

## TAMING OF THE DESERT IN ABU DHABI, U.A.E.†

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1. **Situation, Area, Climate and Soil.** Abu Dhabi lies roughly between 22° 30' to 24° 30' N. latitudes and 51° 30' to 56° E. longitudes alongside the southern coast of the Arabian Gulf. It has an approximate area of 80,000 square kilo metres with an overall hot and arid subtropical climate. The average annual rainfall of Abu Dhabi is hardly 40 mm with most of the precipitation falling in winter months. A considerable amount of moisture condenses on the ground and vegetation in the form of dew. The atmospheric humidity is very high especially in the coastal belt throughout the year on account of the close proximity of the Gulf. From May to October temperatures range between 35° C to over 50° C in the middle of the day and they vary between 20° C to 35° C at mid-day during winter months. The lowest minimum temperatures may go down well below 0° C in the desert areas away from the coast.

Strong winds and severe sand storms are of common occurrence throughout the year. Their intensity is especially high during summer months. The sand dunes not only move but also change their shape and form in the wake of severe wind storms.

Soils in the coastal belt ('Subkha') are heavily impregnated with salts and bear practically no vegetation. Sandy soils and sand dunes at higher elevations away from the coast are less saline.

2. **Natural Vegetation.** The flat areas ('Subkha') along the coast are completely devoid of vegetation. Mangrove vegetation consisting of *Avicennia marina* mostly is present on inundated muddy flats along the coast and coastal islands. Mangrove growth has been considerably destroyed and degraded on account of the past over exploitation.

In the comparatively elevated transition belt from 'Subkha' to sand dunes, the most commonly found species are 'Harm' (*Zygophyllum spp.*), 'Rims' (*Haloxylon salicornicum*) and 'Ghadha' (*H. persicum*).

In the interior sandy dune areas, the sparsely growing clump vegetation consists of trees such as 'Ghaf' (*Prosopis spicigera*), 'Samar' (*Acacia tortolis*), 'Salam' (*Acacia raddiana*), 'Nakhal' (*Phoenix dactylifera*), 'Sidr' (*Zizyphus spinachristi*) and bushes and grasses such as 'Arta' (*Calligonum comosum*), 'Markh' (*Leptadenia pyrotechnica*) 'Zahra' (*Tribulus terrestris*), 'Khadram' (*Cyperus longus*) 'Haad' (*Pennisetum divisum*), 'Thamam' (*Panicum turgidum*) and *Aristida spp.* etc. Whereas 'Ghadha' (*H. persicum*) is a plant indicator of highly saline sub-soil water, 'Arta' (*Calligonum comosum*) indicates sweet under ground water.

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The natural vegetation has been considerably damaged and in some places completely destroyed on account of over use and lack of proper management.

3. **Discovery of Oil and the Allocation of Substantial Funds for the Taming of the Desert.** Prior to the discovery and commercial exploitation of oil, practically little resources were available for afforestation and taming of the desert. In fact desertification of the limited and sparsely vegetated areas was taking place on account of their over use and improper management.

The first oil exploration concession in the Abu Dhabi Emirate was signed in 1939, but on account of the breaking out of the second world war in 1939, oil exploration operations could not be initiated till 1946. The commercial discovery of oil in Abu Dhabi Emirate took place only in 1960 and the first oil exports from Abu Dhabi started in 1962. In 1977, the U.A.E. produced about 3.5 percent of the world crude oil, thus occupying ninth position among more than 30 major crude oil producing countries and fourth position in the Middle East countries following Saudi Arabia, Iran and Iraq. Out of the total production of crude oil in the U.A.E. during 1977, the contribution of Abu Dhabi was 83%.

In the wake of commercial exploitation of oil, resources became available for the taming of the inhospitable and the advancing desert in Abu Dhabi. Sustained and steadily rising funds have been provided for afforestation and development of agriculture since the late sixties. In 1977, Dh. 50,000,000 which amounted to 1.7% of the total development budget of the Abu Dhabi Emirate were allocated for afforestation and agricultural development. During 1978, a sum of Dh. 119,000,000 which equals 2.4% of the total development budget of Abu Dhabi is earmarked for forestry and agricultural development. The amount to be spent on afforestation during 1978 is estimated to be Dh. 76,866,000 which is about 64% of the total allocation for the agricultural sector.

4. **Development of Afforestation Technique.** A desert afforestation technique has been worked out in the course of time under special environmental conditions prevailing in Abu Dhabi. Because of the extremely harsh climatic and edaphic factors all plantations are raised by transplanting sturdy and well grown nursery plants ranging from six months to over one year old. The species most commonly planted are 'Ghaf' (*P. spicigera*), 'Samar' (*Acacia tortolis*), 'Sidr' (*Z. sprinachristi*) and 'Qarat' (*A. arabica*).

All desert afforestation is carried out with artificial irrigation with sub soil water which is obtained by pumping either from open shallow wells or from deep tube wells. All irrigation is done with drip or trickle irrigation system. The drip lines are 7 metres apart and the plant to plant distance is also 7 me ers. Thus about 200 plants per hectare are raised. In the first year of planting the plants are provided about 5 gallons of water per plant per day which subsequently is increased to 10 gallons of water per plant per day. The date palm (*Phoenix dactylifera*) requires two to three times the water given to the above mentioned four arid zone species.

The salinity of the subsoil water varies considerably. The surface shallow water and the under ground water farther from the sea has generally less salts than the sub soil water nearer to the sea and from deeper underground depths. The salinity of under ground water

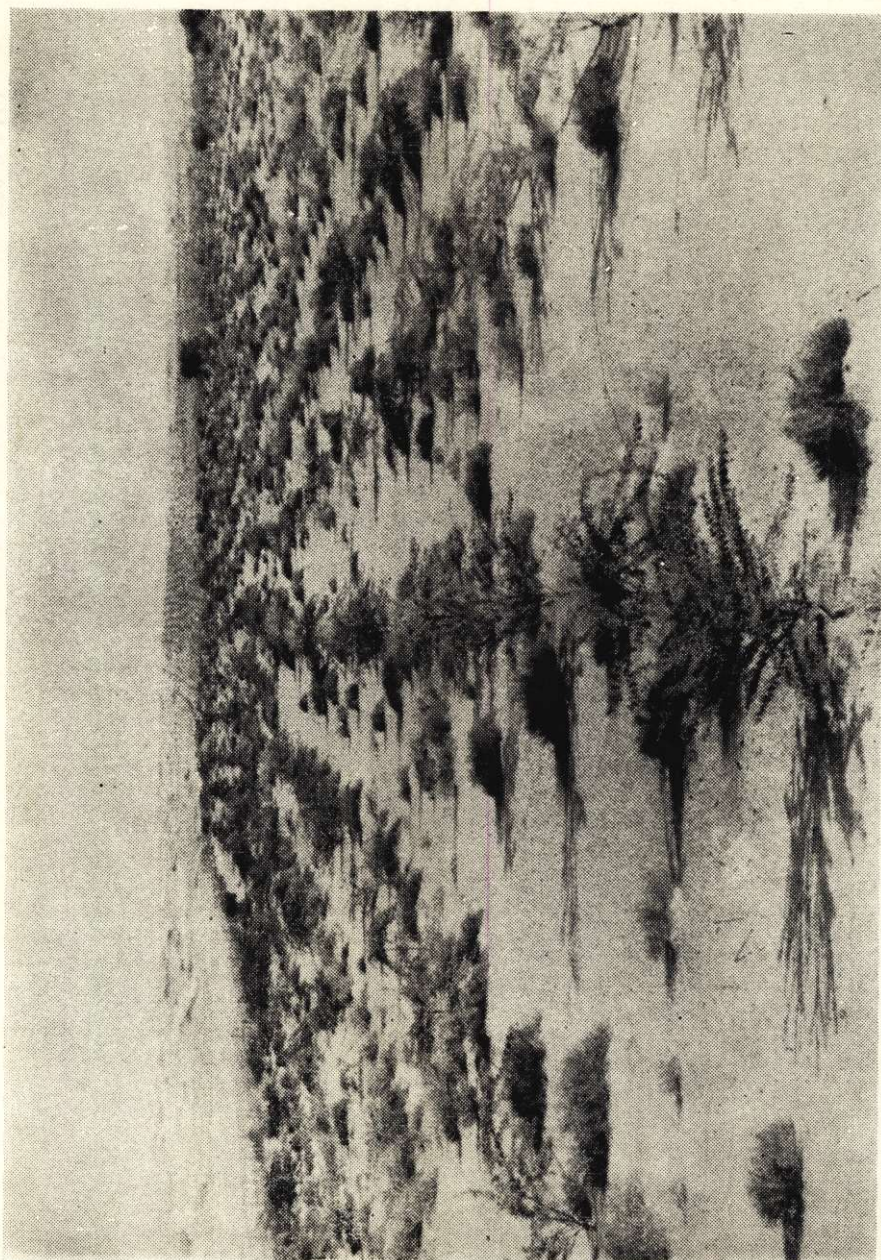


Fig. 1.—Three years old Al Babha Plantation, 120 hectares (T.D.S. in sub soil irrigation water 7000 P.P.M)

(Photo: Author)

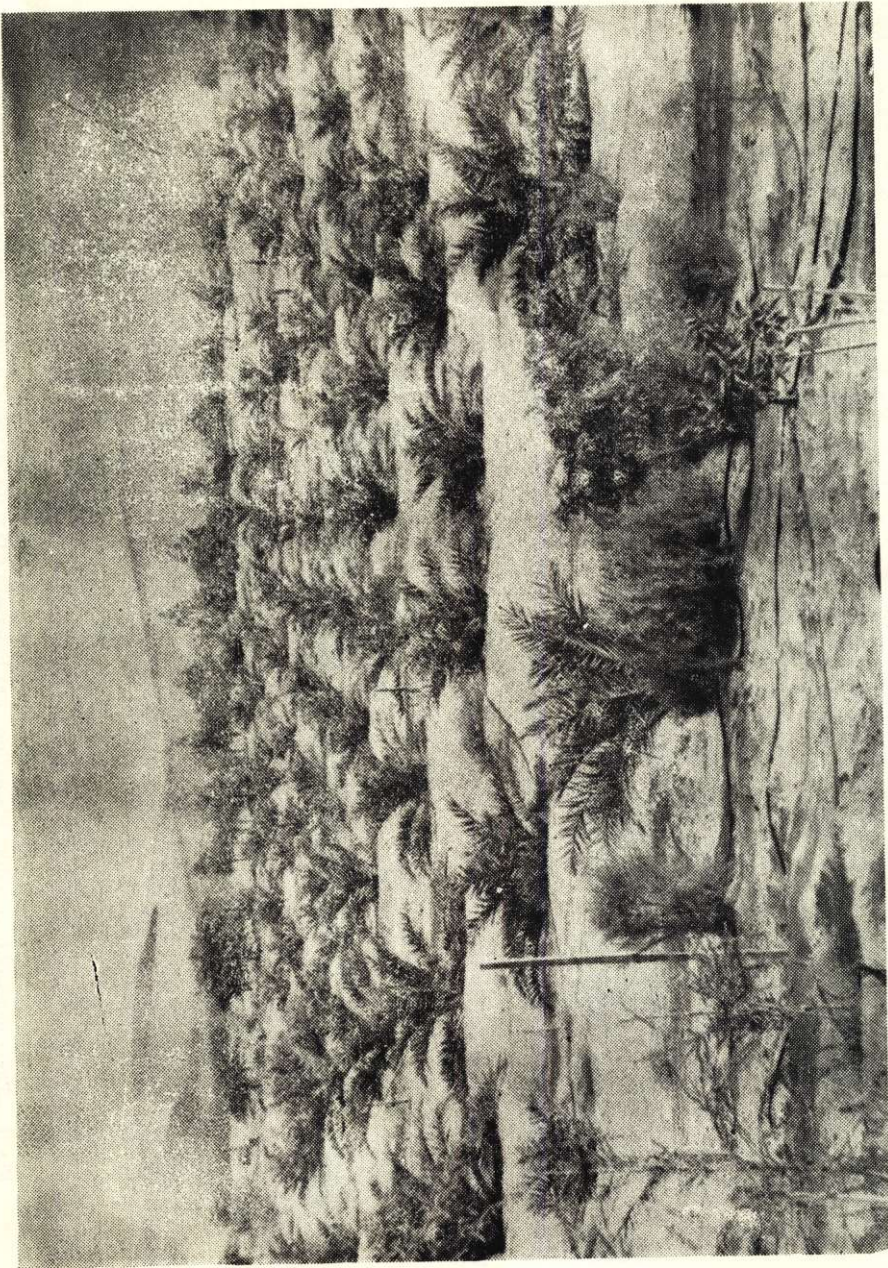


Fig. 2.—Two years old dates in Medina Zayed Plantation (T.D.S. in sub-soil irrigation water 5000 P.P.M.)  
(Photo : Author)

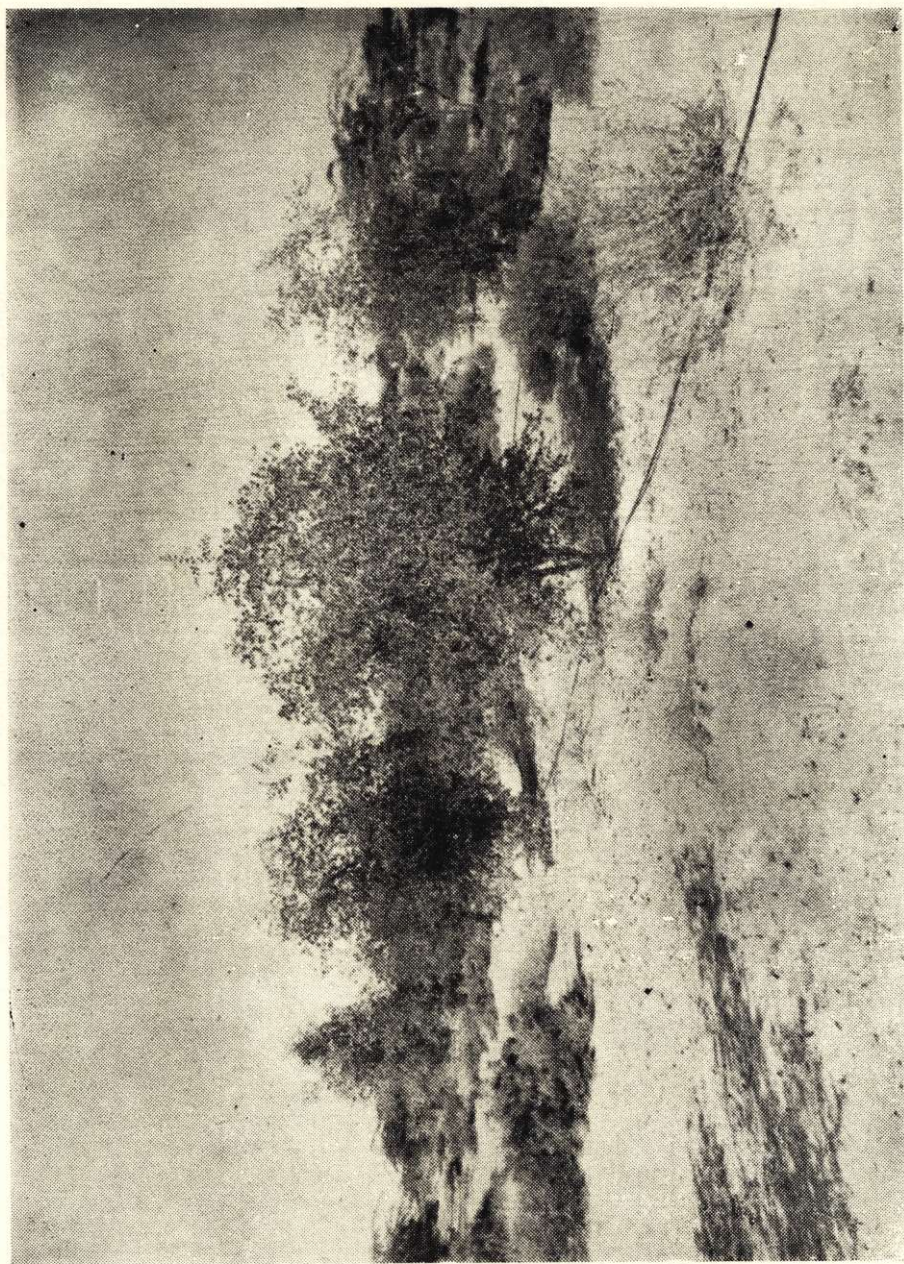


Fig.—3. "Sidr" (*Zizyphus spinachristii*), three years old plants, in Al Babha plantation.

(Photo: Author)



Fig. 4.—Two years old Eucalyptus shelter belt in Al Babha plantation.

(Photo: Author)

being used for afforestation purposes in the Western region of Abu Dhabi may vary from 4000 p.p.m., to over 13000 p.p.m. With higher salinity only high salt tolerant species like 'Ghuaif' (*Prosopis juliflora*) and 'Tamarix' (*Tamarix aphylla*) can be successfully raised. 'Sidr' (*Z. spinachristi*) is rather sensitive to high salinity.

High velocity winds and moving sands also do a considerable amount of damage to young plants. For the first year or so the young plants need to be protected by providing them suitable tree guards. A variety of tree guards is being used in Abu Dhabi. On the removal of tree guards, wooden stakes are generally provided to tree saplings for the first 2-3 years of their growth till their stems are firm enough to withstand the bending and tearing effect of severe wind storms. Wind breaks or shelter belts are also being raised along the outer boundaries of plantations. The outer three rows are grown with species like *Eucalyptus* spp., *Casurina* spp., 'Sidr' (*Z. spinachristi*), 'Ghaf' (*P. spicigera*) and 'Qarat' (*A. arabica*), 3½ metres apart from row to row as well as from plant to plant. They are proving fairly effective.

Desert soils are devoid of organic matter and mineral nutrients so that at the time of initial planting each planting pit is provided about 5 kilos of compost or animal manure which is well mixed with the soil. Subsequently when the plants are well established they are also fertilized with urea through the irrigation water to enable them to put on vigorous and healthy growth. Suitable pesticides have also to be used against any insect and fungal pests and diseases.

Tending operations in the form of scrapping of salt incrustations from around the base of the plants, hoeing and pruning are also done as and when required. Interplanting with fodder species such as *Atriplex* spp. 'Arta' (*C. comosum*) and 'Markh' (*L. pyrotechnica*) is also done when the trees species are well established.

5. **A brief Account of Afforestation work done in Abu Dhabi.** The first afforestation contract in Abu Dhabi was executed in 1969 by Messrs Sogreah, a French Consulting Company. They raised road side plantations along Al Ain—Abu Dhabi road in the Eastern Province of Abu Dhabi, using exotic plant species, such as Eucalypts, Acacias, *Casurinas* and Mesquite. These plantations of exotic species raised with trickle irrigation system using underground waters are well established and doing well. Subsequently, new afforestation contracts were awarded to a number of foreign afforestation companies with the condition that 90% of their plantations should be raised with indigenous species such as 'Ghaf' (*Prosopis spicigera*), 'Samar' (*Acacia tortolis*), 'Sidr' (*Zizyphus spinachristi*), 'Salam' (*Acacia raddiana*), and 'Qarat' (*Acacia arabica*).

The personal keen interest of H.H. Sheikh Zayed bin Sultan Al Nahayan ruler of Abu Dhabi and President of the U.A.E. has been largely responsible for the sustained and ambitious afforestation programme of Abu Dhabi started in the late sixties, subsequent to his accession as ruler of Abu Dhabi in 1966. In the first instance afforestation projects were confined to the Eastern Region of Abu Dhabi where both climatic and soil conditions are more favourable both for natural vegetation and afforestation. Work on a large number of afforestation projects in the Western Region of Abu Dhabi was later taken up beginning

in 1975. Besides a dozen of direct afforestation projects being executed by the Forest Department, about twenty afforestation companies are now working in the Western Region. There are about 1000 hectares under the direct projects and of this about 400 hectares are planted bearing 82089 plants. The afforestation companies have contracted to afforest 5780 hectares in the Western Region and of this 2340 hectares have been planted so far and bear 468,000 plants.

The introduction of fodder species in between the tree species has also been taken up since 1977. Indigenous species such 'Arta' (*C. comosum*) and 'Markh' (*L. pyrotechnica*) and exotic species such as *Atriplex spp.* have been planted in between tree lines with considerable success. Other local browse species such as 'Rims' (*Haloxylon salicornicum*), 'Harm' (*Zygophyllum spp.*), 'Khadram' (*Cyperus longus*) and grasses have also shown considerable natural recovery within the fenced plantations. In some of the well vegetated plantation wild life such as gazelle deer for which Abu Dhabi was well known in the past has also been successfully introduced. As a consequence of these man made plantations there is visible increase in the natural wild bird and wild animal populations. The wild hare is especially on the increase in these plantations.

These plantations are being raised in the vicinity of new villages and towns where nomadic bedouin population is being settled. Besides providing a house the settled bedouins are also being given a date garden of about 2 hectares. These date gardens have a shelter belt of tree species on their periphery and two rows of date palms. The middle half of the date garden is left blank to be cultivated by the settled bedouins for raising fodder for their cattle and grain and vegetables for their own use.

Tree seedlings raised in the nurseries of the Forest Department are also being distributed free of cost to the farmers for planting on their farms and cultivated lands. The demand for the tree seedlings and their distribution amongst the farmers is gradually rising.

**6. Prospects of and Suggestions for Future Work.** The greening of the desert in Abu Dhabi is a great challenge to the professional forester. He is required to use his scientific knowledge and modern technology under the harsh climatic and adverse edaphic and soil conditions obtained in Abu Dhabi. The work done in Abu Dhabi in the past in conquering the desert has met with considerable success. The technology developed so far can be further refined and developed to meet greater challenges in the future.

Abu Dhabi by now has experience almost of a decade, in the taming of the desert. It would be very desirable at this juncture to review and take stock of the entire afforestation work done here in the past. A desert afforestation seminar could be organized in Abu Dhabi in collaboration with the FAO/UNESCO on international basis. The conclusions and recommendations of this seminar would be very useful in planning and executing future desert afforestation projects in Abu Dhabi and under similar environmental conditions in other parts of the world.

However, while looking back, some suggestions and scientific studies which may be carried out forthwith in Abu Dhabi are listed and briefly discussed below:—

- (i) *Detailed ground water survey:*—A detailed ground water survey of the U.A.E. including Abu Dhabi Emirate should be got done. It will be very useful and

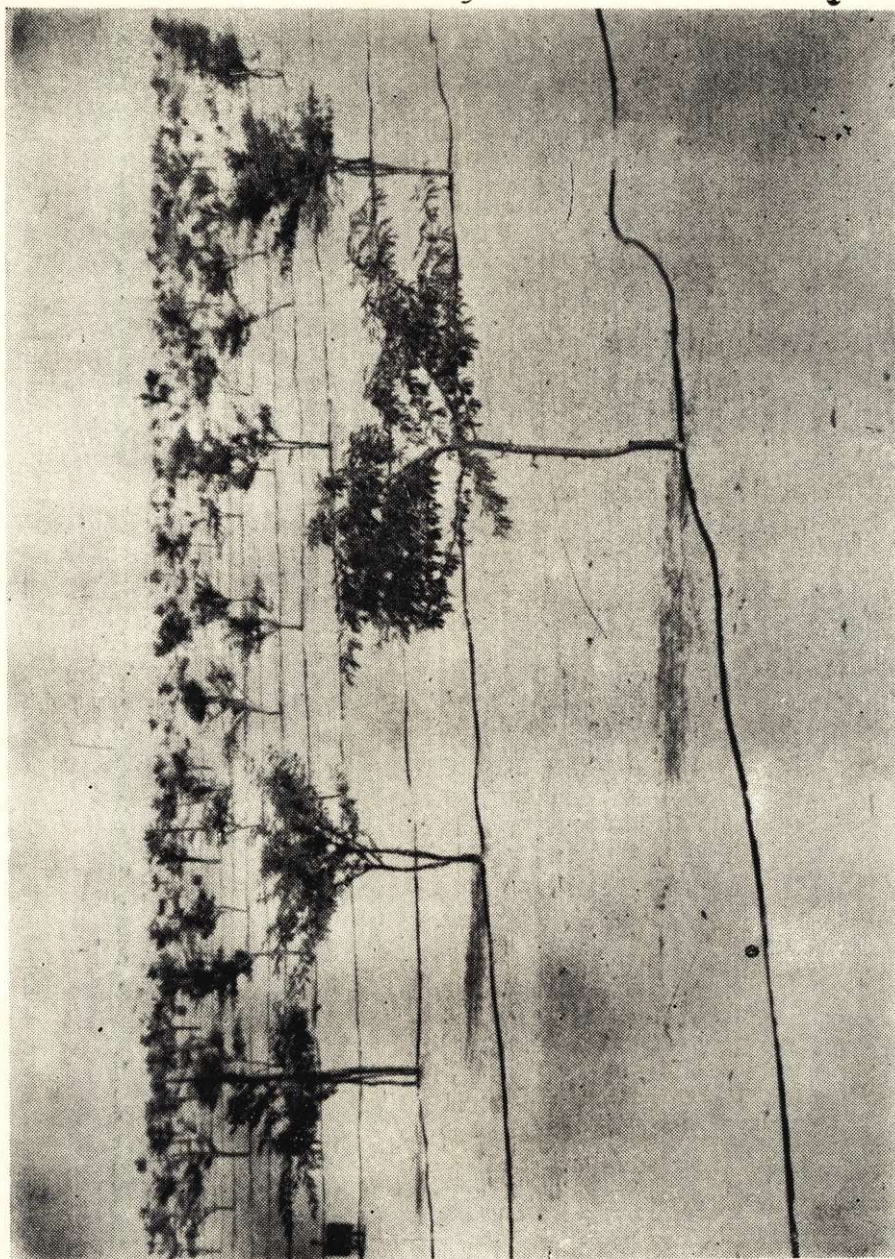


Fig. 5. Two years old Ghates plantation, (T.D.S. in sub-soil irrigation water 9000 P.P.M.).

(Photo: Author)

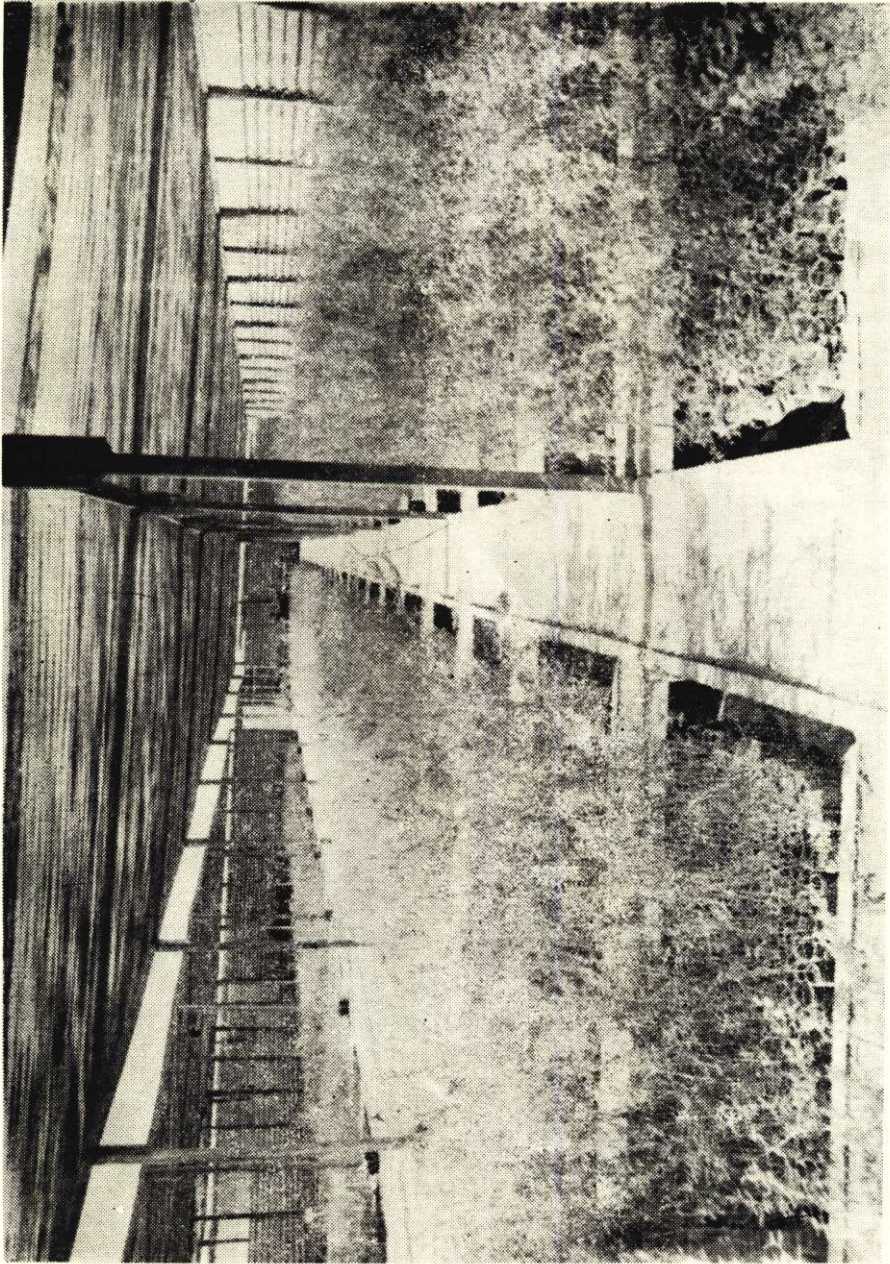


Fig. 6. Inside view of Al Bujair nursery, Western Region, Abu Dhabi. (T.D.S. in sub-soil irrigation water 1200 P.P.M.)

(Photo: Author)



Fig. 7. A date plantation interplanted with *Atriplex* species.

(Photo: Author)

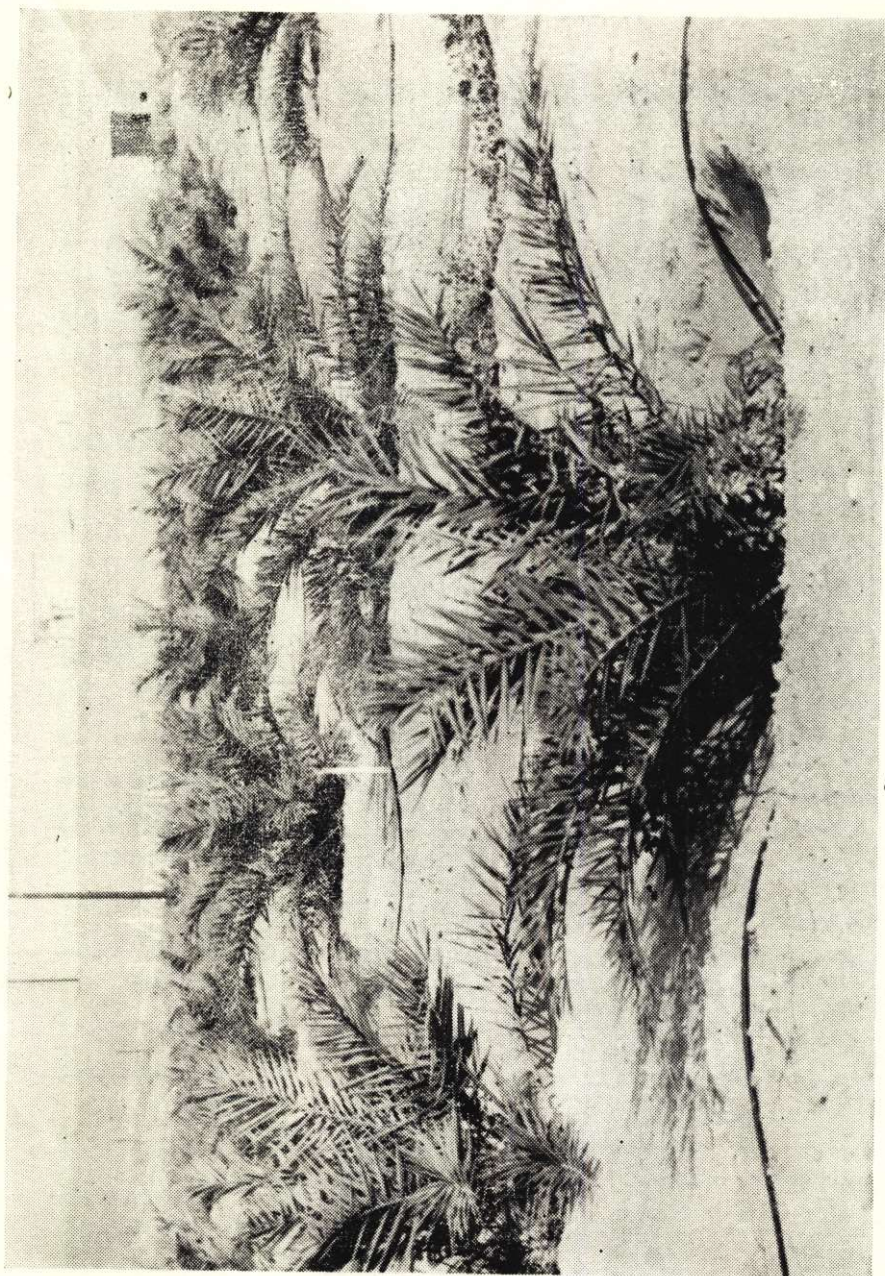


Fig. 8. A date garden in Medina Zayed, (T.D.S. in sub soil irrigation water 5000 P.P.M.).

(Photo: Author)

even necessary for the drawing up of any future plans of afforestation and agricultural development. The earliest it is done the better.

- (ii) *Collection of agro-meteorological data:*—An agro-meteorological station exists in Al Ain and another one was set up in Madina Zayed this year. A few more such stations are strongly indicated to determine and deal with the micro-climatic conditions obtaining in various parts of the Emirates.
- (iii) *Determination of optimum water requirements of various tree crops:*—This study is necessary to determine the precise water requirements of various tree species and for preparing proper afforestation projects according to the availability of water.
- (iv) *Studies on windbreaks and shelter-belts:*—It will be worth-while to develop suitable windbreaks and shelterbelts to protect habitations, farming lands and forest plantations. The plant species to be used and the pattern in which they may be planted need to be worked out.
- (v) *Selection of suitable ecotypes of both indigenous and exotic species:*—The ecotypes of various indigenous and exotic species which will do well in the Emirates should be isolated and used for the further propagation of these species. This will avoid the indiscriminate use of various seed provenances.
- (vi) *Proper management of natural vegetation:*—Patches of natural vegetation still exist in favourable or protected localities. These need to be conserved and scientifically managed. Some of these patches both in the desert and in the coastal mangrove vegetation may be fenced or otherwise protected from any outside interference.

Most of the studies and investigations proposed above could be carried out by setting up a Forest Research Institute for the Abu Dhabi Emirate and the U.A.E. This institute could perhaps be established under the Faculty of Agriculture, Al Ain University. The results of these and similar other studies which may be taken up later on in the Emirates will go a long way in assisting the taming or the greening of the desert.