

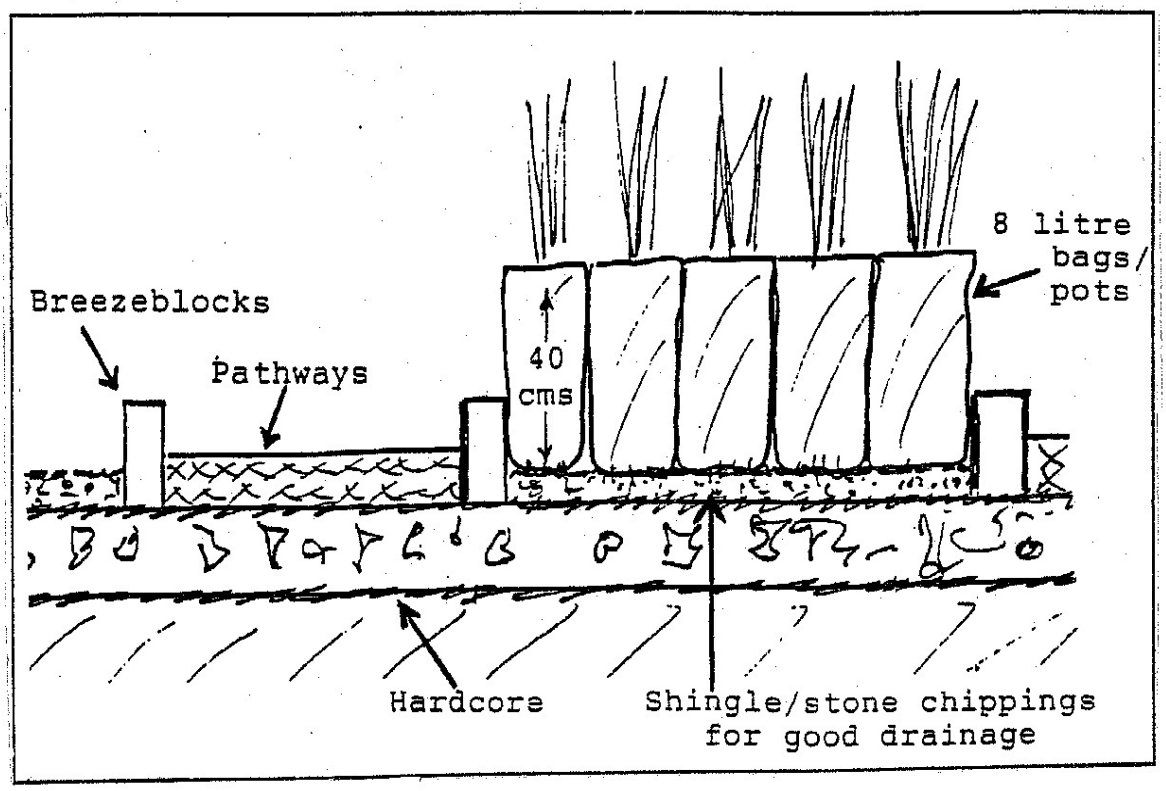
Torpedo plants that have reached a height of at least 30 cm can be transferred directly to 8L bags. This is a choice that can be made by the grower if he/she wishes to grow the plants to a larger height (or at a later date) before planting them in to the field. The plants can be kept in 8L bags until the rooting system completely covers the soil entity. At that stage the plant should be transferred to the field.

Torpedo plants of 30 – 40 cm in height can usually be re-potted into 8 litre containers, ideally 40 cm deep.

This option is particularly useful in areas where there is a danger of plant losses caused through unreliable water supply and/or insufficient sun and wind protection during the immediate period after field planting. Even if these problems are not a consideration, plants grown on using this method will be very robust at the time of field planting and hence the after-care required will be minimal.

The disadvantages are the extra costs incurred in re-potting and the larger area required to hold the plants.

The potting mixture, temperature conditions and the fertilisation regime is the same as that of the plants kept in 3L bags (as described above).



FIELD PLANTING:

Density:

The rules which apply to conventionally propagated date palms also apply to plants propagated through tissue culture, and good practices should be followed at all times.

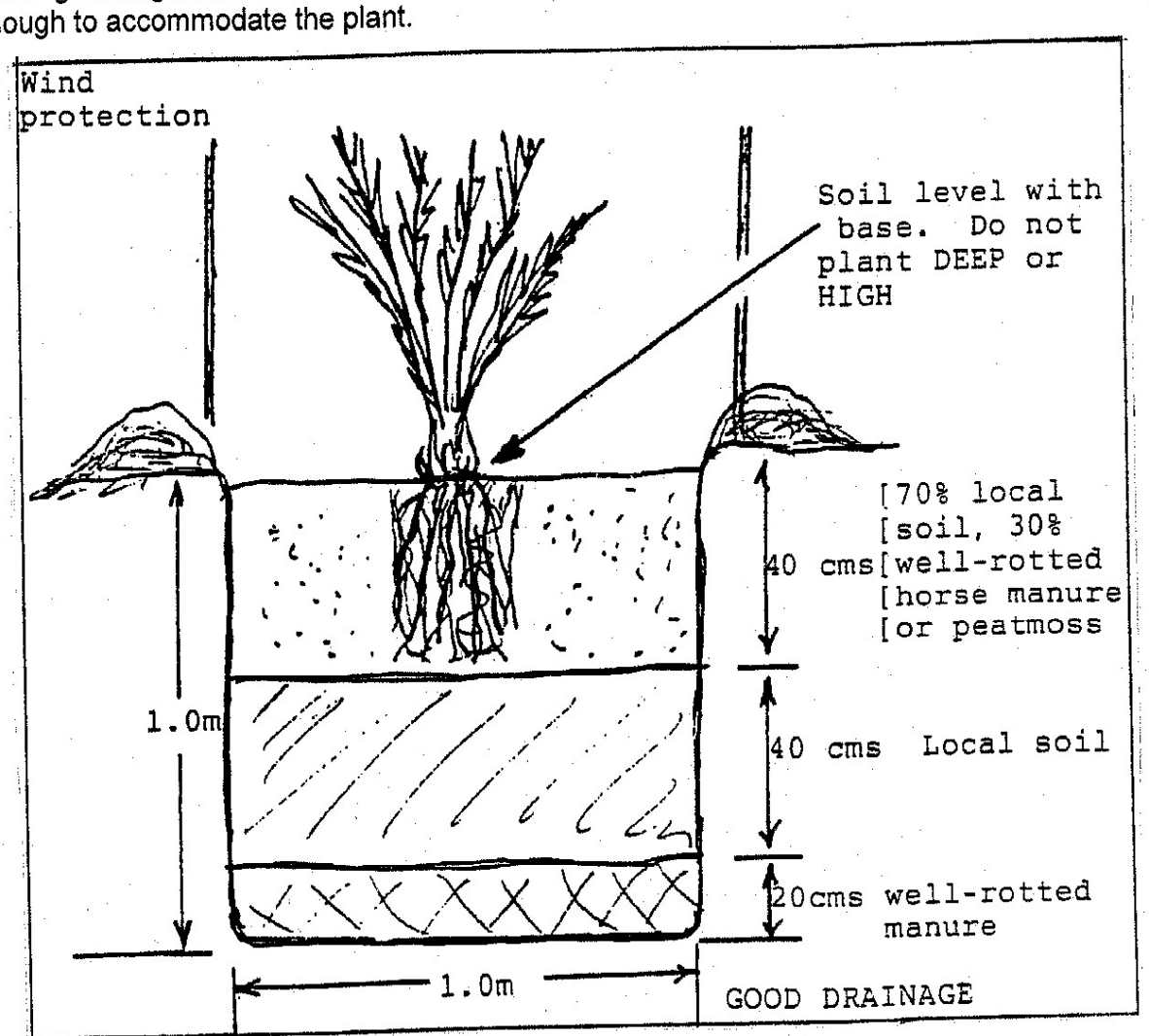
For any date palm plantation the limiting factor is the availability of suitable water. The water requirement must be carefully determined beforehand, based on the proposed size of the plantation: local advice should be sought. If the water requirement is calculated incorrectly, and if insufficient suitable water is available, the plants will not thrive and fruit yield may be affected.

If sufficient suitable water is available, it is recommended that a plant spacing of 9 metres x9 metres be adopted, giving approximately 125 trees per hectare. Although this is a highly suitable spacing across a range of varieties, in certain cases where a higher density plantation is required, the spacing may be reduced to 7 metres x7 metres. This will give an average planting density of 200 trees per hectare.

Planting Procedure:

When an appropriate spacing for field planting has been decided upon the following field planting method is recommended (for either plants in 3L bags or 8L bags):

For plants which have been re-potted in to 8L or 3L containers, the hole will need to be 1 metre in diameter and 1 meter deep. The bottom should be filled to a depth of 20 cm with well rotted manure, followed by 40 cm 30% peat moss (or well matured horse manure). NPK and trace elements should be incorporated into this final mix at the manufacturer's recommended level for young plants. Sufficient time and irrigation must now be given to allow the soil "refill" to settle in the pit before planting. The level of the earth after watering and drying out should be that of the surrounding soil. If planting into good silt soil, the above planting arrangement is not considered necessary and the hole should be dug just deep enough to accommodate the plant.

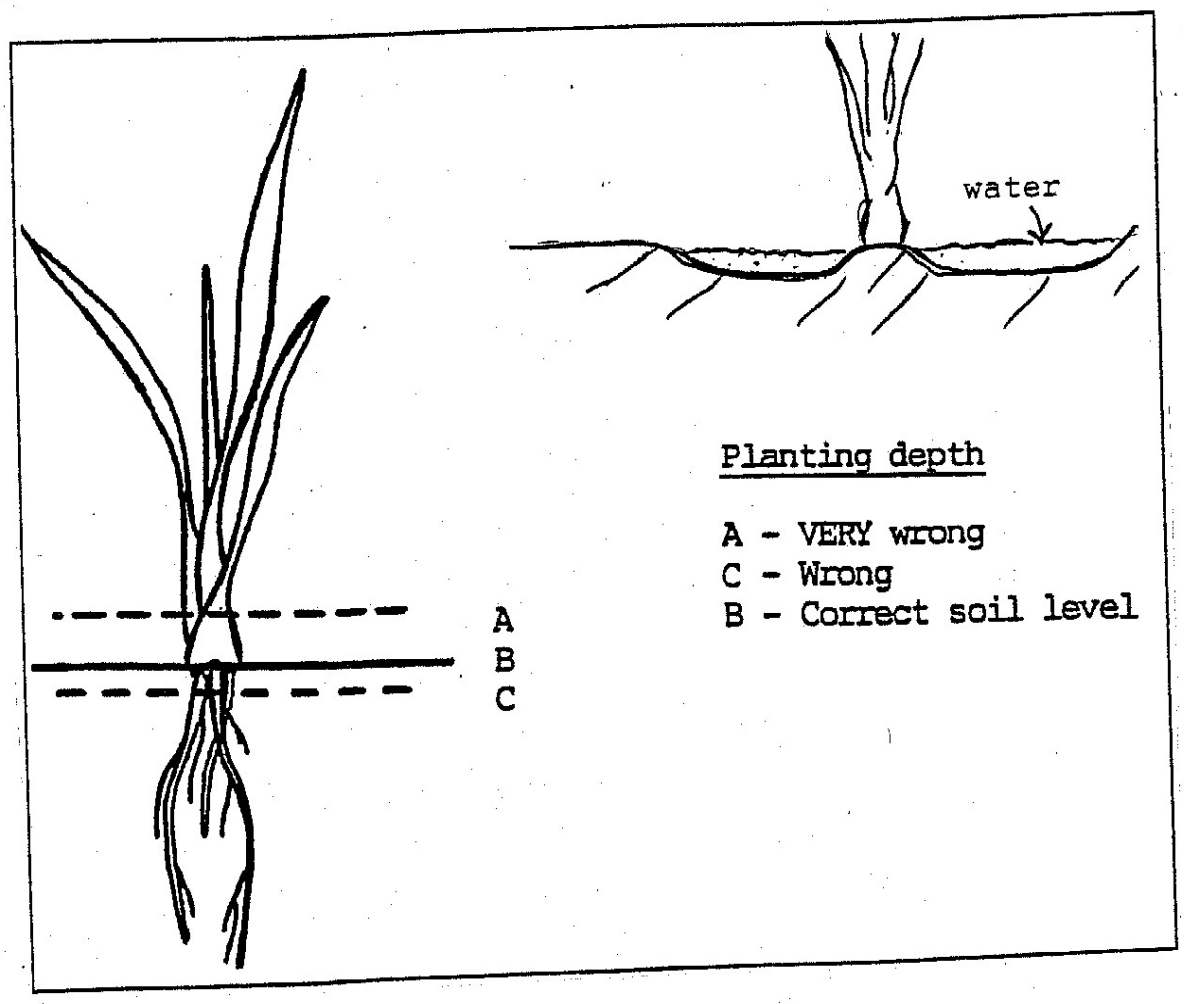


The soil should be carefully tamped down around the plant so that the base is kept in close contact with the soil at all times. A basin 15 – 30 cm deep and 1 – 1.5 metres in diameter should be formed around the plant, with the base of the plant being above the water level at all times. After planting, it should be given water immediately and thereafter irrigated as necessary, depending upon local conditions. By this stage, water of less than 3000 ppm total dissolved solids may be used.

Newly planted date palms should be surrounded loosely with leafy material such as corn stalks, date leaves or suitable cloth for protection against sun and wind during the first summer and against cold the following winter. The plant should not be tightly wrapped or its leaves restricted.

Planting Depth:

Planting depth is very important. It is particularly essential not to cover the base of the plant within which lies the growing point. Plants should be planted up to (not above and not below) the root-shoot junction.



Watering:

It is essential that the plants are well altered by hand immediately after planting and that the soil around the newly planted plants is kept moist at all times by light, frequent watering. Inspection should be made often during the first few weeks to see that the surface soil does not dry and shrink away from the plant. Water quality is very important.

GENERAL INFORMATION:

Time of planting:

In most date growing regions, spring and autumn are the preferred times for planting out young date palms. Spring avoids the cold of winter and takes advantage of the warm weather that causes rapid growth, while autumn gives the young plant longer to establish before the heat of summer.

However, if irrigation is plentiful and frequent, if good quality water is available and if adequate protection is provided, date palms can usually safely be planted at any time of year. Periods of extreme heat or cold should be avoided.

It should be remembered that the younger the date palm at the time of planting, then the more important it is for it to be protected against extreme conditions, and given correct and careful attention.

Soil Type:

Highly saline and highly alkaline soils must be avoided. Heavy clay soils restrict root growth and generally inhibit development. Sandy soil has low water retaining capacity and allows excessive leaching of nutrients.

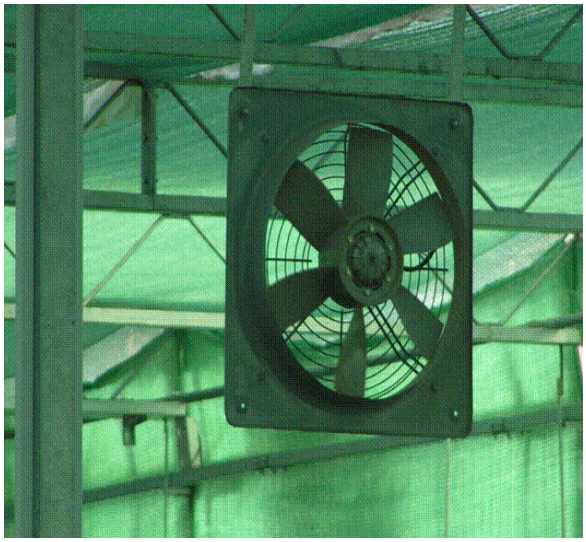
Loam and sandy loam soils have the best structure for date farming. The depth of soil should be such as to enable the roots to anchor the palm firmly to prevent it being blown over. Soil type will, to some extent, dictate the frequency of irrigation. During the first summer, daily irrigation may be required on very sandy soils, while on heavy soils, once a week may be adequate.

A soil that readily takes water to a depth of 2 – 3 metres will contribute to giving good growth and good productivity.

Appendix: Photographs

Picture 1: Date palm in 3L bags placed on stone chippings to allow for good drainage.

Picture 2: Example of poorly planted palm in an 8L pot where insufficient substrate was added and/or the palm was not planted deep enough, causing root exposure.



Picture 3: Example of a fan used for the creation of temperature/humidity uniformity throughout the facility.

Picture 4: Example of properly planted palm in a 3L bag

Picture 5: Example of torpedo pots on stone chippings

Picture 6 (left): Example of a properly planted date palm with pinnate leaves in an 8L pot.

Picture 7 (left) **:** Example of a poorly planted palm in a 3L bag with root exposure being observed.