CHAPTER IV

MATERIALS AND METHODS

4.1 MATERIALS

The following materials are used in the present study:

- Geomorphological map of Assam

  Geomorphological map of Assam prepared by Assam Remote Sensing Application Centre, ASTEC, Guwahati is used for preparation of the base map of the area covered under older alluvium in the Brahmaputra valley of Assam.

- Topographic map of the study area

  Topographic map of the study area is used to identify the specific study location and for collection of other ancillary data.

- Hydrogeological map of Assam

  Hydrogeological map of Assam prepared by the Central Ground water Board, Guwahati is used to study the ground water prospects of the study area.

- Rainfall and temperature data of the study area
Rainfall and temperature data of the study locations collected from the Regional meteorological centre, Borjhar, Guwahati and Central Water Commission, Guwahati are used to study the temperature and moisture regime of the study area.

- **Socioeconomic and Land use data of the study area**

  Socioeconomic and land use data collected from the Directorate of Census Operation, Assam, Guwahati are used to study the population and land use pattern of the study area.

- **Soil map of Assam**

  Soil map of Assam prepared by National Bureau of Soil Survey and Land Use Planning, ICAR, is used to have a comparative study of the Soil classification of the study area.

- **Measuring tape, augar, polythene bag, camera etc.**

  Measuring tape, polythene bag etc. are used during collection of soil sample and storing them for laboratory analysis.

### 4.2 METHODS

The Methodology includes three main stages as below:

#### 4.2.1 Pre field work stage

(i) Preparation of base map of the study area based on geomorphological map of Assam prepared by Assam Remote Sensing Application Centre (ARSAC), Guwahati and interpretation of satellite image for identification of the older alluvium area.
(ii) Collection of all ancillary data including meteorological data, census data, water resource data and other information about the study area from various sources.

(iii) Selection of representative location in the map for soil sample collection.

4.2.2 Field work stage

(i) The areas covered under older alluvium of Brahmaputra valley of Assam were identified using the prepared base map. Limited field checks were carried out for ground truth study on soil, land form and ground water prospects. Satellite image of the area has been examined and interpreted for delineating landforms. Three representative locations in three agro-climatic zones were selected for Soil profile study. Three profiles from each of these locations were studied. Out of nine profiles one each from these places was associated soil. These associated soil profiles were taken for a comparative study.

(ii) Soil profiles were studied up to a depth of 2.0 meters for morphological characteristics like colour, texture and structure, mottling and horizon thickness in the field itself. Each profile has been carefully examined and described in conformity with the terminology of Soil survey Manual (All India Soil and Land Use Survey Organization, 1971) and FAO guidelines. Soil samples were collected horizon-wise from representative pedons for laboratory analysis.

(iii) Slope, drainage, erosion hazards, depth of ground water table, flooding etc. of the study area were examined in the field in the profile study sites as well as other locations.
4.2.3 Post field work stage

4.2.3.1 Preparation of soil samples

The soil samples collected horizon-wise from the representative pedons were air dried under shade. The samples were then ground with the help of wooden mortar and pestle and passed through a 2mm sieve. The fine earth fractions were stored in polythene bag with proper label and were used for subsequent laboratory analysis.

4.2.3.2 Analysis of physical characteristics

Particle size analysis

The particle size distribution of the soil sample was determined by the International pipette method after removing organic matter, exchangeable cations and free sesquioxides (Jackson, 1973). Total sand (2 to 0.02 mm) was determined by wet sieving and coarse (2 to 0.2 mm) and fine sand (0.2 to 0.02 mm) fractions were separated by dry sieving method.

Bulk Density

Bulk density of the studied soil samples were determined by the Clod method (Blake, 1965). The mass of the soil was determined after drying it to a constant weight at 105°C and volume by usual method.

4.2.3.3 Analysis of chemical characteristics

Soil reaction (pH)

pH of the soil was determined by using Elico pH meter, Model LT-10 with distilled water taking soil: water ratio of 1:2.5.
**Organic Carbon**

Organic carbon was determined by Walkley and Black's (1934) wet digestion method. Organic matter was calculated by multiplying the organic carbon with the conventional Van Bemmelen factor of 1.724.

**Cation exchange capacity (CEC)**

The CEC of the soil was determined by distillation method (Jackson, 1973). The soil was leached with neutral normal ammonium acetate to saturate the exchange complex with ammonium ions. Excess ammonium was removed by washing with ethanol and absorbed NH4+ was determined by distillation method and CEC was calculated.

**Exchangeable Cations**

Exchangeable cations of the soil were extracted with neutral normal ammonium acetate solution (Jackson, 1973). Exchangeable Na⁺ and K⁺ were determined using Flame Photometer. Exchangeable Ca²⁺ and Mg²⁺ were determined by Versene Titration method (Barrows and Simpson, 1962).

**Per cent Base Saturation (PBS)**

Percent base saturation was calculated as under:

\[
\text{PBS} = \frac{\text{Exchangeable Bases}}{\text{CEC}} \times 100
\]
Exchange acidity

Exchange acidity of the soil was determined by extracting the soil with 1N KCl (Mclean, 1965). The exchangeable H⁺ + Al³⁺ was determined by titrating the leachate with 0.1N NaOH and then exchangeable Al³⁺ was determined by subtracting exchangeable Al³⁺ from exchangeable H⁺ + Al³⁺.

Available Nitrogen

Available nitrogen was determined by alkaline KMnO₄ method (Subbiah and Ashija, 1956). Nitrogen content was determined by titration after distillation of soil extract.

Available Phosphorus

Available Phosphorus was extracted by Bray’s No. 1 method (Bray and Kurtz, 1945). The quantity of phosphorous from soil extract was determined calorimetrically (Jackson, 1973).

Available Potassium

Available Potassium was extracted from Soil with neutral normal ammonium acetate as given by Jackson (1973). The amount was determined using flame photometer.

4.2.3.4 Soil classification

The soil of the study area has been classified as per existing criteria of ‘Soil Taxonomy’ (Soil survey staff, 1998) on the basis of their morphological and physicochemical
characteristics and taking in to consideration the temperature and moisture regime of the study area.

4.2.3.5 Determination of area covered under older alluvium soil and preparation of final map

The area covered by older alluvium in the Brahmaputra valley of Assam has been determined by using the software Earth Research Data analysis system (ERDAS). The final map has been prepared including soil and site properties and in conformity with the Soil map of Assam prepared by NBSS and LUP, Nagpur(2002).

4.2.3.6 Land Capability and Suitability classification

The morphological, physicochemical characteristics of the studied soils and climatic and site characteristics of the study area were interpreted for Land Capability Classification as per Soil Survey Manual (All India Soil and Land Use Survey Organization, 1971). Soil-site suitability for tea and rubber cultivation was worked out taking into consideration the soil and climatic requirements of the crops.

4.2.3.7 Correlation analysis

Simple correlation analysis was carried out for some selected parameters following the procedure of Snedcor and Cochran (1967). Correlation coefficient between soil parameters like CEC and organic matter, CEC and clay content and sand and clay content has been determined using computer software of Microsoft excel.