

**APPENDIX G**  
**GUIDELINES ON PLANTING NEARSHORE MANGROVE FORESTS**

**G1. DETERMINING THE BELT WIDTH OF MANGROVE FORESTS WITH REQUIREMENTS OF WAVE ATTENUATION CORRESPONDING TO DIFFERENT STATUS OF MANGROVE FORESTS**

**1. Determining wave-attenuating coefficient**

- The reduction of wave height by means of mangrove forest is normally interpreted by the value of  $K_t$  (wave-attenuating coefficient)

$$K_t = \frac{H_d}{H_0}$$

where,  $H_d$  - Wave height at the dike toe;

$H_0$  – Wave height in front of mangrove forest belt.

- According to Quartel (Quartel et.al, 2007), wave-attenuating coefficient ( $R$ ) can be calculated as follows:

$$R = \frac{H_0 - H_d}{H_0} = 1 - K_t \quad (1)$$

Both  $K_t$  and  $R$  depend on the width of mangrove forest belt ( $x$ ) and status of mangrove forests. On the other hand, each status of mangrove forest is characterized by a value of wave-attenuating parameter ( $r$ ).

The correlation between the coefficient  $K_t$  and  $r$  is shown by the following formula:

$$K_t(x) = e^{-rx} \quad (2)$$

- Wave-attenuating coefficient ( $K_t$ ) can also be determined by the following formula devised by Vuong Van Quynh et al. (2010) as follows:

$$K_t = e^{-bx} \quad (3)$$

Equation (3) is identified with equation (2), meaning that value of  $b$  in the formula of Vuong Van Quynh et al. (2010) can be identified with the value of  $r$  in the formula of Quartel (2007).

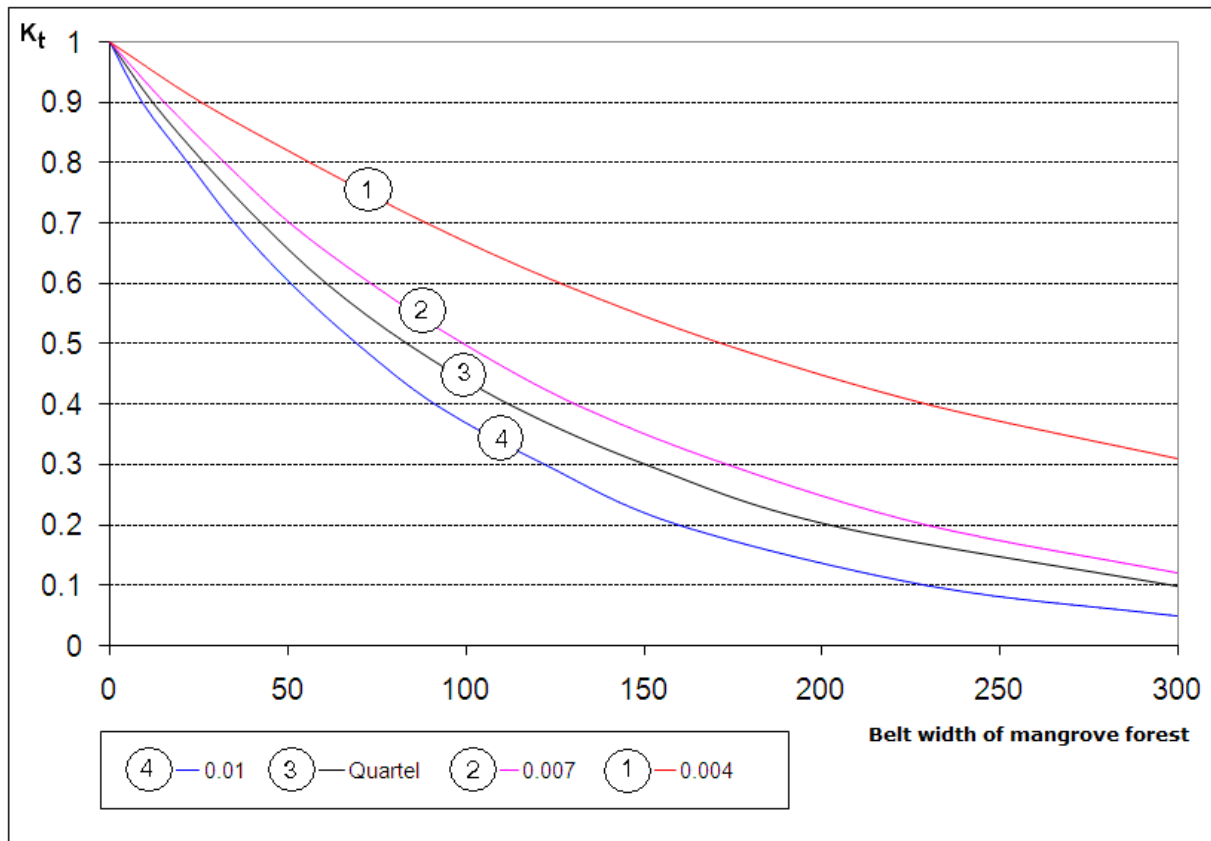
- From actual surveys and analyses, wave-attenuating parameter ( $r$ ) for different status of mangrove forest can be determined as follows:

***Wave-attenuating parameter ( $r$ ) corresponding to different status of mangrove forests***

<b>Status of mangrove forest</b>	<b>Wave-attenuating parameter <math>r</math></b>
Thick	0.010
Medium	0.007
Sparse	0.004

## 2. Determining the belt width of mangrove forest with pre-defined values of wave-attenuating coefficient ( $K_t$ )

- The belt width of mangrove forest with certain values of wave-attenuating coefficient ( $K_t$ ) can be determined by the methods of Quartel (2007).



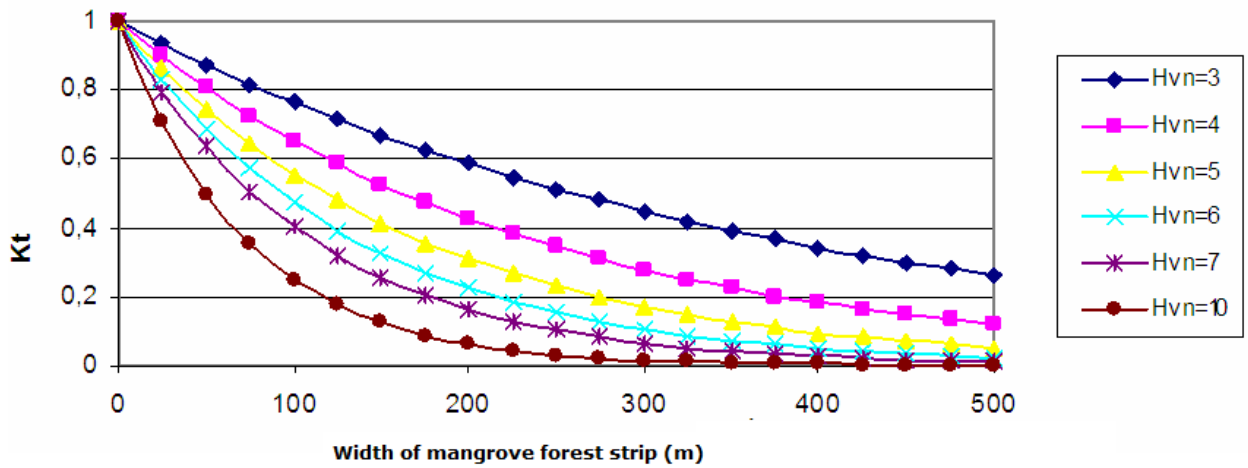
**Figure 1.** *Correlation between the belt width of mangrove forest and wave-attenuating coefficient*

Figure 1 shows the wave-attenuating coefficient ( $K_t$ ) corresponding to different width of mangrove forest belt in different actual status.

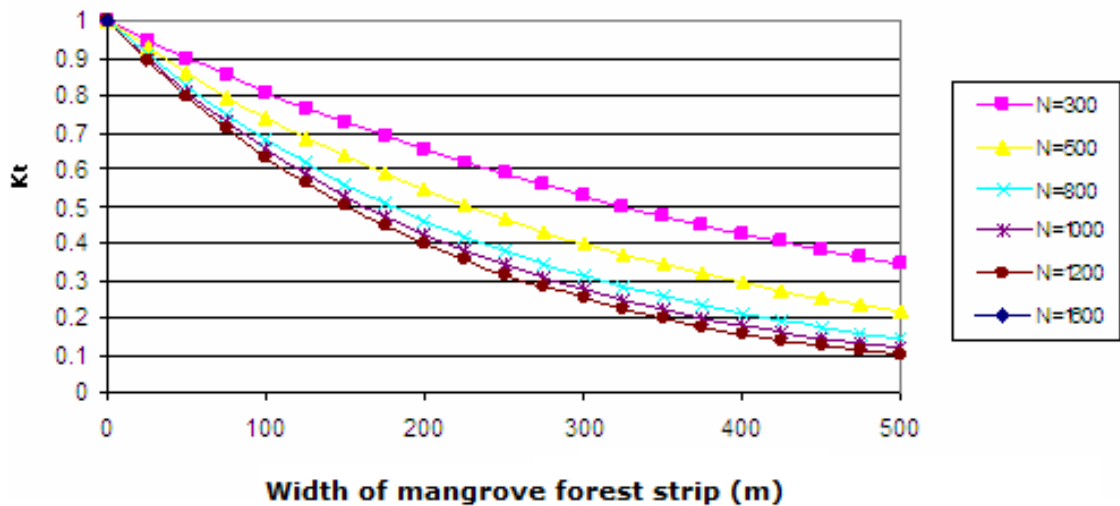
It can be seen that the curves illustrating correlation between wave-attenuating coefficient and width of mangrove forest belt are equivalent to the calculation results made by Quartel (2007). Curve 4 is used for thick mangrove forests, curve 2 for medium mangrove forests; curve 1 for sparse mangrove forests. Curve 3 is the calculation results made by Quartel.

Thus with available status of mangrove forests (thick, medium or sparse), the wave-attenuating coefficients ( $K_t$ ) corresponding to certain width of mangrove forest belt can be determined, and can be used in the design of sea dikes in those areas.

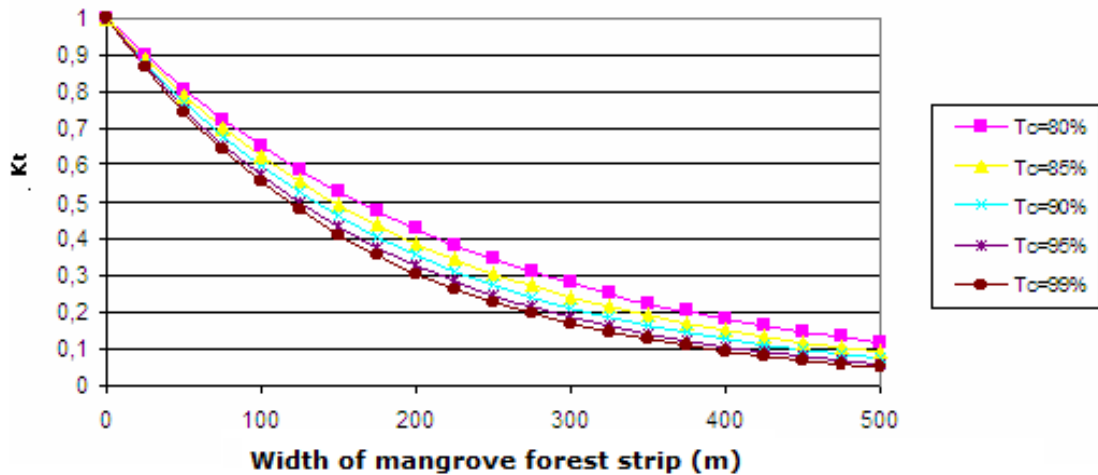
- Apart from the method of using the graphs of Quartel in the design of mangrove forest belts (with existing status of mangrove forest), the graphs presented in Fig. 2, 3 and 4 can also be used in specific cases. These graphs illustrate the relation between wave-attenuating coefficient and the belt width of mangrove forest in conditions that the top height (Hvn:m), density (N: plants/ha) and foliage coverage (TC: %) are variable while the others are constant.



**Figure 2** - Required width of mangrove forest belt and corresponding wave-attenuating coefficient (with a density  $N = 10,000$  plants/ha and foliage coverage  $TC = 80\%$ ).



**Figure 3** - Required width of mangrove forest belt and corresponding wave-attenuating coefficient (top height of mangrove  $H_{vn} = 4m$  and foliage coverage  $TC = 80\%$ )



**Figure 4** - Required width of mangrove forest belt and corresponding wave-attenuating coefficient (with a density  $N = 10.000$  plants/ha and top height of mangrove  $H_{vn} = 4m$ ).

\* Note:

Density (N) - number of mangrove per hectare;

$H_{vn}$  – Top height of mangroves, which is the height measured from the ground to the highest growing top (unit: meter (m));

$H_{dc}$  – Height of lowest branch, which is the height measured upwards from the ground to the first branch of mangroves (unit: meter (m));

Foliage coverage (TC) – the ratio between the total projection area of mangrove foliage on horizontal surface and the ground are (unit: per cent, %).

\* Method for the determination of foliage coverage:

The tool used to determine the foliage coverage is tape-measures. These tape-measures are put along the straight lines at a constant distance of 3m in standard cells. At each round values on the tape-measures (called surveying points of foliage coverage), use a pole to observe upwards in vertical direction. In case of no foliage coverage is observed, this value should be filled as zero (0). The foliage coverage of mangrove forests is defined as the ratio between the total number of surveying points where the value of foliage coverage is equal to 1 and total number of surveying points. In case the total number of surveying points is greater than 80, the error in the determination of foliage coverage is less than 5%.

## G2. PLANTING TECHNIQUES FOR SOME TYPES OF MANGROVES

### 1. *SONNERATIA CASEOLARIS*

In nature, *Sonneratia caseolaris* is usually located in the coastal and estuarine alluvial deposit with brackish water. *Sonneratia caseolaris* is a lucipetal woody plant

with a height of 15-20m and diameter of 40-60cm, can grow well in soft muddy soil and withstand frequent impacts of strong wind and high waves.

### **1.1 Planting techniques**

*Sonneratia caseolaris* is usually planted on shallow tidal plain (less than 70cm), therefore seedlings grown in planting pot of PE type with a required height of more than 100cm, and required age of 18-24 months.

#### **a. Planting season**

From June to August annually, depending to the specific conditions in each areas.

#### **b. Selection of soil for planting**

The most appropriate type of soil for planting *Sonneratia caseolaris* is stable coastal muddy flats. *Sonneratia caseolaris* can also be planted at the locations with high rate of aggradation or being eroded, in combination with other supporting methods.

#### **c. Planting density**

On aggraded beaches, the applied density is from 1.600 plants/ha (2,5m x 2,5m) to 5.000 plants/ha (2m x 1m) depending on the purpose and natural conditions.

#### **d. Planting techniques**

Make sure that the top of these plants is at least 25 cm above the water level.

### **1.2 Care and protection**

#### **a. Caring**

20 days after planting, replace the dead plants and restoring the fallen ones. If the leaves of seedlings are eaten by pests or the trunks of seedlings are covered by teredo worms (or shipworms), pesticide must be sprayed at low tides.

#### **b. Protection**

Throughout the planting stages and many years after, no fishing activities or navigation is allowed within the range of mangrove planting. In addition, cattles should be kept away in order to protect the growth of these mangroves.

## **2. AVICENNIA SP.**

There are 3 types: *Avicennia officinalis*, *Avicennia alba* and *Avicennia marina*. *Avicennia officinalis* usually grow on richly organic muddy soil along the river or on inner areas submerged in salt-water. *Avicennia alba* and *Avicennia marina* can grow on muddy flats with high tidal level and high salinity (25-30‰), under frequent impacts of waves and wind.

*Avicennia* sp. have aerating (or pneumatophores) spike-shaped root system, rising above the ground by 20-30 cm. With this root system, they can withstand the

impacts of waves, wind etc., having great ability to adapt to high salinity, moderately dense and clay-rich soil.

*Avicennia alba* is an highly important types of mangrove; it is considered the primary plants in seaward encroachment at alluvial flats.

### **2.1. Planting techniques**

#### *a. Improving the soil composition*

+ Method of improving: Replace all of the soil in planting holes by fertile alluvial soil;

+ Dimension of excavated holes: edge 0,7m x 0,7m , base 0,6m x 0,6m, depth 0,6m in lines parallel to sea dike routes;

+ Distance between holes: 2m x 2m.

+ Alluvial soil: make use of the alluvial layer on the surface;

#### *b. Standards of seedlings to be planted*

+ Height  $\geq$  0,7m

+ Diameter of trunk base  $\geq$  1cm

+ Growing period of seedlings in planting pots is 10-12 months;

+ Healthy growth without crushed or broken main trunks or branches, breakage of planting pots and pests.

#### *c. Planting density and seasons*

+ Density: 2500 plants/ha (*distance from plant to plant is 2m, distance between rows is 2m*)

+ Planting season: from August till September.

#### *d. Planting techniques*

After the local improvement of the soil base, planting holes are dug with dimensions of 30 x 30 x 30cm, accompanying by planting the seedlings (in order to prevent the outwash of newly-improved alluvial soil). Tear the cover of planting pots, put them in the middle of excavated holes, keep the plants in vertical direction and fill the entire holes with rich soil compacted around and above the base, forming a mound around the trunk base in order to keep the plants stable.

Pole driving and string fastening: after planting, poles with a length of 1m, diameter of 3cm and depth of 0,5m are driven diagonally into the hole side next to the plants, then the trunks are tied to the poles by nylon strings in order to withstand the impacts of waves, wind and current.

## **3. RHIZOPHORA APICULATA BL.**

### **3.1. Planting techniques**

#### *a. Improving the soil composition*

+ Method of improving: Replace all of the soil in planting holes by fertile alluvial soil;

+ Dimension of excavated holes: edge 0,7m x 0,7m , base 0,6m x 0,6m, depth 0,6m in lines parallel to sea dike routes;

+ Distance between holes: 2m x 2m.

+ Alluvial soil: make use of the alluvial layer on the surface;

*b. Standards of seedlings to be planted*

+ Height  $\geq$  0,8 m;

+ Diameter of trunk base  $\geq$ 1,2 cm;

+ Growing period of seedlings in planting pots is 7-9 months;

+ Healthy growth without crushed or broken main trunks or branches, breakage of planting pots and pests.

*c. Planting density and seasons*

+ Density: 2500 plants/ha (distance from plant to plant is 2m, distance between rows is 2m)

+ Planting season: from July till October.

*d. Planting techniques*

After the local improvement of the soil base, planting holes are excavated with dimensions of 30 x 30 x 30cm, accompanying by planting the seedlings (in order to prevent the outwash of newly-improved alluvial soil). Tear the cover of planting pots, put them in the middle of excavated holes, keep the plants in vertical direction and fill the entire holes with rich soil compacted around and above the base, forming a mound around the trunk base in order to keep the plants stable.

Pole driving and string fastening: after planting, poles with a length of 1m, diameter of 3cm and depth of 0,5m are driven diagonally into the hole side next to the plants, then the trunks are tied to the poles by nylon strings in order to withstand the impacts of waves, wind and current.

## **4. NYPA FRUTICANS**

### **4.1 Selection of planting soil base**

Salinity and tidal submergence are important conditions for the existence of *Nypa fruticans* (Watson-1928, De Haan- 1931 at Chapman-1975; Aksornkoae-1987, Untawale-1987). In Vietnam, *Nypa fruticans* grow well in coastal and estuarine areas with low salinity.

Appropriate soil base for planting *Nypa fruticans* is the areas with relatively firm soil base. The average tidal submergence at high tides occurs during the day. Highest salinity in dry season is approximately 6 ‰.

## **4.2 Planting techniques**

The breeding fruits can be conserved for 2 months in brackish water along the canals and ditches and then be planted directly. The sprouting ratio can reach 90%, and surviving ratio can be greater than 75%.

Seedlings after being grown (directly in furrows or in planting pots with PE-typed bags) for at least 2 months, with heights of more than 24cm can be planted in the beginning period of monsoon (in June). If the seedlings grown directly in furrows are planted, the mud around their roots must be gently washed off during high tides before digging so as not to break the roots, as seedlings have many fasciculated roots which penetrate into the ground.

Plant the seedlings of *Nypa fruticans* with a density of 2500 - 4400 plants/ha (distance 2m x 2m or 1,5m x 1,5m).

Dig planting holes with dimensions of 40cm x 40cm x 40cm (in case of plants with aerating roots and grown in furrows, these holes should be smaller), place the seedlings into these holes; if these seedlings are grown in PE bags, the covers must be tear off before placing; fill the holes with compacted soil, and then water these plants in order to ensure the stabilization these plants.

In Southwest estuarine areas of Vietnam, *Nypa fruticans* are usually planted on the banks of rivers, ditches and frequently submerged areas. *Nypa fruticans* grow best in the areas with moderate salinity (Choudhury 1968, Das & Siddiqi 1985). In Ben Tre province, *Nypa fruticans* are located in the areas with low tidal submergence during ebb tides, and grow well in brackish water during high tides.

## **5. THESPESIA POPULNEA**

### **5.1 Planting techniques**

#### ***a. Standards of seedlings***

Height of 30-35cm, with 10-12 leaves, straight trunks and regular foliage, without pests.

#### ***b. Selection of planting soil***

*Thespesia populneas* grow well on clayey sand at relatively high elevation; therefore these plants are located on high mounds or shrimp ponds.

#### ***c. Vegetation clearing***

Before planting, variable types of the vegetation must be cleared.

#### ***d. Planting season***

*Thespesia populneas* are planted in rainy season, June-July annually.

#### ***e. Planting density***



*Thespesia populneas* can be planted with different densities, varying from 1600 to 4000 plants/ha depending on the geological conditions, breeding sources and local social-economic conditions.

#### ***f. Techniques and arrangement of planting space***

*Thespesia populneas* are usually planted homogeneously. However, they can be blended with *R. apiculata* in clusters. *Thespesia populneas* are planted on elevated ground and *R. apiculata* on the ponds/fields.

### **5.2 Care and protection**

7-10 days after planting, the dead plants should be replaced. In case of poor soil with stunted plants, supplementary fertilization must be carried out.

The prevention and extermination of leaf-eating or stem-mining pests must be done frequently.

## **6. CERIOPS TAGAL PERS**

### **6.1 Introduction**

*Cerrop taga* is usually planted on the soil base behind the belt of *Avicennia* and *Sonneratia* forests. The base is composed of soft, compacted or hard muddy soil; heavy or sandy soil. The daily tidal submergence occurs for 4 hours. In case of elevated ground with compacted or highly compacted soil and in case the daily submergence only occurs during high tides, the ground level can be lowered in order to increase the submergence level and aggradation rate. In comparison with *Rhizophora apiculata*, *Cerrop taga* has smaller biomass.

Attention has been focused on *Cerrop taga* in recent years in order to form the mangrove forests, especially on elevated ground with limited tidal submergence.

### **6.2 Planting techniques**

#### ***6.2.1 Direct planting of seed stalks***

Plunge the tail end of *Cerrop taga* fruits into the mud to a depth of 5-8 cm (approximately 1/3 of left length).

During the first year, the caring activities include watering control, ensuring the planting densities, minimizing the damage to the seedlings caused by fiddler crabs, king crabs, etc.

#### ***6.2.2 Planting with seedlings grown in the pots***

The seedlings grown in planting pots have growing period of 8-12 months in the nursery gardens. Before planting, holes with dimensions of 20x20x20 cm must be dug. The covering bags of planting pots must also be torn off. The seedlings are then placed in vertical direction into the holes with the neck of the roots at the same level as the ground, and after that fill the holes with soil without touching the planting pots.

## **7. EXCOECARIA AGALOCHA**

### **7.1 Introduction**

*Excoecaria agalocha* are small lucipetal, woody plants, with heights of 5 - 12m, grow on relatively hard sandy loam, usually along the elevated canals and ditches. In case of poor soil, braching appears near the ground. These plants are located in 3 regions (North, Central and South) of Vietnam.

Their leaves are alternate, with oval shape, acute apex, thick and stiff. All the elements of these plants contain white toxic resin, especially to human eyes and skin, however this type of resin is water-soluble, therefore in case the resin drop onto the skin, it must be washed off immediately with clean water.

These plants produce male flowers separating from female ones. The blooming season is at the beginning of summer, and the ripening season is in the period from August till September. Each fruit has 3 seeds.

Each kilogram has about 2000 – 2500 seeds. *Excoecaria agalocha* grows near the rivers, in the areas where submergence only occur during high tides. If these plants are not cut down, they can develop into homogeneous forests, for example in Can Gio - Ho Chi Minh City. These plants have wide and strong root system with efficiency in soil protection.

### **7.2 Planting techniques**

In Bangladesh, the 1-year-old seedlings are used for planting with higher surviving ratio. However, the nursery gardens are better solution to plant this type of mangroves along the river banks. At the end of August and at the beginning of September, the ripe fruits are picked and then rubbed gently so that the seeds are separated from the fruits. The fallen seeds including sprouted ones can be gathered and then they are placed into the planting pots. The seeds are sown in planting pots with sandy soil, decomposed cow dung and sufficiently warm water. After 10 months, when the seedlings are 40-70cm high, they can be used for planting. With this method, the surviving ratio can reach more than 95%.

## **8. LUMNITZERA RACEMOSA WILLD**

*Lumnitzera racemosa willds* usually grow on compacted muddy soil, with tidal impacts. They can withstand the submergence by fresh water for a long period, and also the environment with high salinity.

*Lumnitzera racemosa willds* have large adapting range, from low to high tidal submerged areas. However, these plants can grow best in medium and high tidal submerged areas.

## **8.1 Techniques for picking and conserving seeds**

The ripening season is in the period of August till October, the best time for seed reaping is in September when the fruits are still on these plants.

The breeding fruits are exposed to the sunlight after being picked in order to reap the seeds, and then these seeds are placed in the sun to be dried off and stored in cool places.

## **8.2 Growing seedlings**

- Method 1: Form the seedlings in nursery gardens by the method of immersing the seeds in water within 24 hours, then pick up, soak and sow them in the sprouting trays. When cracking appears, these seeds are transplanted into the planting pots.

- Method 2: Sow the seeds directly on the furrows.

## **8.3 Care of seedlings**

When caring seedlings, attention must be paid to frequent watering. In case of submerged nursery gardens, tidal water can go up and down everyday.

After caring period of approximately 8 to 10 months, these seedlings are 30-40 cm high and can be used in planting.

## **9. LUMNITZERA**

### **9.1 Introduction**

*Lumnitzera* is a small woody plants of mangrove forests, with a height of 5-15cm and diameter of 20-30 cm. The branching appears near the ground, with developed foliage, rapid growth during the initial stage and then become slower gradually.

In nature, *Lumnitzera* usually grows on argillaceous or loamy sand, interlaced in the tidal submerged areas.

### **9.2 Planting techniques**

#### ***a. Standards of seedlings***

The seedlings of *Lumnitzera* to be planted must grow normally, with no pest, age of 10-12 months and height of 30-35cm.

#### ***b. Selection of planting soil***

*Lumnitzera* are planted on the banks of shrimp ponds. The best types for planting are argillaceous sand, loamy sand and medium argillaceous soil.

#### ***c. Planting seasons***

At the beginning of rainy season, June-July annually.

#### ***d. Planting density***

Depending on topographic and geological conditions, breeding sources and purpose of planting, appropriate density can be determined. *Lumnitzera* can be planted homogeneously with a density varying from 2500 plants/ha to 5000 plants/ha.

### ***e. Planting techniques***

Similar to *Avicennia*. These plants can be planted homogeneously or heterogeneously.

## **9.3 Care and management**

### ***a. Replacing plants***

Replace the dead plants after the first inspection.

### ***b. Fertilizing***

If the plants are stunted, NPK-typed fertilizer must be used.

### ***c. Prevention of pests***

These plants are usually destroyed by leaf-eating or stem-mining pests or king crabs. In the first 3 years after planting, crabs or little (or three-striped) crab catching is prohibited within the planting area. During this period, the vegetation around the base must be cleared, and the ground must be loosened in order to ensure the healthy growth of these plants. In the 5<sup>th</sup> year, some branches near the trunk base must be trimmed.

## **10. KANDELIA CANDEL**

### **10.1 Introduction**

*Kandelia candels* are woody plants with low branching, broadened base, white flower, irregular cylindrical seed stalks which are called “fruits”. These plants usually grow well in alluvial soil with medium tidal submergence in brackish water, and grow more slowly on sandy soil. The ripening season is at the end of April till the beginning of May. There are usually 70 – 90 fruits in 1 kilogram of *Kandelia candels*.

### **10.2 Planting techniques**

*Kandelia candels* should be planted with a density of 20.400 plants/ha (approximately 0,7x0,7cm).

Small ropes can be used with knots corresponding to above-mentioned dimensions, and the seedlings are planted along these straight ropes. The most simple method is to use a bamboo tube or large bamboo pole with a length of 3m, bound up with a length of 10cm and distance of 0,7 x 0,7m (similar to a rake). This tool is pulled along a straight line on the muddy surface. It is then pulled in perpendicular direction to form the marking squares.

The seedlings are kept in a basket, aluminium or plastic pans. These containers are dragged on the muddy surface while plunging the seedlings into the muddy soil along the tracks during ebb tides.

The acute apexes of seed stalks are plunged into the mud to a depth of 4 – 5cm (approximately 1/3 of the fruits). Make sure the depth is not too great as the plants are likely to die, but not too shallow as they can be washed out by waves.

In case of relatively hard soil, use a small and pointed bamboo rod, with a diameter of 10 – 12mm, and length of about 40 – 50cm, to form a hole; then compact the soil around the plant manually so as not to be washed out by waves or currents during high tides.

When planting, the plants with broken tops should be removed, as they grow very slowly and some of them die after 15 days or 1 month.

*Kandelia candels* is an adaptive type of plant, with relatively high surviving ratio, which can reach 90% in case of good care and protection.

These plants blossom after about 2 years of growing. In the first several years, the fruits should not be used for breeding. The older the plants are, the better breeding will become.

However, in the beginning stages, after the seed stalks are planted, *Kandelia candels* are usually spoiled by shipworms and as a result the surviving ratios decrease rapidly. Therefore nowadays the seed stalks of *Kandelia candels* are usually grown in the planting pots with PE-typed bags during a period of 18-24 months, their heights can reach 70-100cm, and can be planted with densities of 2.500 – 10.000 plants/ha, ensuring high surviving ration and healthy growth.

## **11. BRUGUIERA GYMNORRHIZA**

### **11.1 Introduction**

In Vietnam, there are four types of *Bruguiera gymnorrhiza* with heights of 25 – 35m, but in the North their height is only 6 – 8m. There are some stilt roots with no branching on their trunks.

The trunk base usually have broadened parts; there are many knee roots around the base. The leaves are thick, with acute apex and young petiole, usually in purple colour. The flowers have many conical cage-shaped leaves, growing with fruits. Seed stalks are big, with polygonal cross-sections and short sides: 15 – 25cm.

These plants usually grow at the same places as *Rhizophora stylosa*. They provide stiff wood used in construction, furniture, fire wood and coal mines. Seed stalks contain plenty of starches, which can be used as food for cattle. The fallen leaves and branches are food for some animals in tidal areas. The blooming season is from December till March. The picking season of seed stalks is from April till July (in Tien Yen, Quang Ninh); from June till July in Quynh Luu; and from June till August in Ha Tinh.

## **11.2 Planting techniques**

When planting, if seed stalks has separated from the fruits, make sure that the base part (which is stiff, pointed and same colour as seed stalks) is plunged into the mud. The pointed part is obtuser, with lighter colour and smaller. Otherwise, the wrong part (pointed part) could be plunged into the mud and consequently the plants will die.

### **a. Planting density and seasons**

+ Density: 2500 plants/ha (*distance from plant to plant is 2m, distance between rows is 2m*)

+ Planting season: from July till October.

### **b. Planting techniques**

After the local improvement of the soil base, planting holes are dug with dimensions of 30 x 30 x 30cm, accompanying by planting the seedlings (in order to prevent the outwash of newly-improved alluvial soil). Tear the cover of planting pots, put them in the middle of excavated holes, keep the plants in vertical direction and fill the entire holes with rich soil compacted around and above the base, forming a mound around the trunk base in order to keep the plants stable.

Pole driving and string fastening: after planting, poles with a length of 1m, diameter of 3cm and depth of 0,5m are driven diagonally into the hole side next to the plants, then the trunks are tied to the poles by nylon strings in order to withstand the impacts of waves, wind and current.

## **12. AEGYCERAS CORNICULATUM (L.) BLANCO**

### **12.1 Introduction**

*Aegyceras corniculatum (l.) blanco* is a small shrub, with a height of 0,5 – 3m, several trunks, small brown branches, sparse foliage, growing on river banks or alluvial flats.

*Aegyceras corniculatum (l.) blanco* can adapt to variable salinity. These plants are located in 3 regions of Vietnam. Their flowers are white and fragrant, with much nectar. They have small fruits growing in bunches with crescent shape and acute apex.

These plants are grown mainly for woods and pulp. Their most important value is in beekeeping (or apiculture), withstanding waves to protect dike system and preventing the erosion.

### **12.2 Planting techniques**

#### **a. Planting season**

The fruits of *Aegyceras corniculatum (l.) blanco* ripen from December to July. They can be picked and grown for seedlings during this period.

***b. Selection of planting soil***

*Aegyceras corniculatum (l.) blanco* is usually planted on muddy soil near the estuaries in brackish or salty water. The seedlings grown in pots with PE-typed bags can be planted with heights of more than 100cm.

***c. Planting density***

On aggraded beaches, the planting density is from 1.600 plants/ha to 5.000 plants/ha depending on specific purposes and natural conditions.

***d. Planting method***

The breeding fruits of *Aegyceras corniculatum (l.) blanco* can be plunged into the muddy soil. These fruits, however, can be washed out by waves; therefore it is recommended to grow them in planting pots, ensuring the sprouting after 3 weeks. After 10 months these seedlings is 30 – 40cm high, and can be planted with high surviving ratio.