CHAPTER - III

MATERIAL AND METHODS

The material used and methods followed during the course of present investigation "Studies on soil genesis, land evaluation and Nutrient status of some Entisols and Inceptisols of district Bulandshahr" are described in this chapter.

Location :

Bulandshahr is located between parallels of 28° and 28° 4' N latitued and 77° 06' E Longitude in the state of U.P. The experimental site is situated at a height of 78° feet above the MSL and its slope is from north west to South-east.

The survey work was undertaken in Bulandshahr district of U.P. consisting Anupshahr, Narora, Sikarpur, Khurja, Sikandrabad, Gulaothi, B.B. Nagar, Siyana, Lakhaoti and Unchagaon areas.

Geology :

The district under investigation falls in the indo - Gangatic plains, which owe their origin to the alluvium deposits by the two great river, The Ganga and the Yamuna. Belonging to plustocene age. The alluvium can be divided into two sub group, old alluvium plain and recent alluvium plain boundary between two alluvium is not sharp while the old alluvium usually occupy terrace
like position and tend to be silty land. The recent alluvium occupy the flood
plain and lower lying terrains and vary from clay to coarse sand in texture.
Lime nodules are commonly found in the old but not in the recent alluvium.

Climate:

The climate of Bulandshahr district as a whole is hot and dry. The
mean annual rain fall for this district is around 65.10 of which about 80
percent. The rainy season i.e. from June to September. However, a few
showers are not uncommon during winter month and some time fog and
frost are also experienced. Summers are characterised by fierce and scorching
heat.

Natural vegetation and present Land use:

Pepal, Neem, Jamun, Sesoo, Babul etc. are main natural plants. This
time tomato, potato and other vegetable crops and wheat, paddy, suger cane
and pluss crops were cultivated in surveyed areas.

III.1 Soil survey:

Soil survey provides the mean to define nature and properties
of soil in a recognized taxonomic system, map their location and
extent, and provided basic soil and land characteristics for multi purpose
interpretation needed various land uses was studied.
### Table: III (1)

**Annual temperature, humidity and rainfall report**

<table>
<thead>
<tr>
<th>Month</th>
<th>Average maximum temperature (°C)</th>
<th>Average minimum temperature (°C)</th>
<th>Average relative humidity (%)</th>
<th>Total rainfall (m.m.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>January</td>
<td>19.0</td>
<td>0.583</td>
<td>-</td>
<td>66</td>
</tr>
<tr>
<td>February</td>
<td>24.3</td>
<td>09.5</td>
<td>30.2</td>
<td>76</td>
</tr>
<tr>
<td>March</td>
<td>34.5</td>
<td>18.1</td>
<td>00.4.5</td>
<td>57</td>
</tr>
<tr>
<td>April</td>
<td>38.0</td>
<td>23.3</td>
<td>048.5</td>
<td>48</td>
</tr>
<tr>
<td>May</td>
<td>40.0</td>
<td>30.0</td>
<td>041.6</td>
<td>51</td>
</tr>
<tr>
<td>June</td>
<td>40.2</td>
<td>32.0</td>
<td>074.5</td>
<td>58</td>
</tr>
<tr>
<td>July</td>
<td>33.2</td>
<td>26.3</td>
<td>351.0</td>
<td>77</td>
</tr>
<tr>
<td>August</td>
<td>34.1</td>
<td>24.1</td>
<td>041.0</td>
<td>66</td>
</tr>
<tr>
<td>September</td>
<td>33.2</td>
<td>15.6</td>
<td>-</td>
<td>56</td>
</tr>
<tr>
<td>October</td>
<td>30.2</td>
<td>15.32</td>
<td>001.8</td>
<td>77</td>
</tr>
<tr>
<td>November</td>
<td>28.3</td>
<td>16.6</td>
<td>026.6</td>
<td>80</td>
</tr>
<tr>
<td>December</td>
<td>23.4</td>
<td>11.4</td>
<td>042.2</td>
<td>73</td>
</tr>
</tbody>
</table>

1.A. **Reconnaissance:**

Reconnaissance soil survey was done 36500 ha of district was conducted through auger hole observations morphological
PHOTO SOIL PROFILE WITH SURVEY TEAM
features of profile to depth of 1.5 m. Reconnaissance soil survey were using 1:50,000 scale of mapping and the basic mapping unit 5.0-10.0 ha.

1.B. Detailed Survey:

Detailed soil survey of Bihera, Pipala Sagli and Tomari villages covering soil of Entisols and Inceptisols were conducted in order to find out main problem of area. The mapping scale of detailed soil survey 1:4000 rounded was using on toposheets. The area of detail survey was decide 300 ha. in the location of Bihera, Pipala, Sagli and Tomari villages. Some soil samples were collected (horizon wise) for laboratory characterization.

Selection of sites and collection of Soil Samples:

In all 100 auger hole samples were collected from different site of Bulandshahr district from each location, 10 profile samples were selected for laboratory analysis.

Preparation of Soil Samples:

The survey was done from September to October in different location of district Bulandshahr. The soil samples thus collected were put in clean bag and brought laboratory. The soil samples were air-dried and kankar nodules and plant root, if any were removed. The samples were then crushed with wooden hammer and than sieved through 2 m.m. seives. The ground soil samples were properly labelled stored in bags for subsequent analysis.
### Table III (2)

#### Methods of Soil Survey

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Type/level</th>
<th>Basic mapping of unit (ha)</th>
<th>Scale of mapping</th>
<th>Base material used</th>
<th>Level of mapping operation</th>
<th>Level of planning</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Schematic</td>
<td>600</td>
<td>1:50000</td>
<td>Toposheet (1:25000) enlarged imagery</td>
<td>Association of great groups</td>
<td>Micro level (national level planning)</td>
</tr>
<tr>
<td>2</td>
<td>Rapid reconnaissance</td>
<td>25</td>
<td>1:100000</td>
<td>Aerial photos toposheets &amp; association of sub group basin catchment</td>
<td>Meso level state level basin catchment</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Reconnaissance 50-10-0</td>
<td>150000/60000</td>
<td>Aerial photos toposheets &amp; enlarged imagery</td>
<td>Sub groups &amp; association of series</td>
<td>Micro level district sub catchment</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Semi-detailed</td>
<td>10-15</td>
<td>1:20000</td>
<td>Aerial photos toposheets &amp; association of series</td>
<td>Micro level district talab water sheeds</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Detailed</td>
<td>0.25-0.05</td>
<td>1:4000</td>
<td>Cadastral series &amp; maps/enlarged aerial photos</td>
<td>Micro level village, sub water sheeds</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Project execution</td>
<td>0.01-0.10</td>
<td>1:2000</td>
<td>Enlarged cadastral maps or plane table</td>
<td>Micro level farm level</td>
<td></td>
</tr>
</tbody>
</table>
2. **Morphology** :

Morphology of profiles to a depth about 1.5 meter were studied, depth, colour, tecture, structure, consistency, root, concretion, nodules, pH and Boundry were studied during soil sampling field work.

3. **I - Soil Analysis** :

   **A. Physical properties** :

   In the collection and prepration of soil samples, these physical properties were studied in field site.

   1. **Colour** : Colour was determined by munsel colour charts. The chart has hue, value, and chroma. One side and colour chips on the other side.

   2. Soil structure and consistency were determined by using field method. Seive was used to determine size of struture.

   3. Presence of calcium cabronate was determined by using HCl.

   4. **Soil genesis wearring factors of soil formation and pedogenic process** :

      Field study : Relative to soil forming process factors of soil formating and sedimentation or depostion.

6. **Minerology**:

Clay fraction were prepared from soil by following method of Black (1965). Quantitative determination of minerals was made as perleasides Jackson (1965).

Sand, silt, clay minerology were studied mehra and Jackson (1960).

**B. Physico-chemical properties of Soil**:

After completing field examination of soil samples in respect of colour, texture, structure, consistency, nodules, depth of profile, designation of master horizons and other following physico-chemical properties were studied after collecting and processing different profile samples.

1. **pH** - Soil pH was determined 1:25 soil water suspension by (Backman pH meter using glass electrode methods)

2. **CEC** - Cation exchange capacity of soil were determined by the methods of (Bower 1952).

3. **Electrical conductivity** : E.C. of the soil samples were determined soil water suspension by (Richard 1954).
4. **Calcium carbonate**: CaCO$_3$ of soil samples were determined by rapid titration method piper (1966).

5. **Organic Carbon**: Organic carbon of soil samples were determined by the method of walkley and Black's out lined by (Jackson) 1973.

6. **Ca$^+$ Mg$^+$**: Calcium and Magnissium were determined versnate method by (Richard) 1954.

C. **Soils classification**: Classify different soil by the method of land classification by soil texonomy.

**III.2 Land evaluation**

The development of land use planning technology requires systematic evaluation of soils for determining their capability under given condition of management and socio-economic input to provide high and sustainable return per unit area. The land evaluation is therefore the process of estimating the present and potential level of land for alternative use with the resource offered by land. The function of land evaluation is to bring out an understanding of the relationship between condition of land and the manner in which it is utilized.

The principal objective of Land evaluation is to select the optimum land use for each defined land unit taking into account both physical and socio-economic considerations.
Soil survey provide the role soil components of land therefore, forms an important process in the overall process of land evaluation once land unit are identified. It is them necessary to predictor rate their performance for particular use or group of uses.

**Method of Land evaluation**:

At present most system of land evaluation are interpretative classifications.

### III.2.1. Land capability classification:

L.C.C. determined the capacity of a soil area, depth, texture, structure, relief as expressed by slope, extent of erosion, present of salts, and severity of climate criteria suggested by (Tajbani) 1969, Sahgal (1985), Bishwas and Mukharji (1989).

### III.2.2. Land suitability classification:

The suitability of the soils for sugarcane and wheat was evaluated by comparing different land characteristics and land requirement of these crops through the limitation approaches. The system of land suitability classification for specific used suggested by (F.A.O. 1976) was adopted.

**Suitability (s):**

Land on which sustained use of the kind under consideration is expressed to yield benefits with out an acceptable risk to land resources and management.
(i) **Class S1 - Highly suitable:**

Land having on significant limitations to sustained application of a given use or only minor limitation that were not reduce productive or benefits and were not be significantly raise inputs above an acceptable level.

(ii) **Class S2 - Moderately suitable:**

Land having limitation which in aggregate are moderately siver for sustained application of a given use the limitation were reduce are productivity or benefits and increase required input to the extent thus the over all advantage to be gained from the use was appreciable inferior to that expected on class's land.

(iii) **Class S3 - Marginally suitable:**

Land having limitation which in aggregate are sever for sustained application a given use and were so reduce productivity or benefits or increase required input that this expenditure was only marginally justified.

(iv) **Class N1 - Currently not suitable:**

Land having limitation which may be sarmauntable in time but which cannot be corrected with existing knowledge at currently acceptable cost the limitations was so ever as
to preclude successful use of the land in the given manner

(v) Class N2 - Permanently not suitable:

Land with sever limitation for crop production were
permanently not suitable.

III.2.3. Irrigability classification:

Irrigability classification was determined by the method of soil survey

III.3. Nutrient status for different soil series:

III.3.1 Available Nitrogen:

The available nitrogen in soil were determined by alkaline permanagement
method (Subhish and Asija 1950).

III.3.2 Available Sulphur:

The available sulphur in soil were determined by extracted with 0.15% calcium chloride solution. Soil extractant ration 1:5 (Chesnis an Yien 1951).

III.3.3 Available Zinc:

The available zinc were determined using tomm’s reagent - ammonium oxilate (pH 3.3) as described by Grigg (1953).
III.3.4. Nutrient status of available Boron:

To find out the status of available boron in one hundred soil samples of Bulandshahr, belonging to the other Entisols and Inceptisols were extracted with hot 0.01 m.Ca. Cl₂ (Aitken et. al. 1987).

III.4. Statistical Analysis:

Statistical analysis data for the result obtained from the above investigation were analysed.