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**Title:** Cultivation and utilization of Date Palm (*Phoenix sylvestris* Roxb) in Jessore District: A case study

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**CULTIVATION AND UTILIZATION OF DATE PALM (*Phoenix sylvestris* Roxb.) IN JESSORE DISTRICT: A CASE STUDY**



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SCHOOL OF LIFE SCIENCE  
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KHULNA**

**2016**

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**Imunnahar Khanam**

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**CULTIVATION AND UTILIZATION OF DATE PALM(*Phoenix sylvestris* Roxb) IN JESSORE DISTRICT: A CASE STUDY**

**Title of the course : Thesis Work**

**Course No:FWT-4114**

*( This paper has been prepared and submitted for the partial fulfillment of the requirement for four years B.sc (Hons. ) in Forestry from Forestry and Wood Technology Discipline,Khulna University,Khulna)*

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*Dedicated*

*To*

*My beloved parents who*

*Always inspired me*

## DECLARATION

I, Imunnahar Khanam, declare that this thesis is a result of my own works and that has not been submitted or accepted for a degree in any other university or institution.

I, thereby, give consent for my thesis, if accepted, to be available for photocopying and for tittle and summary to be made available to outside organization.

Candidate.....*Imunnahar Khanam*.....

Date.....*11.09.16*.....

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**Imunnahar Khanam**

## ABSTRACT

The main purpose of the study was to know the the farming pattern, the number of date palm cultivation in relation with respondents and the utilization of date palm in Jessore district. A systematic sampling methods and semi- structured questionnaire were used for the study. The chi square test was used to ascertain the significant test of the factors influencing date palm cultivation (farmer categories, site of date palm cultivation, mate production etc.) in the study area. The chi square test for influencing factors in date palm cultivation (religion, earning member of the family, income source and mat production) were significant ( $p>0.05$ ) and the other influencing factors for date palm cultivation (respondent age, education level, farmer categories, site of date palm cultivation and land size) were not significant ( $p<0.001$ ). The highest number of respondents (33 individual) including the age group of date palm > 14-21 years were found in homestead sites. The lowest number of respondents (5 individual) including the age group of date palm >28 years were found in agricultural field. In the study area, 40% household possess <10 trees, 22% household possess <20 trees and only 2% household possess 90-100 trees. Among the study areas, the number of date palm were Jikargacha(33.73%), Jessore sada (28.16%) and Abhynagar (38.05%). In the study area, 90% respondents used date palm for fruit, 100% respondents used it as fuel wood for making molasses and 76% respondents for seasonal juice.



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# CHAPTER ONE: INTRODUCTION

## 1.1 Background

Palm is one of the important horticultural crops in many countries (James,1980,2001). The palm family (Palmae, or more recently Arecaceae), with some 2200 species, is distributed throughout the tropics and subtropics (Johnson 1996) representing an integral and important part of tropical forests (Johnson, 1995).

Date palm belongs to the palmae family. Various types of local name of this species are familiar. These are in Bengali, Khaju, Kajur. English: wild date palm, date sugar palm, date palm. In Gujaarat: Kharak, kharki, Hindi: Kajur, sendi (Krishnamurthy,1993).

Date palm has 200 genera and 1500 species (Dowson,1982). Pheonix is one of the genera which contain a dozen of species, all native to the tropical and subtropical regions of Africa or southern Asia (Munier,1973).Date palm produced as a homestead crop . It grows naturally and it is found in fallow land, around homestead, Pond bank, farmland boundary and marginal land along the roads and canals ( Anonymous,2000).

In Bangladesh, India and Pakistan, they are tapped for the sweet sap which is converted into palm sugar, molasses or alcohol beverages. Date palm is an important component of agroforestry system in our country. Date palm is an evergreen plant so it plays a vital role in environmental and ecological balance. It helps to mitigate natural disaster. It also acts as a barrier against natural calamities. It also withstand both waterlogged and drought condition. Date palm is also an important source of fuel for homestead. Recently, it is widely used in brick- burning industries (Dowson,1982).

Date palm is a graceful tall palm with large crown. If it is not injured when extracting toddy, 9-15m high. Stems occasionally branched. The bark is always angled, gray, brown and thick. Leaves are 3-4 or 5 m long with grayish green, quite glabrous (Kiritikar and Basu,1987).

The fruit is cooling, oleaginous, cardio tonic, fattening, vomiting and loss of consciousness. The juice obtained from the tree is considered to be a cooling beverage. The roots are used to stop toothache. The fruit pounded and mixed with almonds, quince seeds and sugar (Kiritikar and Basu,1935).

Date is a highly nutritious fruit. Date fruits provide abundant quantities of sugar, iron, Potassium and nicotinic acid. Small amounts of protein, copper, magnesium, sulphur, vitamin A, B, are also present in date pulp (Nixon and Carpenter, 1978).

Date palm is an important plant species that constitute the traditional agroforestry system in the greater Jessore region (Abedin *et.al*, 1997). *Phoenix sylvestris* along with all other domesticated palms provides a wide array of commercial products for human kind (Johnson, 1995) and is often the main subsistence resource for the poorest people (Dalibard, 2007).

The palm family (Palmae, or more recently Arecaceae), with some 2200 species, is distributed throughout the tropics and subtropics (Johnson 1996) representing an integral and important part of tropical forests (Johnson, 1995).

It also acts as insurance to the farmers during the time of their economic hardship. Jessore is one of the districts where date palm cultivation is practiced in a large scale by the communities for a long time but now-a-days the date palm cultivation in that area has drastically been reduced (Kamaluddin, 1996). The study was undertaken to explore the indigenous wisdom of farmers farming practices and highlighting the traditional utilization pattern of date palm in Jessore district.

## **1.2 Justification**

The date palm are mainly found Jessore districts. But the farmers of our study area have not known the proper harvesting and cultivation pattern. They plant date palm traditionally in their available land. But they are not conscious about this. If the farmers could be aware on ins and out of the cultivating system and proper management, date palm will give much positive on our environment and ecology. Overall they improve socio economic condition of study area. If the farmers are not conscious about this. The date palm will be decreasing day by day. In the long run, date palm will be extincted.

## **1.3 Objective of the study**

- To know the influencing factors of date palm in the study area.
- To determine the number of date palm cultivation in relation with respondents.
- To practically observe about the date palm used by the people of the study area.

## CHAPTER TWO: TAXONOMY

### 2.1 Classification

Phylum: plant kingdom

Class: Dicotyledons

Order: Spathiflorae

Family: Palme

Genus: Phoenix

Species: Sylvestris

### 2.2 General description of the family

**Plants:** Palm trees are a botanical family of perennial lianas, shrubs, and trees. They are the only members of the family Arecaceae. They grow in hot climates. Palms are evergreen, mostly tropical plant in the family Palmae (also known as Arecaceae). There are over 2500 species of palms. Most Palm are tree-like, with single trunks and either fan shaped (palmate) or feather shaped (pinnate) compound leaves. The larger palm tree makes a dramatic statements in USDA Zone 8-10 landscapes, and a smaller palms are grown in containers everywhere.

**Stem:** The stem of palm tree is in very many palms relatively tall, erect, unbranched, regularly cylindrical, or dilated below so as to form an elongated cone, either smooth, or covered with the projecting remnants of the former Palms leaves, or marked with circular scars indicating the position of those leaves which have now fallen away. The underground stem of some species, e.g. of Calamus, is a rhizome, or root-stock, lengthening in a more or less horizontal manner by the development of the terminal bud, and sending up lateral branches like suckers from the root-stock, which form dense thickets of cane-like stems. The branching of the Palm Tree stem above ground is unusual, except in the case of the Doum palm of Egypt (Hyphaene), where the stem forks, often repeatedly; this is due to the development of a branch to an equal strength with the main stem. In other cases branching, when present, is probably the result of some injury to the terminal bud at the top of the stem, in consequence of which buds sprout out from below the apex.



**Leaves:** The leaves of the Palms are either arranged at more or less distant intervals along the stem, as in the canes, or are approximated in tufts at the end of the stem, thus forming those noble crowns of foliage which are so closely associated with the general idea of a palm. In the young condition, while still unfolded, these Palm leaves, with the succulent end of the stem from which they arise, form "the cabbage," which in some Palm species is highly esteemed as an article of food. The adult Palms leaf generally presents a sheathing base tapering upwards into the stalk or petiole, and this again bearing the lamina or blade. The sheath and the petiole very often bear stout spines. The leaves are unbranched, cylindrical having short internodes covered with leaf-scars and ending at the top in crown of a few large foliage leaves closely packed together, sometimes scrambling, occasionally acaulescent, the erect types may be sometimes branched.

**Inflorescence:** Usually lateral, simple or compound spadix or a richly branched panicle, often very large, bearing numerous small flowers enclosed either in one woody, boat-shaped spathe or several spathes, in the latter case, one for each. The inflorescence of the palm tree consists generally of a fleshy spike, either simple or much branched, studded with numerous, sometimes extremely numerous, flowers, and enveloped by one or more sheathing bracts called "spathes."

**Flower:** The flowers are sessile, generally unisexual, monoecious or dioecious, regular, arranged in a close spiral upon the axis of the inflorescence. The date palms are dioecious which means that there are both male and female date palms. After reaching maturity, the male date palm yields flowers that produce the pollen and the female date palm yields flowers which will become dates, if they are pollinated. The male flowers are borne single and are waxy white, while the female flowers are borne in clusters of three and are yellowish green in colour. The flowers are sessile, generally unisexual, monoecious or dioecious, regular, arranged in a close spiral upon the axis of the inflorescence.

**Fruit:** The date is one-seeded fruit or berry or fibrous drupe, usually oblong but varying much in shape, size, colour, quality, and consistency of flesh, according to the conditions of culture. The dried fruit is more than 50 percent sugar by weight and contains about 2 percent each of protein, fat, and mineral matter.

**Seeds:** The Palm tree seeds show a corresponding variety in size and shape, but always consist of a mass of Palm endosperm, in which is embedded a relatively very minute embryo.

The hard stone of the date palm is the endosperm, the white oily flesh of the coco-nut is the same substance in a softer condition; the so-called "vegetable ivory" is derived from the endosperm of *Phytelephas*. In some Palms genera the inner seed coat becomes thickened along the course of the vascular bundles and growing into the endosperm produces the characteristic appearance in section known as ruminant.

### **2.3. Economic importance of the family**

#### **Ornamental value**

The date palm is used as an ornamental specimen plant in subtropical and tropical climates such as those in southern California and Florida. These trees can commonly be seen along roadsides, parking lots and shopping centers because of their ease of care and noninvasive nature.

Ornamental plants of this family include Fish – tail palm (*Caryota urens* L.) commonly planted in gardens. Royal palm is one of the finest specimens of the family and can be seen planted on both sides of the Oreodoxa Avenue in the Indian Botanic garden.

#### **Timber value**

The wood of this plant is used for making water-pipes; In addition to this product, it also produces various other substances which are utilized in the production of ropes, mats, brushes etc. It also yields strongest timber in making the posts, pillars etc.

#### **Medicinal value**

The fruit is sweet, cooling, oleaginous, cardio tonic, fattening constipating, aphrodisiac; good in heart complaints, abdominal, complaints, fevers, vomiting, wandering of mind, loss of consciousness. The juice obtained from the tree is considered a cooling beverage. The central tender part is used in gonorrhoea and gleet. The root is used in toothache. The seeds is effective in treating ague. Toothaches have been relieved by date palm roots. Gum extracted from the trunk of this tree has effectively been used to treat diarrhea and urinary ailments (Kiritikar and Basu, 1987).

## **Alcohol and vinegar**

The sugary sap derived by tapping the young inflorescence is used for alcoholic drink and toddy yields vinegar. *Phoenix sylvestris* is a common sugar- yielding plant. The common fan-palm produces molasses and sugar from its juice secreted by taping the stem (Iamois,1971).

## **Vegetables**

*Phytelephas*, the common vegetable ivory, is largely used by American people; the hard endosperm of the seed is generally edible (Iamois,1971)..

## **Nutritive value**

Nutrient application is important for satisfactory production in date palm which is largely related to annual nutrient removal by the plantation. Jacob and Coyle (1931) estimated that removal of nutrients by mature date palm to be 12 kg N, 8 kg P,20 kg K per acre.

Date is a highly nutritious fruit. Date was the only staple food available to the desert people. The per capital consumption of dates in Saudi Arabia, Iraq, Libya and Egypt is respectively 28.9, 17.3, 28 and 10.8 kg per year ( Coyle,1931).

## **Waving Baskets**

Women use the leaves produced by the date palm tree to create hand –woven baskets. First, the leaves from the date palm are dyed to the desired color. Then the women wrap the leaves around tight bundles or coils of reed fibers until the desired pattern and shape has been achieved.

## **Seed uses**

The seed produced by the date palm have been used as food for horses, cattle, camels, sheep and goat. The oils contained within the seeds make them a useful ingredient in cosmetics and soaps. The seeds can also be burned to make charcoal. The chemical composition of the seeds allows them to be used to create oxalic acid (Benjamin,1973).

## CHAPTER THREE: GENERAL DESCRIPTION OF DATE PALM

### 3.1 Historical back ground of date palm

Date palm has long been one of the most important fruit crops in the arid regions of the Arabian peninsula, North Africa, and the Middle East. During the past three centuries, dates were also introduced to new production area in Australia, India, Pakistan, Mexico and the United states. Dates are the main income source and staple food for local populations in many countries in which they are cultivated and have played significant roles in the economy, society, and environment of those countries (Danthine, 1937).

Date palm is one of the oldest fruits known to mankind. The origin of the date palm is not known with certainty but it is believed to have originated some where around the Persian gulf and become naturalized in Arabia, north Africa and northern India in ancient times. The cultivation of the date palm dates back from antiquity and it was probably first raised in or near the fertile Crescent' of southwestern Asia as early 5000 B.C. a clay tablet made in Babylon 5000 years ago a picture of a date palm was found. The species was introduced and better to North Africa and Spain. Incidentally Malaga is the only place in Europe where date palms fruit successfully. From Spain it was introduced, two or three centuries ago, to Mexico. The plant was introduced into California by the Spanish in 1765, but commercial date growing in America began after 1890 from select varieties imported from Egypt and Persian Gulf. The world production of dates exceeds two million tones in 1974, about 98 percent of which comes from the Africa and Asia. The remaining two percent come from America, Spain and Morocco (Kochhar, 1981).

### 3.2 Description of the species

*Phoenix sylvestris* is a very graceful palm, when not injured by extracting toddy, 9-15m high. Trunk rough from the persistent bases of the leafstalks. Crown hemispherical, very large and thick, leaves 3-4.5m long, grayish green, quite glabrous, pinnate, petioles compressed only towards the apex, at the base bearing a few channeled triangular short spine 4 to 10 cm. Pinnule is very numerous, long, glaucous, rigid, ensiform, conduplicate at the base. Male flowers white, scented, spadix 60-90 cm . long, erect, peduncle highly compressed. Spathes of about the same length, almost woody, scurfy, separating into two boat shaped valves. Flowers 6-8 mm long, very numerous angula oblique. Calyx cap- shaped, with 3 short rounded teeth. Female flowers spadix and spathe much the same as is the male. Spikes

arranged in distinct groups, 30-34 cm. long. Fruiting spadix 90 cm. long, nodding at the apex from the weight of the fruit, much compressed of a golden orange colour. Pericarp fleshy, yellow, moderate and very astringent. Seed 17 mm. long, rounded at the ends, almost woody, scurfy, separating into two boat-shaped valve spikes very numerous towards the apex of the peduncle, especial on one side, with a slight incomplete furrow on the other side, in the centre of which is a depression with a mammillate fundus, indicating the position of the embryo (Kiritikar and Basu, 1987).

### **3.3 Distribution of date palm in Bangladesh**

Date palm is found in the Canary Island, Northern Africa, Pakistan, India and Bangladesh. The rural farmers of southern Bangladesh depend upon *Phoenix sylvestris* husbandry for their seasonal livelihoods. Jessore is one of the districts where date palm cultivation is practiced in a large scale by the communities for a long time. The most common types of palm trees available in Bangladesh are date palm, palmyra palm and coconut. It is grown in Jessore, Faridpur, Kustia, Chuadanga, Khulna and Rajshahi districts of Bangladesh. In our country, wild date palm is grown and it is very popular (Hossain, 2003).

### **3.4 Geographical distribution in the world**

The major date producing countries are Iraq and Iran, Egypt, Saudi Arabia, Algeria, Pakistan, Sudan and Morocco. There are no commercial plantations of good date palm in India. A number of trees yielding inferior quality fruits are cultivated mostly in the dry regions of Gujarat, Rajasthan, Punjab, Uttar Pradesh and Andhra Pradesh (Kochhar, 1981).

#### **3.4.1 Distribution according to altitude**

Altitude is very important since it imposes the availability of water and the temperature limits which largely determine the distribution of date palm in the world. In fact, date palm grows and flourishes from 392 m below sea level to 1500m above with an altitude range of 1892m (Blatter, 1926).

**Table 1: Date palm distribution in the world with regard to altitude**

Country/Region	Area/District	Altitude
Pakistan	Rawalpindi	527 m
	Makran	600 m
	Rukshan	900 m
Iran	Kazarum	808 m
	Shiraz	1,530 m
	Fasa	1,200 m
	Darab	1,189 m
	Baluchistan	1,069 m
	Hajabad	933 m
	Aliabad	1,380 m
	Qasr-i-shirin	< 500 m
	Bam and Jahrus	1,067 m
Iraq	Most commercial plantations	< 400 m
	(Fao)	< 500 m
	Kirkuk	
Eritrea	South Denkala and Diredawa	1,000 to 1,500 m
Saudi Arabia	Hijaz	1,630 m
	Hasa	< 500 m
	Teima (Medina)	1,300 m
Oman	Oman	500 - 1,000 m
	Wadi Hadhramout	625 m
	Hadhramout valley	700 - 800 m

Source: UN Agroforestry Statistics, 1998

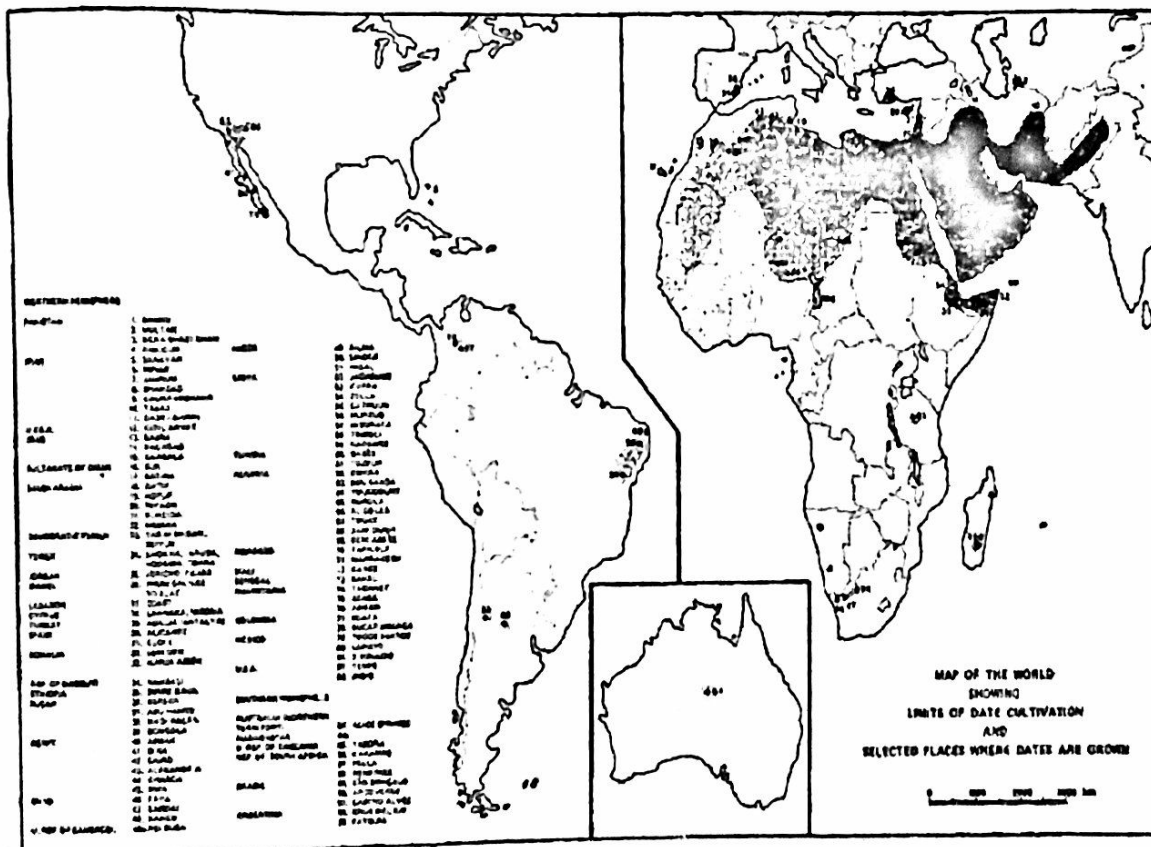
### 3.4.2 Distribution according to latitude

The distribution according to latitude for both northern and southern hemispheres is illustrated in Tables 2 and 3. In Asia, 32° north, in the Indus Valley, is the northern limit of date palm cultivation. It follows the southern edge of the Perso-Afghan mountain mass, till it reaches the 35° north in Iraq and turns south west to the Mediterranean sea at the Gulf of

Gaza. Date palm then follows the Mediterranean coast as far as Tunisia and skirts the southern edge of Morocco to the Atlantic Ocean.

The 17° north parallel is the southern limit of the date palm in the Sahara. From the 15° north in Sudan, it follows the coast of the Red Sea and the Gulf of Aden, till it drops to 10° north to cover the northern part of Somalia. This southern line continues till it reaches the coasts of Arabia and Pakistan till the limit of Indus.

At about 33° north in the American continent, date palm plantations were newly introduced in Southern California. Seven degrees (7°) further south, less important and older introductions are found in the lower California Peninsula of Mexico (Blatter, 1926).



Source: [www.fao.org/docrep/006/y4360e/y43600.HTM](http://www.fao.org/docrep/006/y4360e/y43600.HTM)

Fig. 1: Geographical distribution of date palm in the world

**Table 2: Latitude limits of date palm cultivation in the Northern Hemisphere of the Old World**

Limits	Country	Region/District	Parallel
Northern	Pakistan	N.W.F. Province - Bannu	33° N
		Makran - Siahan Mountain Range	27° N
	Egypt	Cairo	30°02' N
	Tunisia	Gabes	33°57' N
	Morocco	Erfoud	31°26' N
	USA	Indio/Ca	33°43' N
	Mauritania	Atar	20°38' N
Nema		16°50' N	
Southern	India	Turbat	25°59' N
		Gujarat	23° N
	Pakistan	Sind-Kotri	25°22' N
	Arabian Peninsula	Muscat	23°37' N
		West of Aden	12°36' N
	Djibouti	Hambali/Djibouti City	11°30' N
	Ethiopia	Dirre Dawa	10°15' N
	Sudan	Kamlin/Nile	15°02' N
	Cameroon	Rei Buba/Garua	8°40' N
	Chad	Lettire	13°40' N
	Niger	Guidimouni/Zinder	13°45' N
		Bilma	18°50' N
	Burkina Faso	Dori	14°10' N
	Mali	Kolokani	13°20' N
		Kidal	18°27' N
Kayes		14°26' N	

Source: UN Agroforestry Statistics, 1998



**Table3: Latitude limits of date palm cultivation in the southern hemisphere**

Country	Region/District	Parallel
Tanzania	Tabora	5° S
R.S.A.	Henkries Fontein	29° S
	Kakamas	27° S
	Klein Pella	27° S
Australia	Coward Springs	29°29' S
	Lake Hairy	29°25' S
	Petra Bore	33°51' S
	Gasgoyne	25°03' S
	Hergott Springs (Now Marree)	29°39' S
	Oodanadatta	27°33' S
Namibia	Naute/Keetmanshoop	26°57' S
	Hardap/Mariental	24°33' S
	Aussenkehr/Karasburg	28°24' S
	Eersbegin/Kunene	20°09' S

Source: UN Agroforestry Statistics, 1998

### 3.4.3 Number of date palms in the world

The world total number of date palm is about 100 million, distributed in 30 countries and producing between 2.5 and 4 million tons of fruit per year. If we look at the distribution region by region we find that Asia is in the first position with 60 million date palms, while Africa is the second position with 32.5 million date palms.

**Table 4: Superficies and total number of date palms around the world**

Country	Number of palms (in 1,000)	Part of the world's total (%)	Superficies (in 1,000 ha)	Density of planting (number of palms/ha)
Iraq	22,300	22.30	125	178
Iran	21,000	21.00	180	116
Saudi Arabia	12,000	12.00	45	148
Algeria	9,000	09.00	45	200
Egypt	7,000	07.00	45	155
Libya	7,000	07.00	27.5	254
Pakistan	4,375	04.37	-	-
Morocco	4,250	04.25	84.5	50
Tunisia	3,000	03.00	22.5	133
Sudan	1,333	01.33	-	-
Mauritania	1,000	01.00	-	-
Oman	1,000	01.00	-	-
Yemen	800	00.80	6.4	125
U.A.E.	359	00.35	3.44	105
Somalia	204	00.20	0.35	577
Bahreïn	200	00.20	3.70	50
Israel	200	00.20	1.6	125
Palestine	60	00.06	0.25	200
Kuwait	38	00.03	-	-
Syria	12	00.01	-	-
Other countries	4,929	04.92	-	-
World total	100,000	100	770	173

Source: Djerbi, 1995

## Worldwide Production of date palm

**Table 5: Top ten date palm produces country (metritonnes) in 2012**

Name of Country	Production ('000MT)
Egypt	1470
Iran	1066
Saudi Arabia	1050
Algeria	789
Iraq	650
Pakistan	600
Oman	270
United Arab Emirates	250
Tunisia	190
Libya	170

Source: FAO,2012

### 3.5 Climatic requirement for date palm cultivation

Dates are grow in very hot and dry climates, and are relatively tolerant of salty and alkaline soils. Date palms require a long, intensive hot summer with little rain and very low humidity during the period from pollination to harvest. Dates are widely grown in the arid regions between 15° N and 35 °N and it survive in a wide temperature up to about 50-60 °C. Date palm can grow from 12.7-27.5 °C and sustaining short periods of frost at temperature as below -5° c. The ideal temperature for the growth of the date palm, ranges from 21-24°C . The ideal temperature for Vegetative stage is 10°C. Flowering stage: shade temperature more than 18°C. Fruiting stage: temperature more than 25°C (Kabir,2000).

### 3.6 Edaphic condition

The date palm requires a dry atmosphere, deep alluvial clayey soil and liberal irrigation during its flowering and fruiting seasons. Date palm can tolerate high soil salinity . Date palm can survive in soil having 4 percent salt concentration (Ahmad and Farooqi, 1972).

### 3.7 Phenology of date palm

Tall trees or low shrubs, the entire stem of the upper portion only closely covered by the more or less rhomboid bases of the petioles; stems occasionally branched. Flowering begins from February to June. The fruit ripening in August or September (Macmillan, 1993).

### **3.8 Morphology of date palm**

#### **3.8.1 Root morphology**

The primary root of *Phoenix silvestris* is superficial long lateral roots numerous fibrous, distributed down main root.

#### **3.8.2 Leaf morphology**

Leaves pinnate, linear, folded longitudinally and attached obliquely with their folded base to the common woody petiole, the lowest pinnae usually transformed into spines; no midrib but a slender nerve on either side of the fold; nerves longitudinal, parallel, stout and slender. In the majority of the species the leaflets in the lower portion of the petiole stand in fascicles of 4 or 6, 2 or 3 on each side of the petiole while the upper leaflets are usually alternate or opposite (Kiritikar and Basu, 1987).

#### **3.8.3 Flower morphology**

Flowers dioecious, small, yellowish, sessile on the bends of the long glabrous, undulating spikelets usually supported by 1 or 2 minute, subulate or triangular bract the female flowers often approximate in pairs (Hossain, 2003).

#### **3.7.4 Fruit morphology**

Fruit a single oblong one seeded berry with a terminal stigma fleshy pericarp and membranous endocarp seed oblong ventrally grooved, albumen uniform or sub ruminant, embryo small (Hossain, 2003).

#### **3.8.5 Wood morphology**

Sap wood is dark brown. Bark is irregular.

#### **3.8.6. Leaf chlorophyll content**

The leaf of *Phoenix sylvestris* is green fleshy and thick containing chlorophyll for photosynthesis (Hossain, 2003).

### **3.9 Fruit ripening**

In the Middle East countries, most of the harvest is done at 'Tamar stage' when the fruit is fully mature and has 60 to 84 percent sugar depending upon location and cultivar. If left on the tree, the fruit will be damaged by rains (Hossain, 2003).

### 3.10 Age of Tapping

Date palm can be tapped at a rather early age when the trees are 5 years. The number of years a palm tree can be tapped is very different depending on the species. Date palm can be tapped for more than 20 years (Abedin *et. al.*,1987). Some species are able to produce sap all year round, but *Phoenix sylvestris* produce seasonally (Crevost and Lemarie,1913).

### 3.11 Tapping technique

In Bangladesh, the oldest leaves are removed at the end of October on one side of the palm tree along about 35 cm. The bases of the petioles and the sheaths are carefully removed. A triangle piece of bark is cut but great care must be taken not to expose the sap supplying inner zone. A week later, as the fine covering of soft tissues gets a little hardened and begins to crack. Then take a rest of 12-14 days after which a lateral incision is done in the triangle. The sap exuding from the scooped surface is run through a bamboo spout into a vessel. A new inclusion is made the following 2 days and then there is a 4 day period of rest and the same cycle is repeated until the heart is reached. The juice is allowed to run during the night. In the morning the juice collected in a pot hanging beneath the bamboo spout is removed and the heat of the sun causes the exuding juice to ferment over and shut up the pores in the trees. The third night no new cutting is made but the exuding surface is merely made quite clean. In the beginning of November tapping has begun. In December and January the juice flows best, beginning as early as 3 p.m. and dwindles away as the warm days of March come. The juice of the date palm is largely turned into molasses by being boiled in a vat. A special variety is the patali, a hardened circular cake of molasses generally consumed with rice and milk (Alam,1990).

# CHAPTER FOUR: SILVICULTURE OF DATE PALM

## 4.1 Silvicultural characteristics

The tree is strong light demander but does not tolerate overhead shade. The tree can reach heights of up to 50 feet and grow well where the temperatures do not fall below 15<sup>0</sup> F. Leaves are pinnately compound and blue-green and they can grow to 10 feet in length. Leaflets can reach 18 inches long and grow opposite to one another on the rachis in such a way that the entire leaf looks flat. The petiole or stem that attaches the leaf to the trunk, is 3 feet long and armed with spines. Young trunks bear triangular shaped leaf scars that become more diamond shaped with age. The aerial roots tend to be present at the base of trunk. Yellow inflorescences can reach length of 3 feet, heavily branched, bear small white blossoms and grow among the leaves. The adventitious roots are sufficiently long and grow mostly in the upper strata of the soil. The tree prefers loose moist loam soil. The seedlings are sensitive to frost and grow well in full sunlight. Numerous offshoots or suckers are produced from the base of the trunk which if not cut off developed into subsidiary trunks that would give that plant a clumpy habit (Dalibard, 2007).

## 4.2 Silvicultural system

In agroforestry when it occurs as one of the component of mixed crop, it can be worked under selection system. When planted on the banks of the stream, marginal lands and boundaries the crops field (Kamaluddin, 1996).

## 4.3 The rate of growth

The rate of growth of seedlings are slow, however sapling and poles grow fast. The plants come into bearing about four or five years after planting. The palm may continue productive until they have reached the age of sixty to eighty years or more which they are used for a extraction of toddy obtain from incisions made in the upper stem (Dalibard, 2007).

## 4.4 Tending operation

### 4.4.1 Regulating leaf number

The bearing capacity of palm is related to the number of green leaves that it carries. Insufficient number of leaves results in low quality fruit and fewer inflorescences in the following spring. Tate and Hilgeman (1962) recommended 100 leaves per palm to be the

optimum number. It is obvious that nearly 70-100 leaves per palm depending on the cultivar are required for optimum productivity.

#### **4.4.2 Fruit Thinning**

Thinning in date palm is necessary to ensure adequate flowering in the following year, to improve the quality of fruit, to prevent delayed ripening and to reduce compactness and increase ventilation of the bunches. Thinning is the first practice which provides more nutrients to a fewer number of fruits. This will increase the fruit size, enhance the quality, prevent delay in ripening, and reduce the weight and compactness of the fruit bunch. Thinning will also decrease fungal infection and mechanical damages. This will benefit both the harvesting and packing operations (Nixon, 1969).

There are three different methods of thinning: first method of thinning will reduce the number of strands from the central part of each bunch, the second method reduces the number of bunches per palm, and the third method of thinning reduces the number of fruits per strand. Thinning can be also carried out either by certain chemicals or by using diluted pollen grain (Pieniżek and Pieniżek 1981, Soliman *et. al.* 2010). Implementation of these systems depend on the water resources and its quality, age of the palm trees and soil composition. The irrigation methods currently in use are furrow and basin. Recently, 'drip irrigation' system was introduced (Al-Amoud, 2010).

## CHAPTER FIVE: REGENERATION PATTERN OF DATE PALM

### 5.1 Artificial regeneration

Date palm being dioecious requires cross-pollination. Pollination has therefore to be done artificially when the female spathes crack open. Artificial pollination necessitates storage studies of pollen. The dry pollen retains viability for a long time i.e. two or three months in a dry room and for a year in a desiccator at 44<sup>o</sup>c. Artificial pollination encounters problems owing to the height of the tall palm trees. In USA trailer-mounted palm dusters are now used for pollination (Brown *et al.*, 1969). When pollen dust is used, dusting has to be repeated two or three times (Srivastava, *et al.*, 1986).

### 5.2 Natural regeneration

Pollination of date palm is by wind but fruit set can be improved by placing or tying the male flower clusters in the female inflorescences or brushing pollen directly on the female flowers with a pollen duster. The pollen is viable for a number of years. The size, quality and time of maturity of dates are affected by the pollen from different male palms. After pollination, only one of three carpels in the female flowers enlarges and the remaining two fall off when they are about the size of pea (Stolen, 1971).

### 5.3 Pre-sowing treatment

Large, deep holes are prepared as for date palm, these being at first only partially filled using rich soil and adding some well-decomposed manure, the plants being shaded and kept moist. The best time for planting is the early spring. It is usual to plant one male to about every fifty females for the purpose of pollination which is effected artificially (Stolen, 1971).

### 5.4 Nursery technique

The palm both male and female is usually propagated by offshoots or suckers. Offshoots are not usually separated from the parent until 3 or 4 years old. They are then removed and established in nursery beds or they may be planted at once in their permanent places (Hossain, 2003).

### 5.5 Planting technique

As date palm trees are perennial in nature and having long life about 50 years, it is essential to have adequate spacing between the plants. The square planting system is adopted in the date palm cultivation and 8 m distance between rows is maintained in this system for proper



intercultural operation and growth. The plant density is about 160 plants per hectare and 10% of those must be male off shoots to provide pollen grains (Hossain,2003).

### 5.6 Germination of seed

The optimum temperature for seed germination was found to be 25-27<sup>0</sup>c. Low concentration of salt solution between 0-1 and 1-0 percent NaCl caused some inhibition at the early stage of germination and concentration of 2 percent NaCl caused complete inhibition (Khudairi,1958). The seeds germinated satisfactorily up to 6-8 years. At 11 years, the average percentage of germination was only 26

Nixon (1969) and Sento (1972) recorded 90 percent germination of date palm seeds at an optimum temperature of 25-3<sup>0</sup>c.

### 5.7 Germination of pollen grains

The procedure used for *in vitro* pollen was basically that of Tisserate et.al., [13]. Pollen grains were germinated in liquid medium consisting of 500 mg/l-13B03 , 300 mg/l Ca(N03)z.4l-lz0, 200 mg/lMgS04• H20, 100 mg/l KN03 , 100 mg/l ethylenediamine tetra acetic acid and 200 gil sucrose. Ten milligrams of pollen grains from each male cultivar were added to 250 ml Erlenm yer flask containing 5 ml of the germination medium. The flasks were capped with sterilized cotton plugs and incubated at 27 - 28°C for 24 hrs. under dark conditions (Nixon,1969).

Two drops of germination liquid medium from each treatment were separately smeared on slide and examined under light microscope to obtain the germination percentage. Four random replicates were used for each treatment and only 100 pollen grains were examined in each replicate. The emergence of pollen tube growth was considered as indicator of pollen germination. The pollen tube length in each treatment was measured with the light microscope. Ten germinated pollen grains from each of the four replicates were randomly selected and their tubes were measured under microscope using an ocular micrometer (Nixon,1969)

### 5.8 Cultivations

The palm is of a halophytic hardy nature, thriving where few other plants will barely exist. Its chief requirements are great heat for a considerable period of the year, a dry atmosphere, deep alluvial clayey soil and liberal irrigation during its flowering and fruiting seasons. The

crown of the tree needs to be accessed for pollination, bunch tie-down, covering, harvesting, and pruning. Different pollen sources can influence the size and shape of the seeds. Pollen also can have a "metaxenia" effect, influencing the tissue outside the embryo and endosperm. After pollination, bunches are often tied to the leaf stalks to support the weight of the fruit. Manure has traditionally been used in date production, but in many instances inorganic fertilizers are used for getting high quality production (Carpenter, 1981).

### **5.8.1 propagation of date palm**

There are 3 techniques to propagate date palm: seed, offshoot and the recently developed tissue culture.

#### **5.8.1.1 Seed propagation**

Seed propagation also called sexual propagation, although useful for breeding purposes, is not a proper method of date palm propagation and ought to be discouraged. The main reasons in favour of discouraging seed propagation are as follows:

- Date palm is a dioecious species and consequently half of the progeny will be males and half will be females, with no certain way to determine at an early stage the sex of the progeny, nor fruit or pollen quality prior to flowering (often only seven years later) (Schroeder,1970).
- Female plants originating from seedlings usually produce late maturing fruits of variable and generally inferior quality compared to established clonal palms. In a seedling plantation it is rare that more than 10 percent of the palms produce fruit of satisfactory quality(Schroeder,1970).
- Date palms are heterozygous, and thus there will be much variation within the progeny, and desirable characteristics of the parent palm may be lost. In other words, it is not true to type propagation and no two seedling palms are alike. Seedlings differ considerably with regard to production potential, fruit quality and harvesting time, making them very difficult to market as one harvest (Schroeder,1970).

The above reasons result in waste of time, space and money.

Thus, seed propagation is by far the easiest and quickest method of propagation. However, it is not a true to type propagation technique and no two seedlings will be alike. Because of its diversity, the seed approach can only be useful for breeding purposes. Taking the above into

consideration, date growers are encouraged to use tissue culture-derived material of known varieties with high date quality and marketing potential.

### **5.8.1.2 Offshoot propagation**

Offshoot propagation also called asexual or vegetative propagation, offers advantages over seed propagation, but though true to type, it is not very practical from a mass propagation point of view, and consequently does not satisfy the large needs of plant material. The following reasons illustrate this handicap:

- Offshoot production is limited to a certain period in the life span (a short vegetative phase of about 10 to 15 years) of date palm.
- During this short phase, only a limited number of offshoots are produced (20 to 30 offshoots, at most, depending on the variety).
- Some varieties produce more than others (some do not produce offshoots at all).
- A mature specimen with no offshoots will be lost if not propagated through another technique.
- Depending on the care given, a low planting survival rate is frequently obtained when using offshoots.
- The use of offshoots will enhance the spread of date palm diseases and pests.
- Offshoot propagation is difficult, laborious, and therefore expensive.
- The rapid propagation of date palm as well as propagation from a mature specimen is impossible due to the limited number of offshoots produced and the fact that offshoot production is limited to a certain period in the life span of the palm.

### **5.8.1.3 Tissue culture**

Since the beginning of domestication and cultivation of plants, human beings are looking for techniques that could help to produce maximum number of individuals from the minimum number/quantity of explants. Tissue culture is the ultimate finding for the mass multiplication of plants using minimum quantity of propagules. Some of the advantages of this technique are that heterozygous materials may heterozygous materials may be perpetuated without much alteration; it is easier, faster, dormancy problem eliminated and juvenile stage reduced.

Tissue culture refers to the aseptic growth of cells, tissues or organs in artificial media. Although the culture of plant cells and tissue has been a tool of the plant physiologists, this technique is now increasingly used as a means of rapid plant propagation (Janick, 1979). In vitro culture or micro propagation of plants involves three distinct steps, each of which requires specific set of conditions: (1) establishment of aseptic culture, (2) multiplication of the propagule and (3) hardening and acclimation of plantlets. These steps involve the use of different chemicals, management of light, humidity, temperature etc.

### **Somatic Embryogenesis**

This term refers to the development of a complete embryo from vegetative cells. In the case of date palms Somatic embryos are produced from in vitro produced friable callus cells. The selection of the explant source material is the most critical decision and may require a systematic analysis of embryogenic potential of different explant sources within the plant. The first step involved is the culture of the selected explant in a suitable callus inducing medium. Introduction of embryogenic potential in the callus is achieved through the transfer of cells to a basal medium with high concentration of auxin. The most effective auxin used in date palm is 2,4-dichlorophenoxyacetic acid (2,4-D). Differentiated proembryos can be separated and the remaining smaller cells can be sub cultured in the same media for continued production of somatic embryos. Proembryo masses are cultured in an auxin free basal medium. Somatic embryos develop from single cells in clumps or small masses, develop polarity and grow like zygotic embryos. Regeneration of the somatic embryo is the next step involved for which an agar medium devoid of any auxin but containing a low level of cytokine is required. This technique has been employed in the mass production of many date palm cultivars.

Regeneration of date palm by somatic embryogenesis has been reviewed by Tisserat (1979,1984) and Branton and Blake (1989). Shoot apices extracted from the lateral and axillary off-shoots are used to induce embryogenic callus. Large number of somatic embryos were produced by sub culturing with low concentrations of growth regulators. With somatic embryogenesis, it is easy to produce plants on large scale but the use of high level of hormones in the media may cause somaclonal variations (Tisserat, 1984)

### **Organogenesis**

This term refers to the development of adventitious shoots from the undifferentiated callus masses or directly from the explants. This process usually occurs after an intervening period

of callus growth. Organogenesis can be induced by transferring callus or explants to a suitable medium or sequence of media that promotes proliferation of shoots, roots or both. Meristemoids are differentiated in the callus which later transformed into cyclic nodules from which shoots or roots are developed. Shoot formation followed by rooting is the general characteristic of organogenesis. Generally high concentrations of cytokinin favours shoot bud formation whereas high level of auxin promotes rooting.

Beachesne and Riss (1979) established organogenesis as an alternative for date palm tissue culture. Organogenesis by single cell from organs like shoot may not cause mutations in the plants due to the use of low level concentration of hormones. Direct organogenesis has been successfully established from the shoot tip explants of date palm cultivars ( Khierallah and Bader,2006). Direct regeneration of vegetative buds minimizes the risk of soma clonal variation among regenerants. More over duration of culture period is limited by frequent renewal of the plant material.

### **Explant selection**

The apical meristematic tissues extracted from the axillary and lateral off-shoots gave promising results and are now used as the widely accepted explant for date palm tissue culture. Very young or over mature off-shoots are not recommended. Two-three year old off-shoots can be used as explant for cultural initiation. Healthy off-shoots are separated from field grown trees using sharp tools. Older leaves are trimmed off and the remaining ones are tied in one bundle. Off-shoots have to be transferred to a clean area near the laboratory for dissection. Leaf fibers are cleaned from the base and then the leaf-sheaths are removed one by one from the outer ring towards the center. Care must be taken to avoid any kind of shock or damage to the internal soft tissues. The final size of the off-shoot heart is about 2 to 3cm in width and 4-6 cm in length. At this stage the explant has to be transferred to a sterilized bottle containing chilled aqueous solution of citric acid and ascorbic acid ( $150\text{mg}^{-1}$ ). Sterilization and final dissection has to be carried out under a sterile laminar air flow hood (Branton and Blake,1989).

### **Sterilization**

The explant must be kept in one percent sodium hypochlorite solution mixed with one drop/100ml of Tween-20 for 20 minutes followed by 4-5 rinses in sterilized water. Then it is immersed in 0.1% mercuric chloride solution for 5 minutes, followed by 4-5 washes in

sterilized distilled water. Sterilized explants of date palms are kept in a cold sterilized solution of ascorbic and citric acid ( $150\text{mg}^{-1}$ ) to avoid browning.

### **Media and culture conditions**

During the early stages of tissue culture development in date palms various nutrient media were used by many workers (Ammar and Benbadis,1977). Now the most extensively used nutrient medium in date palm tissue culture is Murashige and skoog medium. When the germination of embryos begins light intensity must be increased to 3000lux. Different stages of date palm tissue culture starting from explants to rooted plant.

Micro propagation of date palm is a very lengthy process which requires several subcultures and serious attention. Acclimatization process of the tissue culture –derived plantlets also needs careful attention, otherwise casualty rate will be very high. Fifty to ninety percent losses has been reported in date palm culture during acclimatization. An in vitro cultured plant in a tube enjoys 100% relative humidity in sealed culture tube may develop various abnormalities in their morphological, physiological and biochemical characteristics. Planting operation has to be done as quickly as possible after washing off any traces of culture media and disinfecting with broad spectrum fungicides. Containers and potting media must be adequately cleaned and sterilized. Moisture content of the medium must be regulated to minimum and relative humidity of the growth must be maintained high (Ammar and Benbadis,1977).

### **5.8.2 Irrigation for date palm**

A low humid environment where rains are non existent and adequate supplies of underground water or irrigation. Date palm is ordinally planted around water- holes and water courses or regions where adequate irrigation facilities are available. Growth is good in regions with a warm and humid climate but the palm will not bear fruit. Irrigation is essential usually about once a week (Barreveld,1993).

Correct and adequate irrigation is very important for date palm trees to ensure good palm growth, high yields and good fruit quality (Bazza,2008). Generally date fruit production is negatively affected by the lack of adequate level of irrigation water. The availability of the water in the soil varies for each type of soil, according to its capacity and capability to retain water. Most of the date palm orchards in Basra depend on the water tide of the Gulf's water. There are many irrigation systems used in the date palm orchards. The implementation of

these systems depends on the water resources and its quality, age of the palm trees and soil composition. The irrigation methods currently in use are furrow and basin. Recently, 'drip irrigation' system was introduced (Al-Amoud,2010).

### **5.8.3 Fertilization**

Generally 1.5–3.0 kg of nitrogen, 0.5 kg of phosphorus and 2.0–3.0 kg of potassium per tree yearly is recommended to maintain optimum growth of palm tree. Long term trials on the use of chemical fertilizers in different areas are needed. In Iraq, date palms are fertilized once a year with manure at the rate of 20 to 44 kg per tree in dependence on age of tree and fertility of soil (Adlan,1994).

## CHAPTER SIX: DISEASES AND PESTS OF DATE PALM

This chapter is an attempt to provide basic information on major diseases and pests of the date palm.

### 6.1 Fungal diseases of date palm

#### 6.1.1 Bayoud disease

The name bayoud comes from the Arabic word, "abiadh", meaning white which refers to the whitening of the fronds of diseased palms. This disease was first reported in 1870 in Zagora-Morocco. By 1940, it had already affected several date plantations and after one century, the disease has practically affected all Moroccan palm groves, as well as those of the western and central Algerian Sahara (Killian and Maire, 1930; Toutain, 1967).

#### Disease symptoms

The bayoud disease attacks mature and young palms alike, as well as offshoots at their base (Saaïdi, 1979).

#### External symptoms

The first symptom of the disease appears on a palm leaf of the middle crown . This leaf takes on a leaden hue (ash grey colour) and then withers, from bottom to top, in a very particular way: some pinnae or spines situated on one side of the frond wither progressively from the base upward to the apex . After one side has been affected, the whitening begins on the other side, progressing this time in the opposite direction from the top of the frond to the base.

#### Internal symptoms:

A small number of disease infected roots, reddish in colour, are revealed when an affected palm is uprooted. The spots are large and numerous towards the base of the stipe. As they advance towards the upper parts of the palm, the coloured conducting fascicles separate and their complicated path inside the healthy tissues can be followed.

Palm fronds manifesting external symptoms exhibit a reddish brown colour when cut, showing highly coloured conducting fascicles. There is, therefore, a continuity of vascular symptoms that exist from the roots of the palm to the tips of the palm fronds.



The observation of symptoms is necessary to recognise the bayoud, but to identify this disease with certainty, samples of affected fronds must be analysed by a specialised laboratory.

### Control of Bayoud disease

#### *Chemical control*

Soil treatment of this type of disease is destined, *a priori*, to fail and should therefore be avoided. Chemical control can, however, be feasible in the event of the discovery of primary sources of infection in a healthy area. In this case eradication techniques should be used: palms are uprooted and incinerated on the spot. The soil is then treated with methyl bromide or chloropicrin and the area closed off with replanting prohibited until further notice.

#### *Cultural control*

Since the factors that favor high yield in date palms (irrigation, fertilisation, etc.) are the same that favour the growth of the fungus, cultural techniques are not advised. However, a significant reduction in the amount of irrigation can retard the advance of infection, i.e. stopping irrigation between the months of May and October, during the hot season in the northern hemisphere (Pereau-Le Roy, 1958).

Since the contamination occurs mainly by root contact, disease-free palms can be isolated by digging a trench of 2 m deep around them. Water should be provided by a trough bridging the rest of the grove to this isolated plot. Under these conditions these palms can be protected for more than 10 years (Djerbi, 1983).

#### *Prophylactic measures*

The essential task is to prevent the movement of contaminated plant material from an infected palm grove to a healthy one. This material, as has been previously mentioned, consists mainly of offshoots, palm fragments, manure and infected soil, and artifacts made from these materials. Legislation preventing the conveyance of contaminated vegetative material from one country to another, or from one region to another, has been passed by various countries such as Algeria, Egypt, Iraq, Libya, Mauritania, Saudi Arabia, Tunisia and USA.

#### *Genetic control*

The only productive means of controlling bayoud disease lies in continued research into resistant varieties. Many resistant cultivars have already been obtained in Morocco from three

sources: selection of bayoud-resistant varieties from those already existing (local and introduced), selection of high-quality, resistant clones from the natural population of the date palm, and creation of resistant and high quality varieties through a hybridisation programme (Djerbi *et al.*, 1986; Toutain, 1968).

### **6.1.2 Black scorch disease**

Black scorch has been observed on date palm in all date growing areas of the world. Symptoms are usually expressed in four distinct forms: black scorch on the leaves, inflorescence blight, heart or trunk rot and bud rot on palms of all ages. Infections are all characterized by partial to complete necrosis of the tissues.

## **6.2 Phytoplasmic diseases of date palm**

### **6.2.1 Lethal yellowing**

In date palm the fronds become desiccated and grey-brown instead of becoming yellow. A soft rot of the growing point occurs, converting the meristematic area into a putrid, slimy mass. The crown topples from the palm, leaving a naked trunk. Phytoplasma is the main of this diseases.

#### **Management**

Diseases severity can be reduced by injecting the antibiotic oxytetracycline HCL into the trunk; antibiotic can also be administered as a protective measures if the diseases is known to be in the area; control of the disease long term relies on planting resistant or tolerant varieties .

### **6.2.2 White nose**

White nose disease is commonly found in Iraq, Libya and Morocco (Hussain, 1974; Djerbi, 1983). Dry and prolonged wind in the early Rutab stage causes rapid maturation and desiccation of the fruit resulting in whitish drying at the calyx end of the fruit. The affected fruit becomes very dry, hard and has a high sugar content. Hydration may correct this condition in harvested fruits.

### 6.2.3 Bending head

Also called "Le Coeur qui penche" in French, the bending head is a minor disease observed in Algeria, Egypt, Mauritania and Tunisia (Munier, 1955). The central cluster of fronds takes the form of an erect fascicle with a bent tip. The trunk bends and may even break.

*Thielaviopsis paradoxa* and *Botryodiplodia theobromae* Pat are fungi commonly isolated from declining palms (Brun and Laville, 1965). Efficient maintenance and appropriate sanitation of the date plantation is the first control measure. Diseased parts of infested palms are to be collected and burnt in order to limit the spread of the disease.

### 6.2.4 Dry bone

Originally this disease was first reported by Fawcett and Klotz (1932) in USA. Other cases were found in Algeria, Egypt and Tunisia (Djerbi, 1983). According to Djerbi, the disease is characterized by whitish, irregular blotches and streaks on the leaf stalks, midribs and pinnae that become outlined by reddish brown margins. The name "dry bone" comes from the drying out of the surface of the leaf stalk with a hard, smooth and white appearance. Lesions, from one to several centimeters, involve only the epidermis and a thin layer of subjacent tissue.

According to Fawcett and Klotz (1932), a bacterium is commonly found associated with the lesions, and certain palms are more susceptible than others.

### 6.2.5 Faroun disease

Laville and Sachs (1967) reported this disease of unknown cause from Mauritania. Affected palms, present a parasol form produced by the old and mid-level fronds, while new fronds present a short rachis with an irregular arrangement of pinnae and spines. Leaves remain green during the first stages and then decline and become yellow. The terminal bud assumes a conical form and becomes a stunted rosette.

All these symptoms are accompanied by the abortion of the axillary buds, resulting in failure of flowering for one or two seasons before foliage symptoms appear. Two to four years is the average duration of the disease from the appearance of the symptoms to the death of the palm. According to Djerbi (1983) no varietal resistance has been observed.

### 6.2.6 Rhizosis

Also called "Rapid decline", rhizosis is a minor but fatal disease of unknown cause. The first symptom is premature falling off of fruits. However, if the attack is sometime after fruit

development, the fruit withers and shrivels on the bunch. A reddish-brown discolouration of pinnae appears on mature fronds and the disease progresses from the bottom to the top of the fronds which rapidly die.

### **6.3 Physiological disorders of date palm**

#### **6.3.1 Black nose**

Blacknose applies to the abnormally shrivelled and darkened tip of a date. Deglet Nour and Hayani seem to be the most susceptible varieties to this physiological disorder (Fawcett and Klotz, 1932).

Black nose results from excessive checking of the epidermis, especially in the form of numerous small, transverse checks or breaks at the styler end of the fruit. Pronounced shrivelling and darkening occur in proportion to the abundance of the checks and are related to humid weather at the Khalaal stage (Calcat, 1959).

#### **6.3.2 Crosscuts**

Crosscuts is a physiological disorder of fruit stalks and fronds reported from the United States, Pakistan and a few Middle East date growing countries such as Israel and Iraq (Bliss, 1937; Djerbi, 1980). In the United States more than 1,000 fruit bunches were damaged in a single plantation in 1934, up to a quarter of the crop was lost.

Crosscuts result from an anatomical defect in the fruit stalks and fronds involving internal, sterile cavities leading to mechanical breaks during elongation of the stalk or the fronds. Crosscuts are commonly found in varieties having crowded leaf base (Fawcett and Klotz, 1932).

# A CASE STUDY ON FARMING AND UTILIZATION OF DATE PALM

## CHAPTER SEVEN: METHODOLOGY

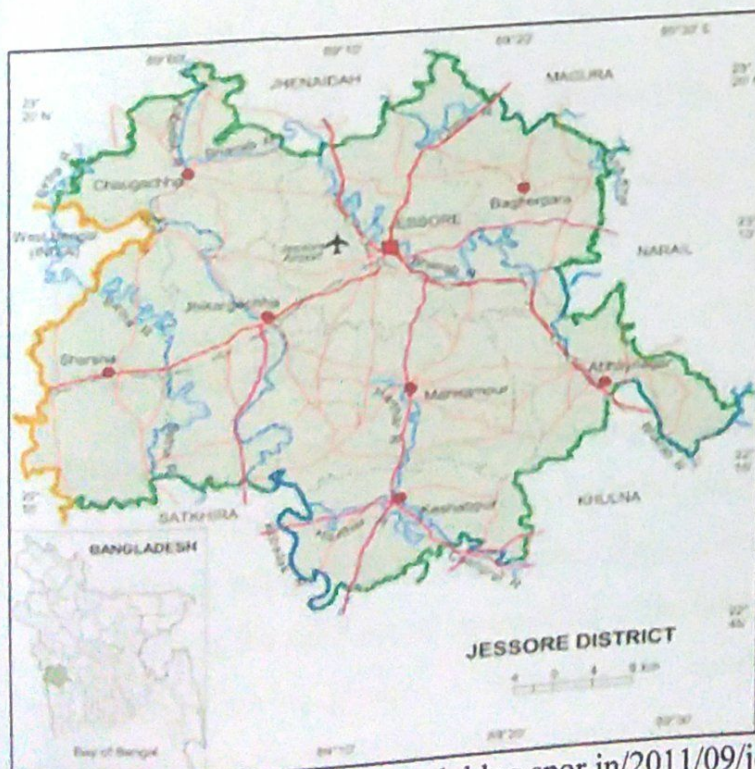
### 7.1 Materials

#### 7.1.1 Selection of the study area

The study was conducted in three Thanas (Abhynagar, jessore sodar and Jikargasha) of Jessore district. The farmers of this area have been practicing date palm cultivation for a long time. Once upon a date palm was the main crop in this area. But now date palm is not cultivated as the main crop now the farmers cultivate different seasonal and annual crop to their land. Three village were selected from each Thana.

#### 7.1.2 General information of the study area

Jessorre is the district situated on the south-western part of Bangladesh. Jessorre district is located between  $22^{\circ}49'$  and  $23^{\circ}46'$  north latitude and between  $88^{\circ}42'$  and  $89^{\circ}49'$  east longitude. Tropic of cancer passes through the northern part of the district jointing Kotchandpur in the west and Kamarhatighat in the west. Jhenidah district bounds the district on the north, on the east by Narail and on the west by border of India. The district consists of eight upazillas comprising an area of 995 sq. miles.



Source: [http:// map of Bangladesh blog spor.in/2011/09/jessore district](http://map of Bangladesh blog spor.in/2011/09/jessore district)

**Fig.2: Map of the study area in Jessore district**

Table 6: Jessore district (with the study area) at a glance

Upazilla	Area(sq. miles)	village
Abhaynagar	96	106
Jikargacha	119	179
Jessore sodar	168	250

### 7.1.3 Sample size

For the purpose of my study, from the selected 3 Thanas, 90 respondents are selected randomly. But 40 households had not found date palm and rest were found date palm. So, the sample size was 50 including 17 samples who tap juice from date palm and rest 33 samples are owner from three Thanas. This samples were surveyed with a pre-tested questionnaire. Different categories of farmers were included in sample survey. The farmers were categorized according to the following land holding.

Farmers category	Farm size/ha.
Landless	< 0.20
Marginal	0.20- <0.50
Small	0.50-<1.00
Large	1and above

## 7.2 Methods

### 7.2.1. sampling design

A sample of farmers was selected following a systematic sampling procedure. The district was chosen purposively because it is remarkable site of date palm. In 1<sup>st</sup> step three Thanas were randomly selected. In 2<sup>nd</sup> step, three villages were randomly selected from each Thana. As date palm is the function of landholding of the households, the farmers were categorized into above following groups. A semi-structure questionnaire was used to collect all the relevant information by directly interviewing the farmers or owners.

### **7.2.2 Preparation of the interview schedule**

According with the objectives of the study, a set of preliminary interview was designed for collection of data for the study. The interview schedule was carefully designed in such a way that all factors associated with date palm cultivation and the opinions of the farmers could be included. It contained both open and closed form of questions. The questions are design in English. Simple questions regarding their basic factors were included in the schedule. The final interview schedule was prepared in a simple manner maintaining logical sequences and necessary adjustments.

### **7.2.3 Data collection and processing**

To get valid and pertinent information, the researcher made all possible efforts to explain the purpose of the study to the respondent. The researcher administered the interview schedule personally to the respondents. Co-operation was obtained from respondents during data collection. Data were collected from August to October in 2015. Collected data were verified, compiled and tabulated according to the objectives of the study.

#### **7.2.3.1 Primary data collection**

For this purpose a questionnaire was prepared which helpful for data collection. Selected people (respondents) are interviewed to collect information on the following aspects:

- i. The respondent's age, name, education qualification, family members, homestead size, cultivated land size, occupation, daily/ per month income and The income from date palm by the respondents per seasons.
- ii. Category of number of date palm by the respondents in my study area.
- iii. Age class distribution of date palm from different sites by the respondents.
- iv. Comparison of number of date palm (%) among three upazillas (the study area).
- v. Use of date palm for different purposes (fruit, fuel wood, juice, mate production etc.) by the respondents.
- vi. Number of date palm cultivation respondents.

### 7.2.3.2 Secondary data collection

The necessary secondary data and literature were mainly collected from the following sources:

- i. Books.
- ii. Journals.
- iii. Khulna University Library.
- iv. Seminar library, Forestry and Wood Technology Discipline, Khulna University, Khulna.
- v. Internet.
- vi. Other relevant documents.

### 7.4 Analysis of data

After data collection, those were compiled, tabulated analyzed statistically using Microsoft Excel, past statistical software in accordance with objectives of the study. Qualitative data were converted quantitative data when necessary. Descriptive statistics such as number, percentage, range, maximum, minimum and median were used in describing variables of the study. Chi square test was done to know the significance difference of observed and expected value of different variable of date palm cultivation.



## CHAPTER EIGHT: RESULT AND DISCUSSION

### 8.1 RESULT

#### 8.1.1 Household characteristics

During survey, collect information about household characteristics of those people who interviewed and this including respondent's age, occupation, total income, education level etc. Among the selected households the minimum age of the respondents is 22 years and maximum age is 70 years. The education level of the respondents is 46% illiterate, 26% primary, 8% secondary and 4% higher study. According to the number of family members the family size is 22% (1-3) members, 54% (4-5) members and 22% (6-8) members. The earning member of the household head 94% male and 4% female. The maximum earning member in the family is 3 and maximum cultivated member is 2. Among the 50 respondents, 54% respondents household size is less than 0.07ha and 46% is greater than 0.07ha. Occupation of the household head is 66% farming and 34% is non farming. The maximum household income other than date palm is 15,000 Tk. and date palm income is 10,000 Tk.

**Table 7: Demographic and socio – economic characteristics of randomly selected household from Jessore district**

Demographic	Minimum	Median	Maximum	Percentage in terms of total sample
Respondent's age(years)	22	43	70	4% (1-25year), 52%(26-49), 44%(50-70year)
Respondent's education (years of schooling)	0	6	12	48% illiterate, 24% primary,20%secondary,8% higher secondary
Family size(numbers)	8	4	2	26% (1-3) 54% (4-5), 20%(6-8)
Gender of the earning members of the family	-	-	-	94% male and 6%female
Earning members in the family (numbers)	1	2	3	92%(0-1),8%(2-3)

Cultivate members in the family	1	1	2	94%(0-1), 6%(2-3)
Homestead size (ha.)	0.013	0.6765	1.34	54%(>0.07),46%(0.7)
<b>Socio-economic</b>				
Major source of family income	-	-	-	66% farming, 34% non farming
Occupation of the household head	-	-	-	66% farming, 34% non farming
Household income other than date palm (TK./month)	4500	9750	15,000	56%(4000-8000)tk,44%(9000-15000)tk.
Household income from date palm (Tk./seasons)	2000	6000	10000	81.25%(1000-5000)tk, 18.75%(6000-10000)tk.

### 8.1.2 Factors influencing date palm cultivation of the study area

Religion, respondent age, education, site of date palm cultivation, mate production etc. significantly influenced the number of date palm( table 4). The muslim family had highest 72.34% date palm than that of hindu 66.67%.Similarly among the date palm cultivation land size, the small land sized6.25 medium 70% and large 62.5% had highest number of date palm. Among the education level, the illiterate respondents had 33.33% Secondary(, primary 90.90%Secondary 66.67%and higher study 18.18% had higher number of date palm. Among the respondent age adult and old age had more lowest number( 65.38% ,76.19%) of date palm than highest number (34.62%,23.81%) of date palm and 100% young age respondent had lowest number of date palm. Here some other factors that influence the number of date palm.The influencing factors for date palm cultivation religion,earning member of the family,income source and mat production were significant( $\text{Chi}^2$  value=0.765, 1.162, 0.0673 and 1.43,  $p>0.05$  for all). The influencing factors for date palm cultivation respondent age,education level, farmer categories, site of date palm cultivation and land size were not significant ( $\text{Chi}^2$  value=40.585, 129.11, 40.78, 31.86 and 97.66,  $p<0.05$  for all).

Table 8: Factors influencing date palm cultivation in the study area

Factor	categories	Date palm cultivation per household		Statistical test ( $p > 0.05$ significant and $p < 0.001$ not significant)
		High	Low	
Religion	Muslim	72.34	27.66	Chi <sup>2</sup> value: 0.765 Df:1 P value: $p > 0.05$
	Hindu	66.67	33.33	
Respondent age	Young( 18-29yr)	0	100	Chi <sup>2</sup> value:40.585 Df:2 P value: $p < 0.001$
	Adult(30-49yr )	34.62	65.38	
	Old age(more than 50)	23.81	76.19	
Education level	Illiterate(0year)	33.33	66.67	Chi <sup>2</sup> value: 129.11 Df:3 P value: $p < 0.001$
	Primary(0-5year)	90.90	9.09	
	Secondary(6-10year)	66.67	33.33	
	Higher Secondary(10-12 year)	18.18	81.82	
Farmer categories	Landless (0-0.21ha.)	45.45	68.75	Chi <sup>2</sup> value:40.78 Df:3 P value: $p < 0.001$
	Marginal(0.2-0.50ha)	14.28	85.71	
	Small(0.5-1ha)	55.56	44.44	
	Large (up to 1ha)	28.26	71.74	
Earning member	One	25	75	Chi <sup>2</sup> value: 1.162 Df:1 P value: $p > 0.05$
	More than one	18.75	81.25	
Income sources	Date palm only	33.33	66.67	Chi <sup>2</sup> value: 0.0673 Df: 2 P value: $p > 0.05$
	Other than date palm	31.33	66.67	
	Combination	31.82	68.18	
Site of date palm cultivation	Agricultural field	33.33	66.67	Chi <sup>2</sup> value: 31.86 Df: 3 P value: $p < 0.05$
	Roadside	21.43	78.57	
	Homestead	2.33	97.67	
	Pond side	19.0	80.95	

Mate production	Own used	25.64	74.36	Chi <sup>2</sup> value: 1.43 Df: 1 P value: p>0.05
	Selling	33.33	66.67	
Land size	Small ( up to 1 ha.)	6.25	93.75	Chi <sup>2</sup> value: 97.66 Df: 2 P value: p>0.001
	Medium (1.05- 1.50 ha.)	70	30	
	Large (above 1.50 ha.)	62.5	37.5	

### 8.1.3 Age class distribution of date palm

During the study, we observed a total 1509 date palm managed by 50 households from four different sites (Fig.3) namely agricultural field, Roadsides, homestead and pond sides. It was found that, highest number of respondents were found by the age group 14-21 years from homesteads. The lowest number of respondents were found by the age group >28 years from agricultural field.

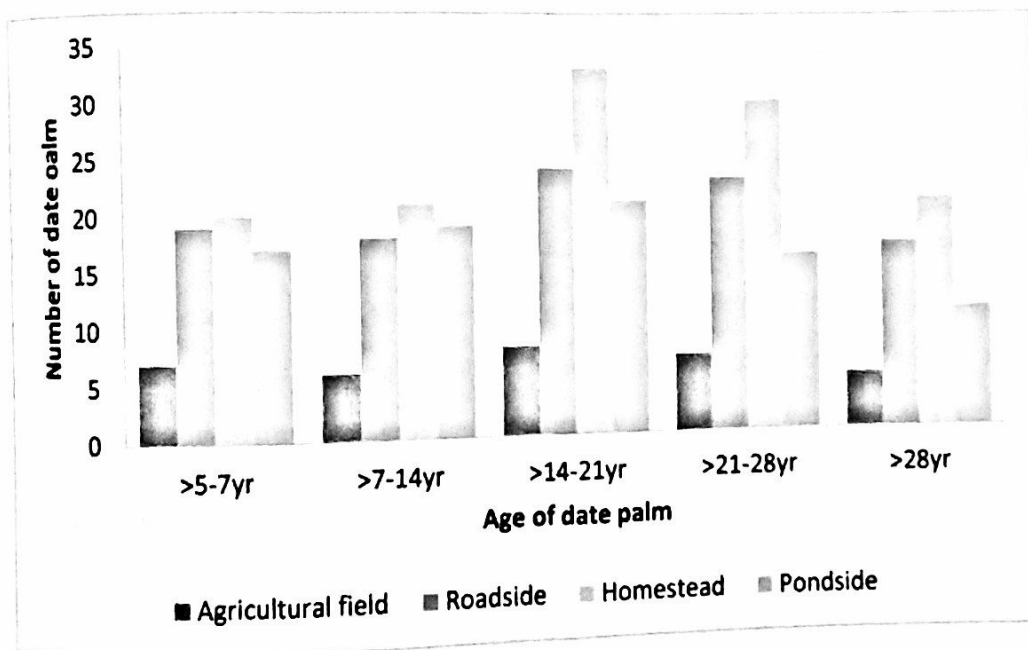


Fig.3: Age class distribution among different sites in relation with respondents

### 8.1.4 Number of date palm cultivation in relation with respondents

Categorizes the date palm tree according to the number of date palm by the respondents. The highest number of respondents (38%) were found between the number of date palm trees 0-9 (Fig.4). The lowest number of respondents (2%) were found between the number of date palm tree 90-100 ( Fig.4).

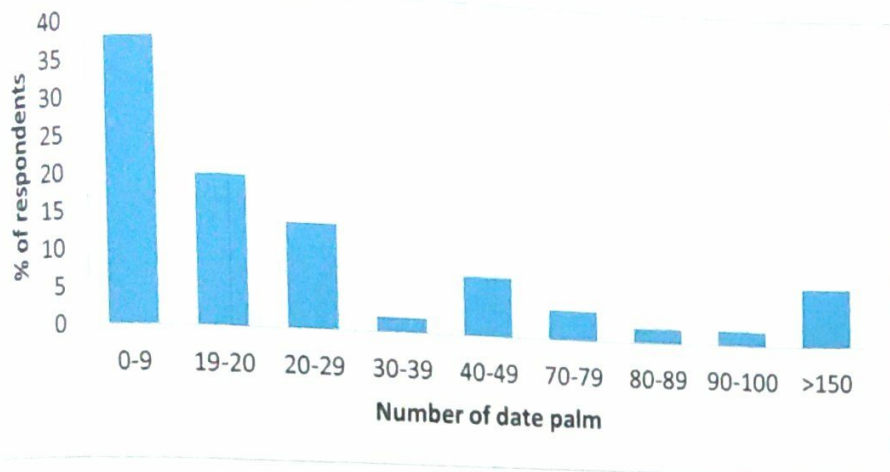


Fig 4. Category of number of date palm by different respondents in the study area

### 8.1.5 Comparison of number of date palm (%) among three Thanas ( the study area)

In the study area, 1509 date palm managed by 50 households from four different sites namely agricultural field, road side, homestead and pond side. The date palm managed by different household categories (landless, marginal, small and large) among three Thanas ( Jikargacha, Jessore sadar and Abhynagar). The percentage of date palm in Jikargacha was 33.73% and in Abhynagar was 38.04%. The lowest percentage of date palm in Jessore sadar was 28.16% (Fig.5).

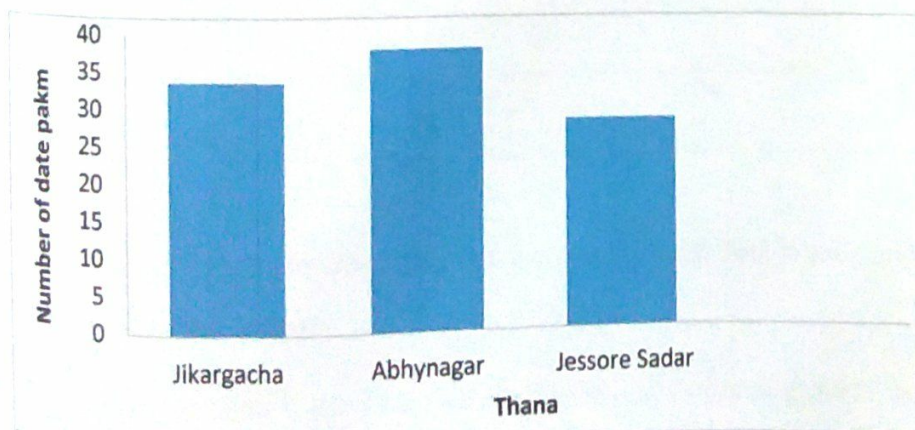


Fig 5: Percentage of date palm in the study area

### 8.1.6 Comparison of the distribution of number of date palm trees by the respondents in Jessore districts

According to the Categories on the basis of number of date palm highest number of respondents in the study area was 0-9 (the range of date palm number)(Table:9) and the lowest respondents were found 30-39,80-89 and 90-99(the range of date palm number) . The other similar study was found by Das, Alam and Rahman,(2010),they found highest number of respondents 20-29 (the range of date palm number).(Table.9) and the lowest number of respondents 10-19 (the range of date palm number).

**Table 9: Comparison of the distribution of number of date palm trees by the respondents**

Categories on the basis of number of date palm	Number of respondents(This study)	Percentage of respondents	Number of respondents (Sanjoy,2010)	Percentage of respondents (Sanjoy,2010)
0-9	19	38	-	-
10-19	10	20	4	4.44
20-29	7	14	41	45.56
30-39	1	2	-	-
40-49	4	8	-	-
50-59	-	-	35	38.89
70-79	2	4	-	-
80-89	1	2	6	6.67
90-99	1	2	4	4.44
>100	4	8	34	42.4

### 8.1.7 Use of date palm for different purposes (fruit, fuel wood, juice ,mate production etc.) by the respondents

We know date palm is used for fruit, fuel wood, brick burning juice, patali ,mat production, wine, poles and etc. In my study area, 90 % respondents used date palm for fruit 100%respondents fuelwood for making molasses and others 44% respondents for brick burning 76% respondents for seasonal juice that were used delicious making cakes and

drinking fresh juice of date palm. 66% respondents for mat production that were very widely used in domestic purposes in rural area. 32% respondents used it for house making. Only 2% respondents used for Alcoholic beverage (locally called Tari).

**Table 10: Different source of date palm tree use by the respondents**

Different sources	Respondents	percentage
Fruit	45	90
Fuel	50	100
Brick burning	22	44
Juice	38	76
Patali	20	20
Mat production	33	66
Alcoholic beverage (locally called Tari)	1	2
Poles	16	32

## 8.2 DISCUSSION

The age of the respondents ranged from 22-70 years, The highest portion (52%) of the respondents fall in the age category of 26-49 years, 4% was below 25 years and 44% was above 50 years old. The education score of the respondents ranged from 0 to 12. Based on education, the participants were classified into four categories. Among the respondents, 46% were illiterate, 26% completed primary education, 8% completed secondary education and 4% completed higher secondary education. The family member of the respondents varied from 2 to 8 with an median of 4. 34% household income come from non farming and 66% come from farming (table 7).

Das *et.al.*(2010) conducted a study in two upazilas- Monirampur and Keshabpur of Jessore district. The age of the respondents ranged from 38 to 78 years. The highest proportion (43.8%) of the respondents fell in the age category of 40-50 years, 13.8% fell below 40 years and 42.5% were above 50 years old. The education score of the respondents ranged from 0 to 15. Based on education, the participants were classified into four categories. Among the respondents, 21.3% were illiterate, 40.0% completed primary education, 17.4% completed

secondary education, 6.3% completed higher secondary education and 15.0% were graduate. The family member of the respondents varied from 2 to 13 with an average of 7.13. 25% household income come from non farming and 75% come from farming .

The  $\chi^2$  test for influencing factors in date palm cultivation( religion, earning member of the family, income source and mat production) were significant ( $p > 0.05$ ) that this results were not strongly influence date palm cultivation. The influencing factors for date palm cultivation (respondent age, education level, farmer categories, site of date palm cultivation and land size) were not significant ( $p < 0.05$  ). So, this results is the determinant of date palm cultivation. ( Table 8).

In this study, the highest number of respondents were found by the age group 14-21 years from homesteads and the lowest number of respondents were found by the age group  $> 28$  years from agricultural field (Fig.3).

The similar trend was found by Islam and Miah (2003) for Mirsharai of Chittagong in Bangladesh where they revealed that canal bank occupied the maximum number of palms. Most of the palms (30.48%) were found to be occupied in the study area by the age group of 14-21 years .

The highest number of respondents (40%) were found between the number of date palm trees 0-9 ( Fig.4). The lowest number of respondents (2%) were found between the number of date palm tree 90-100 ( Fig.4).

The similar study were found by Das and Alam, (2010 )where the respondents (45.56%) were found between the number of date palm trees 20-29 (Table 9) .The lowest number of respondents (4.44%) were found between the number of date palm tree 90-100 (Table 9).

In the study area, 1509 date palm managed by 50 households, from four different sites namely agricultural field, road side, homestead and pond side in Jessore district. The percentage of date palm in Jessore sadar was 28.16% and in Abhynagar was 38.04%. The lowest percentage of date palm in Jikargacha was 33.73% (Fig.5). The similar study was found by Shaheed and Halim (2008) in Chuadanga district. They observed a total 2015 date palm managed by 36 households, from seven different sites namely agricultural field, road side, homestead ,pond side, canal bank, and orchards.



In the study area, 90 % respondents used date palm for fruit ,100% respondents used as fuel wood for making molasses and 44% respondents used for brick burning ,76% respondents used for seasonal juice that were used delicious cakes and drinking fresh juice of date palm. About 66% respondents used for mat production that were very widely used in domestic purposes in rural area. About 32% respondents used it for house making. Only 2% respondents used for Alcoholic beverage (locally called Tari).

## CHAPTER NINE: CONCLUSION AND RECOMMENDATION

### 9.1 Conclusion

Date palm is a major and economically very important species in south-east Asia. It plays an active role in the contribution to the rural economy to the cultural heritage of the countrymen. The farmers are applying solely indigenous knowledge of their own in the farming and management of this resource, exerting a sustainable manner of utilization. An attempt had taken in Abhynagar, Jessore sadar and Jikargacha upazilla of Jessore district to know the present condition of date palm farming and utilization pattern. Now a days, date palm cultivation farmer is decreasing day by day because they are participating in other occupations. So, this species are decreasing due to lack of proper take care. If we want to preserve this traditional species, local people, public and private sector combindly should take necessary steps to preserve this species.

### 9.2 Recommendation

- ❖ People awareness should be increased about the utilization as well as economic importance of date palm.
- ❖ The scientific management of date palm during cultivation should improve date palm production in the study area.
- ❖ The use of date palm trees in the brick burning industrias should be banned.
- ❖ Date palm plantation should be raised in agricultural field, road side, homestead and pond side for increasing date palm plantation.
- ❖ Date palm should be raised in each homestead for increasing date palm plantations.
- ❖ Only dead tree should be used for poles in the country.
- ❖ Adopting scientific methods should also minimize the pest and diseases attack of this species.

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Land size of cultivated area	Small(up to 1 ha) / medium( 1-1.50 ha)	Large( up to 1.50 ha)
Cultivate member of the family	1 /2	more
Gender of household head	Male	Female
Occupation of household head	Farming /job/labour	others

### 3. Farming

- Do you plant date palm :      Yes      No
- Have you any farm for date palm:    Yes      No
- Cultivation pattern :    Orchard /    Scattered trees    /    intercropping
- Location of your cultivation area : roadside / pond bank / field / home garden
- How many plant do you have \_\_\_\_\_
- Ownership status: Own land/Leased
- Is it grow naturally or plantation: yes/ No/ don't know
- Do you practiced by yourself : yes/no
- Would you say that your profession is profitable: yes/No
- How long time are they practice    date palm plantation: \_\_\_\_\_
- How many people are    you need    for your cultivation:2/1/only own
- How    many of plants do you have for your sap production\_\_\_\_\_
- Do you practiced by yourself : yes/no
- How much    sap produce per tree per day:1liter/6-7liter/3liter/more
- Rate of conversion of juice to molasses from \_\_\_kg of juice \_\_\_kg molasses produced.
- Sources of seedlings of date palm: home garden/ own/others/fallow land

#### 4. Mat production

- Which plant are you use to make mat : mature/young/ very young
- What size of mat are you produce:4/5hand
- How much time are required for your mat design: 1day/2 days/1 week
- Which season are they select for mat production \_\_\_\_\_
- How many mat are produced per season: 1 -2 pieces/2-3 pieces/no one
- Do you sell it to the market: yes /no
- What is the price of it: 300-400/180-200/more
- Amount of selling mat \_\_\_\_\_ pieces
- Amount of used mat \_\_\_\_\_ pieces
- How much leaves are you need for mat:18-19/12-13/8-10

#### 5. Utilization:

Use of date palm	yes	No		Yes	No
Fruit			Juice		
Fuel wood			Patali		
Brick burning			Mat production		
Poles			Alcoholic beverage(Tari)		

#### 6. Age class distribution of date palm in the study area

Site	Age classes(years)						
	>5-7yr	>7-14 yr	>14-21yr	>21-28yr	>28 yr	Total	Percentage
Canal bank							
Road side							
Homestead							
Pond bank							