MATERIAL & METHODS
MATERIALS AND METHODS

The present study was undertaken with a view to examine the characteristics of soils of district Sultanpur. The details of materials used and methodology adopted are described here in this chapter.

Sultanpur district consists of five Tehsils namely Amethi, Gauriganj, Kadipur, Musafirkhana and Sultanpur Sadar. Table shows Tehsil distribution chart along with their development blocks which are twenty two in number.

Table 3.1

<table>
<thead>
<tr>
<th>Tehsil</th>
<th>Development Blocks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Amethi</td>
<td>Amethi, Bhadar, Bhetua and Sangrampur</td>
</tr>
<tr>
<td>2. Gauriganj</td>
<td>Gauriganj, Shahgarh and Jamon</td>
</tr>
<tr>
<td>3. Kadipur</td>
<td>Kadipur, Akhandnagar, Dostpur, Lambhua and Pratappur Kamincha</td>
</tr>
<tr>
<td>4. Musafirkhana</td>
<td>Musafirkhana, Baldirai, Jagdishpur, and shukul Bazar</td>
</tr>
<tr>
<td>5. Sultanpur Sadar</td>
<td>Dubepur, Kurebhar, Dhanpatganj, Kurwar, Bhadainya and Jaisinghpur</td>
</tr>
</tbody>
</table>

A reconnaissance survey of the whole district was done for the purpose of collection of soil and profile samples.
A. MATERIALS:

1. Surface samples and profile studies:

Collection of soil samples:

Surface samples:

The collection of soil samples from different field of normal as well as salt-affected were done at random with the help of post-hole Auger from 0-25 cm depths. The sampling field are shown in map. 3.1

Profile exposure:

Five representative profiles at (1) malapur (Kadipur block) (2) Bhatrua (Dostpur block) (3) Gindaura (Kurebhar) (4) Manipurwa (Pratappur Kamanche block) (5) Rampur(Dubeper block) from normal soil as well as six representative profiles at (1) Sakda (Bhetua block) (2) Kamagaon (Bhadainya block) (3) Bhagautipur (AkhandNagar block) (4) Mohanpur (Gauriganj block) (5) Mau-atavara (Jagdishpur block) (6) Dhomphor (Dubeper block) were examined. Depthwise samples were collected for further analysis. The locations of the profile's site were determined on the basis of Exchangeable sodium percentage (ESP), Sodium adsorption ratio (SAR) and Residual sodium carbonate (RSC) values of surface soil covering the entire district. The morphological features such as soil colour, texture, structure, consistency, effervescence with Hcl and depth of root penetration etc. were studied. The soil colour was compared with Munsell's colour chart and texture was determined by feel method in the area.
Climate and Geography:

Climate plays significant part affecting the human activities and qualities. The climate of the district varies from hot dry in summer to pleasant cold in winter. During the summer, the temperature shoots up to 42°C or even higher. In winter it drops to about 4°C.

Geographically speaking, the sultanpur district is situated between 81°32' and 82°41' east longitude and 25°59' and 26°40' north latitude.

B. Methods

Surface samples and Profile study:

Preparation of soil samples:

The samples collected from normal as well as salt-affected field were brought to the laboratory and dried under the shade. All the samples were crushed with mortar and pestle and sieved through 20 mesh and stored. These samples will be analysed for different studies.

Profile study:

Soil profiles were examined according to the method given in the U.S.D.A. Handbook No. 18 (1966). The profile pits were exposed up to 150 cm or even more if required.
Preparation of saturation paste and saturation extract:

saturated soil paste:

Prepared the saturated paste by adding distilled water to sample of soil while stirring with a spatula with the procedures given by Richards (1954).

Saturation Extract:

The saturated soil paste was transferred to the filter funnel having filter paper in place and vacuum was created with vacuum pump. The extract was collected in a bottle for various determinations.

Determination of physico-chemical properties of the soils:

pHs:

pH was determined in 1:2.5 soil water ratio and in saturated soil paste with the help of pH meter. Reading was recorded carefully.

ECe: (dSm-1)

Electrical conductivity in 1:2.5 soil water ratio and in saturated extract was determined with the help of conductivity bridge.

Mechanical Analysis:

50 gm of the soil sample was transferred in a 250 ml beaker. 150 ml distilled water and 10 ml of 5 percent
sodium hexameta phosphate solution was added in it. The sample was mixed properly and it was transferred into a 1000 ml cylinder and the volume was finally made up to the mark. The suspension was inverted about 20 times for complete mixing and was placed on the table and after 20 seconds, hydrometer was placed in the cylinder carefully and first reading was recorded at 40 seconds. The temperature was also noted simultaneously. After 2 hours another hydrometer reading was recorded. With the help of these readings the sand, silt and clay percentage was calculated as described by Black (1965).

Cations and Anions in Saturation Extract:

Cations:

\[ \text{Ca}^{++} \text{ and } \text{Mg}^{++} \]

Calcium and Magnesium were determined by titration with EDTA method as advocated by Richards (1954).

\[ \text{Na}^{+} \text{ and } \text{K}^{+} \]

Sodium and Potassium in saturation extract were determined by flame Photometer as per procedures of Richards (1954).

Anions:

\[ \text{CO}_3^{--} \text{ and } \text{HCO}_3^- \]

Carbonate and bicarbonate in saturation extract were estimated by titration with sulphuric acid as per procedures given by Richards (1954).
Chloride was determined by titration with nitrate as per procedures of Richards (1954).

Sulphate was determined by precipitation as barium sulphate and quantity was calculated as per following formulae,

\[
\text{Millequivalents per liter of } SO_4 = \frac{(\text{mg. of BaSO}_4 \text{ ppt.} \times 8.56)}{(\text{ml. in aliquot})}
\]

Determination of Available Nutrients:

Available N: (Alkaline permanganate method Jackson, 1973):

20 gm of soil sample was transferred in distillation flask and added 20 ml of water. 100 ml of 0.32% potassium dichromate solution and 100 ml of 2.5 percent sodium hydroxide solution was added and immediately fitted it up in the distillation apparatus. 20 ml of 0.02 N sulphuric acid was taken in a conical flask and end of the delivery tube was dipped in it. Ammonia gas from the distillation flask was collected and titrated with 0.02 N NaOH in the presence of 5 drops of methyl red indicator. The quantity of available nitrogen was calculated with the following formula

\[
\text{Available nitrogen} = (20-x) \times 28 \\
(\text{kg/ha}) \quad \text{where } x \text{ is volume of 0.02N NaOH used}
\]

Available P: (Olsen's method)

20 ml. of N/20 NaHCO\textsubscript{3} and a pinch of Dacro-G 60 was added to 10 gm of soil sample. Shaked the
mixture for 10 minutes properly and filtered and washed with water. 10 ml. ammonium molybdate solution and 5 ml of SnCl₂ solution, was added in it. Again shook well and make the volume upto 50 ml. Compared the blue colour colorimetrically and calculated phosphorus in the soil.

Available K : (Morgan's method)

The available potassium was determined by flame Photometer using 1 N ammonium acetate extractant.

Sodium Adsorption Ratio :

The sodium adsorption ratio (SAR) of a soil is simply related to the adsorption of sodium by the soil. The SAR of soil was estimated by using following formulae

\[ \text{SAR} = \frac{\text{Na}^+}{\sqrt{\text{Ca}^{++} + \text{Mg}^{++}}} \]

Where Na⁺, Ca ++ and Mg ++ represent the concentrations in milliequivalent per liter of the respective ions.

Exchangeable sodium percentage :

The ESP was calculated by the following formulae;

\[ \text{ESP} = \frac{100(-0.0126+0.01475 \text{ SAR})}{1+(-0.0126+0.01475 \text{ SAR})} \]

Residual sodium carbonate :

R.S.C. was estimated by following formulae
R.S.C. = \((CO_3^{--} + HCO_3^-) - (Ca^{++} + Mg^{++})\)

**Nutrient Index:**

N.I. was calculated by the following formulae, given by Parker (1951).

\[
\frac{\% \text{ of samples L} \times 1 + \% \text{ of samples M} \times 2 + \% \text{ of samples H} \times 3}{100}
\]

Where L, M, and H denote low, medium, and high test values of a given nutrient, respectively.

**Statistical Analysis:**

The data collected and observed during the course of investigation were analysed statistically and valid conclusions were drawn after applying test of significance as suggested by Panse and Sukhatme (1978).