CHAPTER III

METHODOLOGY

1. Study site

1.1 Study pond

The shrimp farm that was selected to be the study site belongs to UNICORD FEED CO. LTD. It locates in Tambon Klongkone, Changwat Samutsongkram. (Figure III-1) There are 19 shrimp ponds altogether. The selected pond is about 4 rai. Of this 0.85 rai is the study area. The rest is the slope edge and non-flattened area. The pond is far from the sea but with a small channel directly to the farm. There is also a large reservior for storing water. Water is pumped through sluice gate to the reservior every spring tide (every 15 days). There are two sluice gates, one for receiving water from reservior to the pond and other for draining water out of the pond to the wastewater channel prior draining to the sea. At present the pond is not in operation for a year and half due to low production. There is waterlog of rainwater in the pond. The physico-chemical properties of the pond is with soil texture is clay loam. Soil pH is 7.2 . The salinity of natural sea water is 18 ppt.
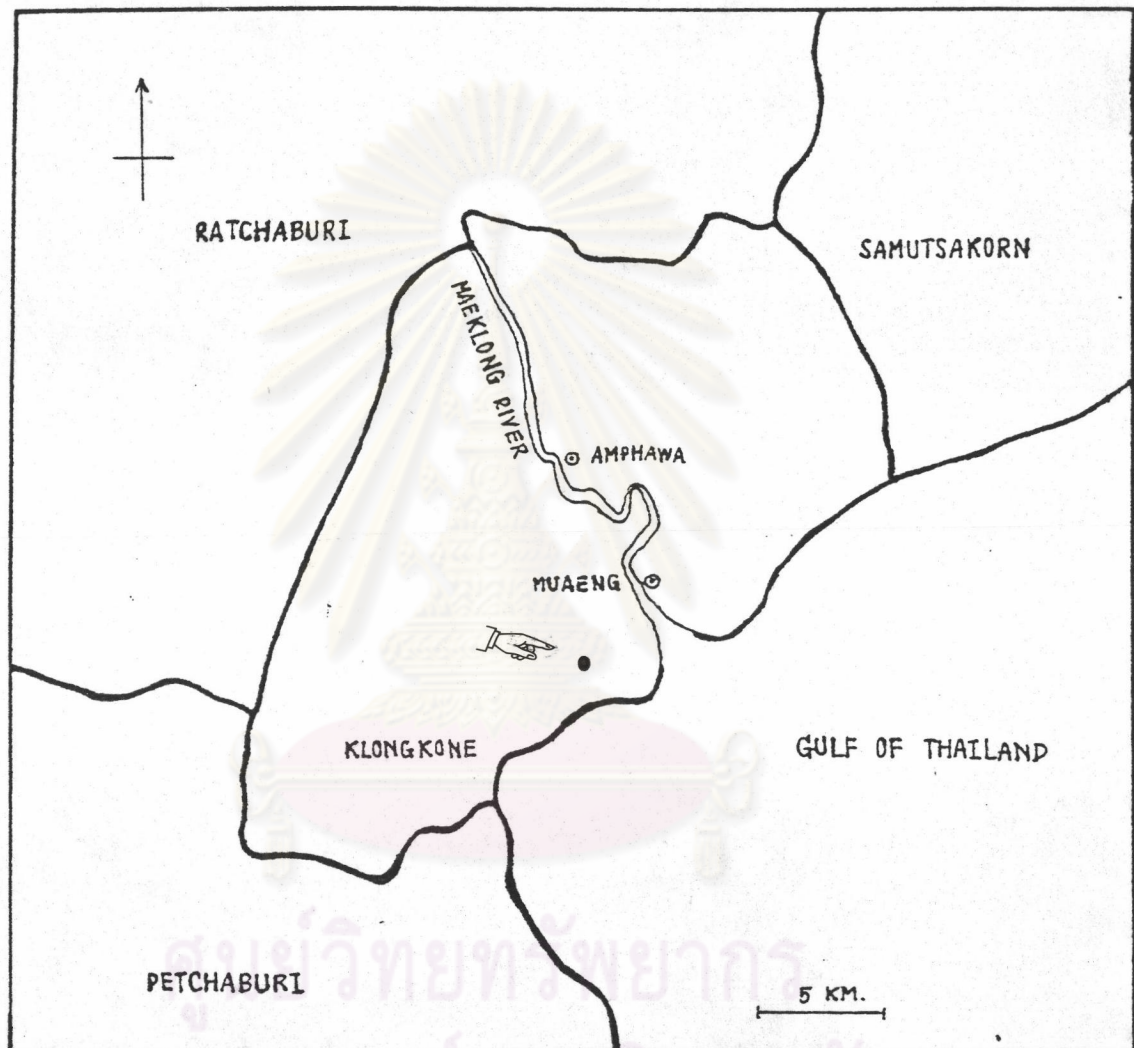
Figure III-1 The selected pond belongs to UNICORD FEED CO.,
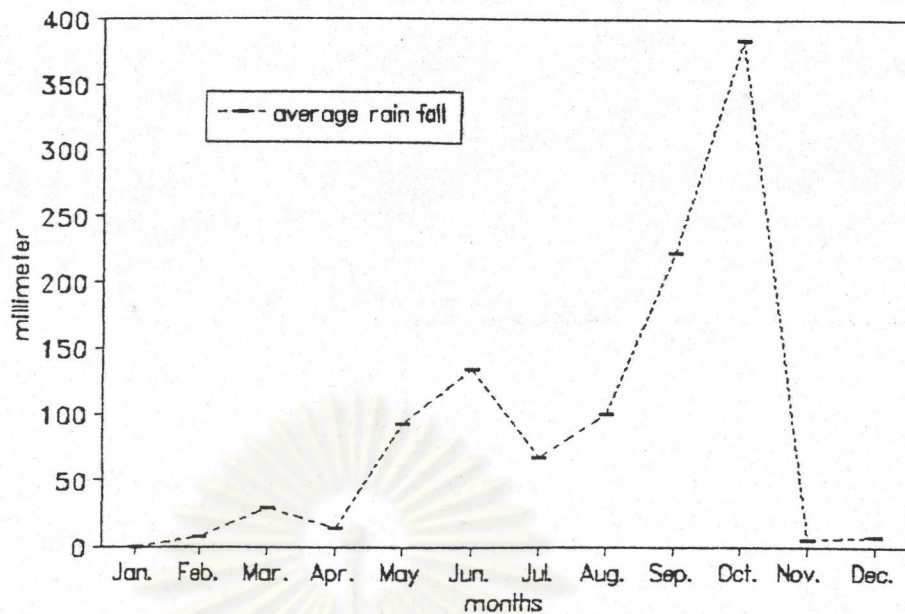LTD. located on Tambon Klongkone, Changwat
Samutsongkram.

Figure   III-2   Average rainfall in millimeter at Changwat

Samutsongkram during Feb.,1993 - Feb.,1994

(from Climatology Division, Meteorological
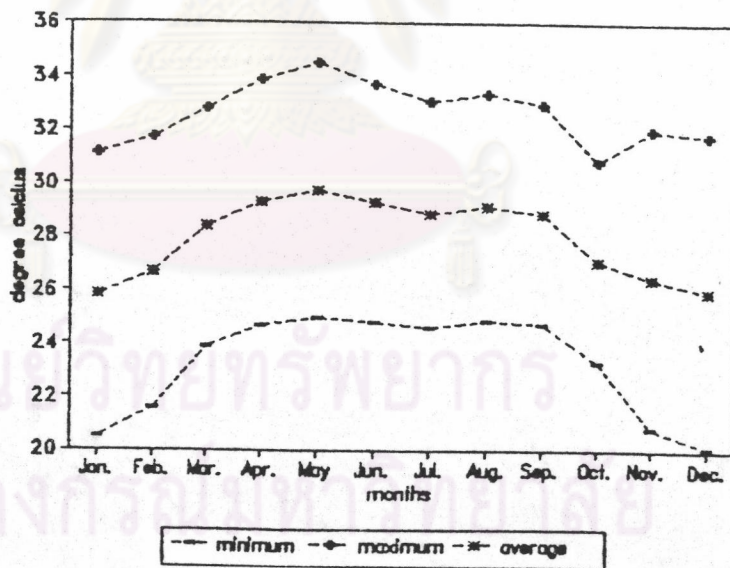
Department)

Figure   III-3   Average   temperature   in degree celcius at

Changwat Samutsongkram   during Feb., 1993-

Feb.,   1994 (from   Climatology   Division,
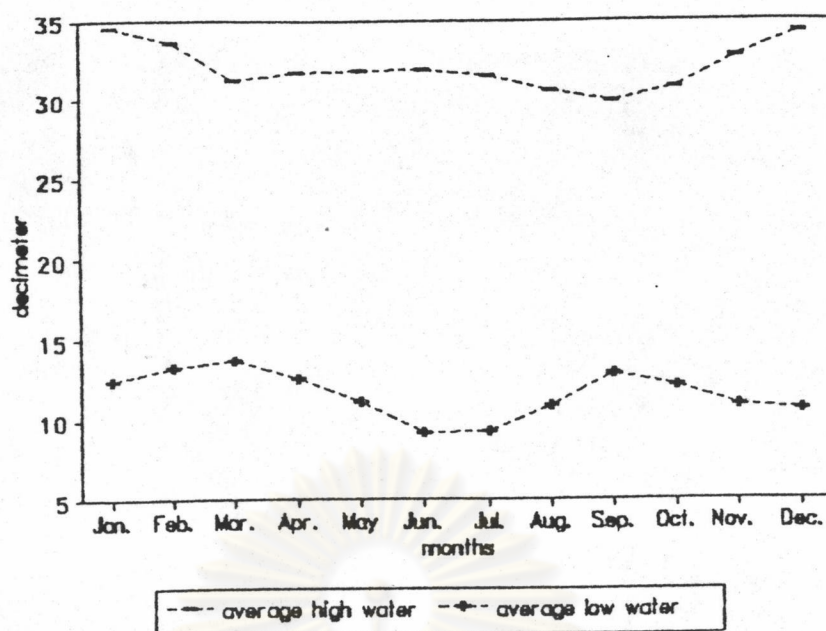
Meteorological Department)

Figure III-4 Average tidal range in decimeter at Changwat

Samutsongkram during Feb., 1993 - Feb., 1994

(Hydrological Department, Royal Thai Navy, 1993)

2. <u>Preparation of study site</u>

2.1 Preparation of pond

Freshwater was pumped out of the pond. The floor surface was cleared. Since the clearing of the dike was not possible, the seawater was pumped into the pond and drained out through the water gates. Water was drained daily synchronizing with the spring tides.

2.2 Soil sampling

Soil was sampling for physical and chemical analysis. The parameters for analysis were nutrients(potassium), soil salinity, pH and texture. These data were used as guide to select the suitable plant species and experimental design.

3. The Selected Species And Experimental Design

3.1 The Selected Species

The selected mangrove species are in Family Rhizophoracae. These are the economic species and high quality charcoal especially *Rhizophora sp.* The plants in this family are suitable for replantation in non-fertility area due to the fact that in the begining of growth, the seedling uses nutrient from the propagules. Over-ripe propogules were used for replantation.

3.1.1 *Rhizophora apiculata* (Figure III-5)

This species can grow in clay and floody soil at pH 6.6. The growth is rapid and can tolerate low salinity.

3.1.2 *Bruguiera gymnorrhiza* (Figure III-6)

Bruguiera gymnorrhiza can grow in sand and clay at neutral pH. The salinity range within 10-25 ppt. This species grow rapidly in this condition.

3.1.3 *Ceriops tagal* (Figure III-7)

This species grows in soft clay to hard clay at neutral pH. The optimal salinity is 20 ppt.
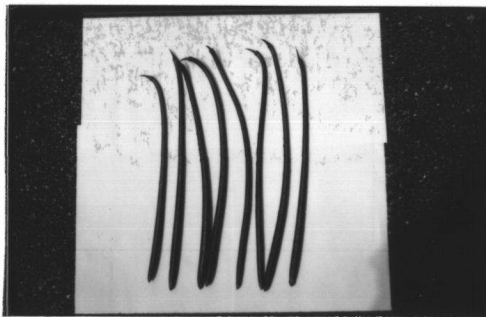
Figure III-5 *Rhizophora apiculata* seedlings

Figure III-6 *Bruiera gymnorrhiza* seedlings

Figure III-7 *Ceriops tagal* seedlings

4. Experimental design

Latin square was used in this experiment. The study area was divided into 3 plots. The area for each plot was 9 x 37 meters(Figure III-8). Each species were cultivated in each plot by random samplings at spacing 1 X 1 squaremeters in order to deminish the density effect. The area of each plot(subplot) was 9 X 9 squaremeters so the total number for each species per plot was 100 seedlings (Figure III-9).

5. The cultivation

The propagules were planted into the soil about one-third of the total lenght. After planting, seawater was pumped and drained into the pond daily synchronizing the spring tide. No fertilizer was added to the soil.

6. Data collection

6.1 Seedling

6.1.1 Survival rates

Each species were counted every two months for one year planting.

6.1.2 Height growth measurement

Choose the 50 seedling samples by incomplete randomize from 100 plants of each species for height measurement (Figure III-10). The height was recorded from the first node to the

the base of the shoot apex because the height of the propagule
and the distance from the propagule to the the base of the first
leaves pair were constant(Figure III-11). The measurement was
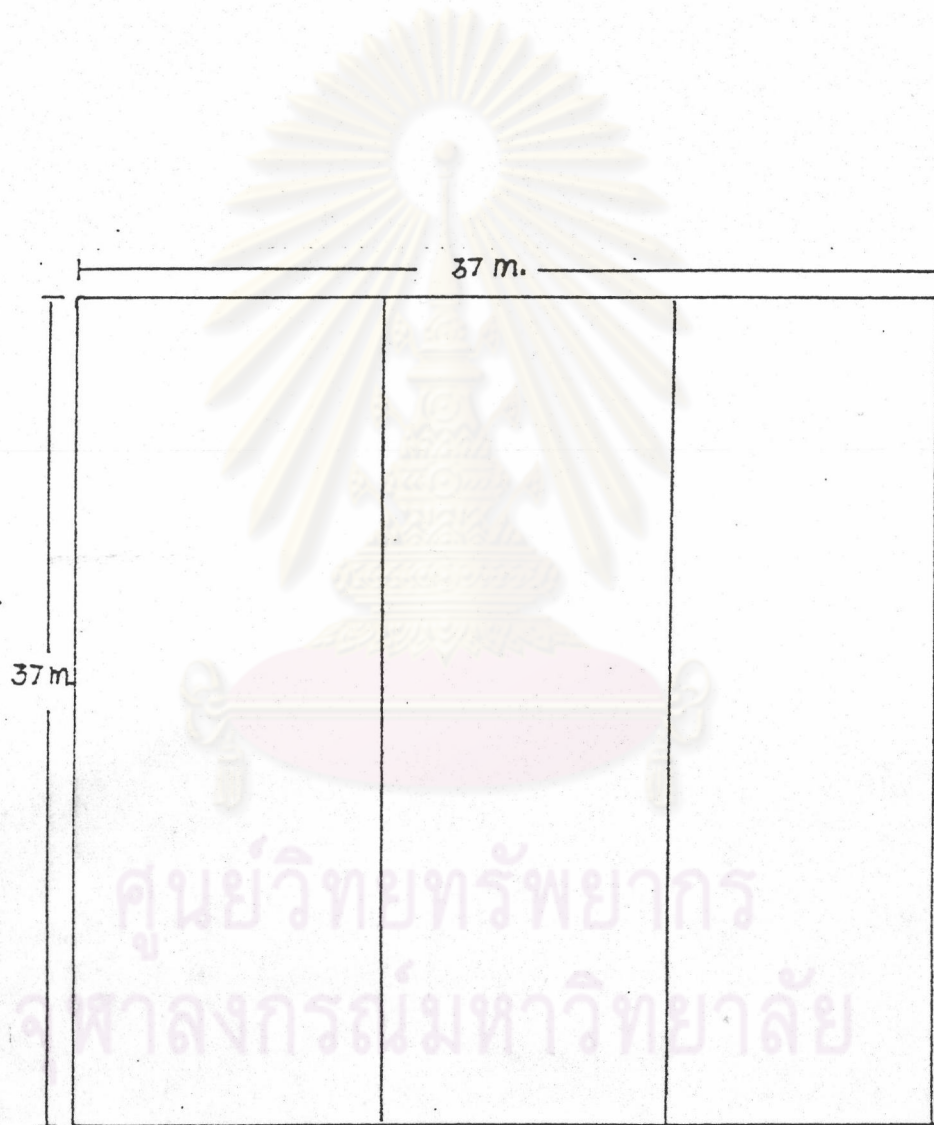carried out every two months for one year period.

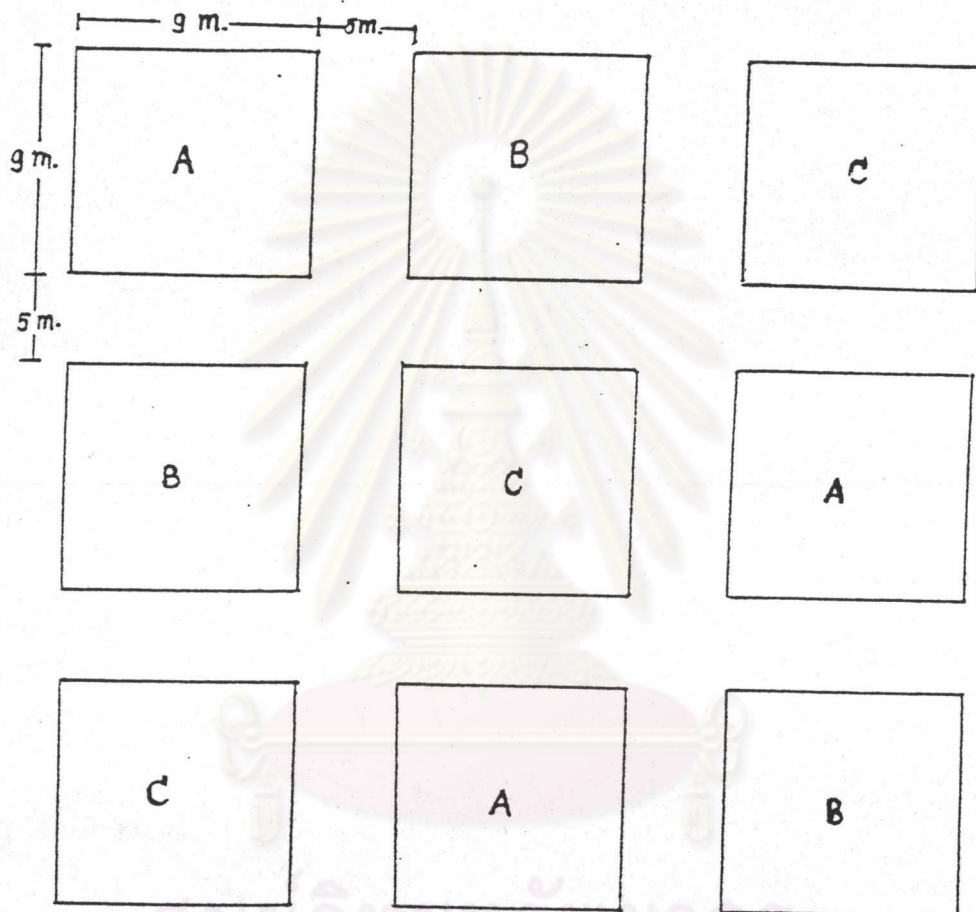Figure III-8 The study area is divided to 3 plots

Figure III-9 Latin square design for plantation

A : *Rhizophora apiculata*

B : *Brugiera gymnorrhiza*

C : *Ceriops tagal*

6.2 Soil

The five samples surface soil to approximately 15 centimeters were collected from each subplot, pooled and divided into three replications for chemical test. The first soil collection and analysis was carried out at the begining of replantation. They were consequently collected and analysed every four months for one year period.

6.3 Water quality measurement

Measurements of temperature, salinity , pH and dissolved oxygen were carried out every two months for one year period. Temperature and salinity were measured by SCT meter. Gem 310 Analouge pH meter was used for the measurement of pH while dissolved oxygen was measured by YSI—model 51B oxygen meter.

7. Data Analysis

7.1 Percent Survival

percent survival = S/N x 100

$\quad$ S – the number of plant that can survive

$\quad$ N – the number of plant from start(100)

7.2 Growth

mean height growth

$$\bar{H} = H/n$$

$\bar{H}$ – mean height of sample at that ages(cm.)

H – height of each sample at that ages(cm.)
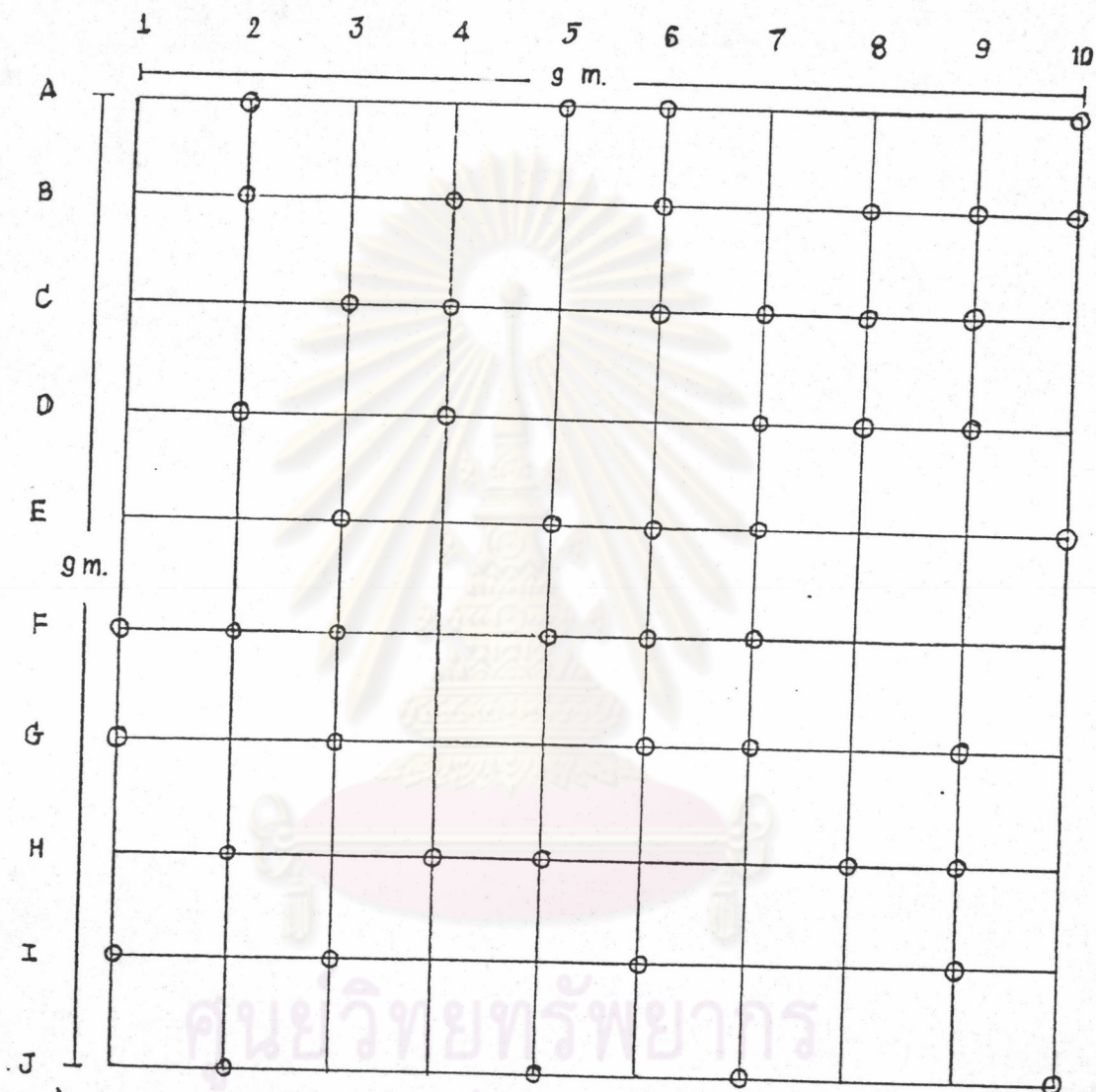
n – the number of sample(50)

Figure III-10 The 50 positions of seedlings were sampling

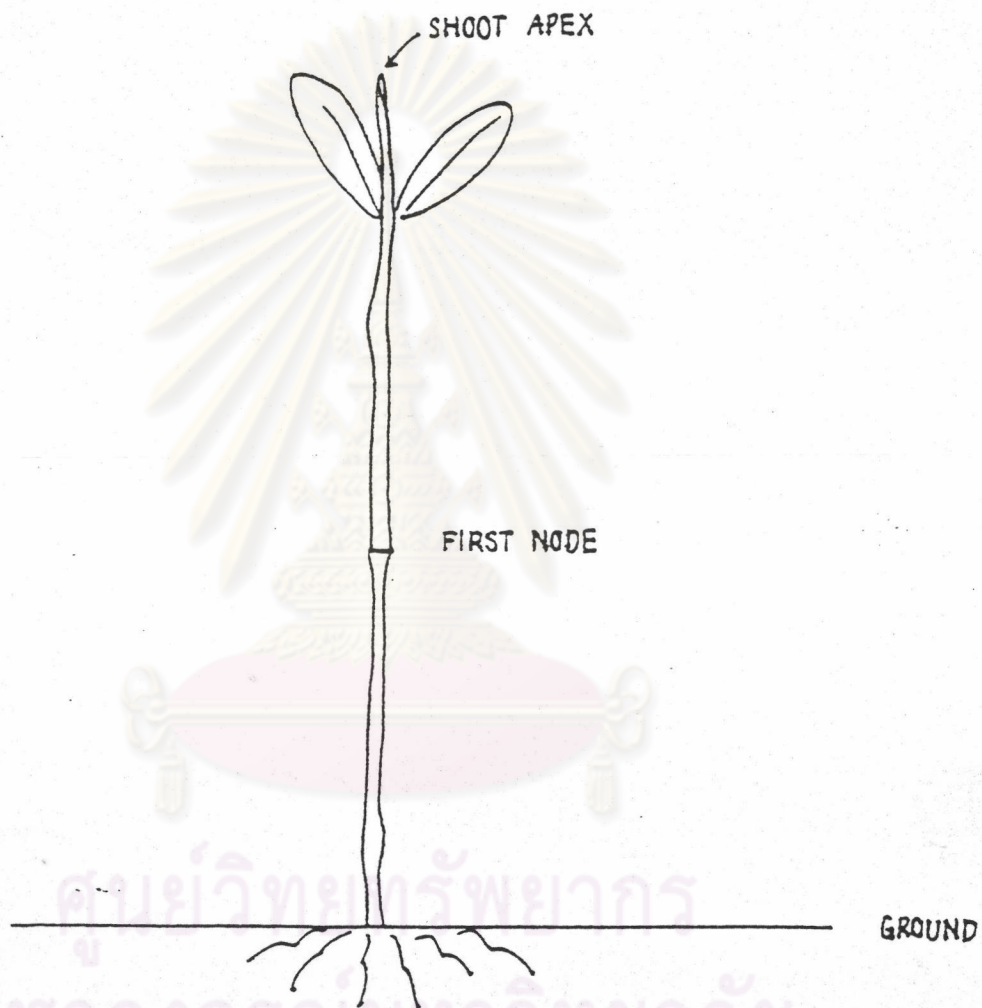by incomplete randomized for each mangrove

species.

Figure III-11 The seedling of Rhizophoraceae. Height growth
was recorded from the first node to the base
of shoot apex.

7.3 Soil Physical and Chemical Analysis

Soil parameters was analysed as show in Table III-1

7.4 Statistic Analysis

To compare the difference of mean of

7.1.1 Survival of each species every two months for one year period.

7.4.2 Height growth of each species every two months for one year period

7.4.3 All soil parameters of each species at the beginning of planting and every four months for one year period .

Multiple Regression Analysis was used to determine the effect of soil parameters on

7.4.4   survival of each species

7.4.5   height growth of each species

Table III-1 Method for analyse each soil parameters.

Analysis	Method	Reference
Chemical		
NH_3	3% NaCl extraction,Sodium-hypochlorite + phenol spectrophotometer at 640 nm.	Strickland and Parson,1972
NO_2^-	3% NaCl extraction, Sulphanilamide + NNED spectrophotometer at 543 nm.	Strickland and Parson,1972
NO_3^-	3% NaCl extraction,Cd reducing column, Sulphanilamide + NNED spectrophotometer at 543 nm.	Strickland and Parson,1972
PO_4^{3-}	Ammonium molypdate+Ascobic acid +Tartar emetic,spectrophotometer at 885 nm.	Strickland and Parson,1972
K,Na	Ammonium acetate extraction and Flame Atomic Absorption	Jackson,1973
Ca,Mg	Ammonium acetate extraction and EDTA titration	Jackson,1973

Table III-1 Method for analyse each soil parameters(cont.)

Analysis	Method	Reference
pH	soil : water ratio = 1:1	Wacharotayan et.al., 1988
% moisture	Oven-dry method and calculate % moisture from (wet weight-dry weight)x100 / wet weight	Wacharotayan et.al., 1988
Physical		
soil texture	Hydrometer method and calculate percent sand silt and clay	Wacharotayan et.al., 1988