Some soil studies have been carried out recently in the adjoining tracts such as Seohara Sugar Mill area (Bijnor Dist.) and Kosi khadar (Rampur Dist.) under the sugarcane Research Scheme of Uttar Pradesh. The soil survey in Seohara area was carried out in the year 1953-54 and 112 soil profiles were examined in situ under field conditions in respect of morphological characteristics such as colour, texture, structure, secondary formations such as nodules and concretions of iron and lime, etc. The soil samples obtained from the different layers of the soil were further examined in the laboratory, in uniform conditions of moisture and light, and observations taken in respect to the soil reactions to hydrochloric acid and on wetting. On the basis of morphological characteristics obtained in the manner stated above, the soils were classified into soil families, series and types. The morphological characteristics of some typical profiles of the area are described and tabulated (tables LXX to LXXXIV) in the Annual Report of Sugarcane Research work in Uttar pradesh, 1953-54, pp.163-172, Pub. 1955.

The soil survey in Kosi khadar was carried out in the year 1957-58, when a detailed village to village soil survey of 248 villages was conducted in the cane development zones of Raza and Buland Sugar Mills Ltd., Rampur. 286 profiles were studied in situ. The morphological characteristics and soil analytical data of two representative profiles from Kosi khadar are described and tabulated in the Annual Report of Sugarcane Research Scheme.
Soils of the Kosi Khadar

The two representative soil profiles from the low level khadar of the Kosi nadi have been taken from villages Bijaiya and Surjanpur, where water table is about 5 feet below the ground level. In both the profiles the prominent colour of the surface soil as well as of subsoil is greyish. Calcium Carbonate is present in amorphous form. The iron minerals are in a reduced condition. The coarse sand fraction is low except for the last layer of Bijaiya profile, which is sandy in texture. The soil of Bijaiya is silty loam upto 58" depth and loam sand below that of Surjanpur is sandy silty loam upto 11" depth, sandy loam upto 31", silty loam upto 42" and clayey loam upto 50". There is no evidence of illuviation of clay and sesquioxides in Bijaiya profile. But there is a slight indication of it in that of Surjanpur.

The physical and physico-chemical properties of the soils show that they possess high water holding capacity and alkaline nature. The base exchange status of soils is moderate with moderate lime saturation. Lime content is high and increases with depth upto 58 inches in the case of Bijaiya, while in that of Surjanpur alternate layers show low lime content and are free from calcium carbonate concretions. Magnesia is on the whole more than lime and is not uniformly distributed. Potash and phosphate contents are fairly high. Nitrogen and organic carbon contents are average.
except the surface layer of Bijaiya profile where they are fairly high. The concentration of water soluble salts is moderate but highest on the surface. Saline patches, therefore, in such tracts are very common.

Soils in the Seohara Zone

The findings of the soil studies in the Seohara Zone may be summarized as under:

1. Soils of the Ramganga Khadar: The soil formations of the Ramganga khadar have been largely influenced by the nature of the alluvium and the course of the Ramganga river and its tributaries. They may be sub-divided as below:

   (a) Soils of the Ahtmali Khadar: The soils in the ahtmali khadar vary from sandy to silty loam in texture. The sandy loam soils found normally adjacent to the stream are marked by alternate layers of sand, silt and clay as represented by the soil profiles of village Sipahiwala (water table 10 to 12 feet deep) and Tanda Barkhera (water table 7 to 8 feet deep). The sandy layers are thicker and more pronounced than silty loam. The soils vary in colour from ashy-grey to brownish-grey at all depths of profiles. Soil structure is single grained to cloddy. Small calcium carbonate nodules and amorphous lime are found at all depths except the last (45'-72'). In some pockets in the floodplain, however, the soil texture varies from silty loam to sandy clay as represented by the soil profiles of villages Wazirpur Jagir and Mukarpuri (water table in both cases 3-5 feet deep). The surface soils in such cases are silty loam. The pre
sufficient organic matter in these soils is indicated by brownish-grey to dark grey colour of the soils on wetting. The sub-soils vary in texture from silty loam to silty clay loam while the sub-strata contain coarse sand or loamy sand. The soils are also characterised by the presence of amorphous and nodulated lime. They are generally of better structure being granular to cloddy, but the clods are only partially stable in water.

(b) Soils of the Mustekam Khadar: Next to the ahtmali khadar lies an alluvial terrace only occasionally subjected to flood action (Khadar Mustekam). On its margin towards the ahtmali khadar the soil is mostly sandy, deep brown to reddish brown in colour and very poor in organic matter. Within the alluvial terrace, there are depressions having soils resembling those of the ahtmali khadar. They are represented by the villages Amanullahpur (water table 5 to 6 feet) and Bichalpur (water table 5'–6" to 6'–6"). There the surface soils are ashy-grey in colour but the subsoils are brownish to brownish-yellow indicating the oxidation and hydration of iron compounds. It is typical of the freely drained soils of areas which are not subject to flood action. Calcium carbonate nodules are present, though the substratum is sometimes free from them. The profiles show the stratification common to the soils of flood plains as well as illuviation of clay.

The other group of soils met on the alluvial terrace vary in texture from sandy loam to clay. They are represented
by the soil profiles of villages Bagwara (water table 20-25 feet deep), Champatpur (water table 10-12 feet deep) and Hasan Alipur Chuhr (water table 4.5 feet to 5 feet). The profile of Bagwara is highly sandy showing oxidised character except in the last two layers (48"-72" deep), where calcium carbonate is found to be present. The profile shows illuviation of clay and iron concretions in the zone of illuviation. The profile of Champatpur shows signs of illuviation between 10 to 30 inches below the surface, where small iron nodules are also present. A heavier layer of fine sandy loam is present at the depth of 65 to 72 inches. In the soil profile of Hasan Alipur Chuhr illuviation of clay is found from 9 to 47 inches. The soils are highly mottled. Calcium carbonate nodules are found in the surface layer. The sesquioxides are hydrated. In a few depressed places in this tract the clay counterpart of this type of soils has also been observed.

2. Soils of the Uplands: West of the alluvial terrace land rises into an upland characterised by sandy ridges and depressions between them. The soils in this part are subdivisible as under:

(a) Soils of Sandy Ridges: The soil profiles of the ridge villages, e.g., Girdharpur (water table 30 to 32 feet deep) and Sarkari (water table 20 to 22 feet deep) are extremely sandy, deep red to reddish brown in colour and freely drained. They are poor in organic matter and there is no sign of illuviation except consolidation due to close packing and mechanical translocation of finer material to the second layer. These soils
show signs of excessive oxidation. The soil profiles of villages Budhanpur (water table 35-37 feet deep) and Alampur (water table 23 to 25 feet deep) are also similar.

(b) Soils of the Depressions: In the depressions lying between the sandy ridges there is a variety of soil types varying in texture from sandy loam to sandy clay. The clay loam and heavy loam soils are found surrounded by loamy soils which in turn are bordered by the sandy loams. These soils are represented by the soil profiles of villages Daulatabad (water table 16 to 18 feet deep), Kuri Bangar (water table 16 to 18 feet deep) and Ganwari (water table 22 to 24 feet deep). In Daulatabad, there is illuviation of clay between 16 to 43 inches. Iron nodules and concretions are present in all layers between 8 to 72 inches. The soils are consolidated with yellowish cements. The surface layer shows signs of oxidation of sesquioxides, while the lower layers are partially hydrated. On wetting these soils show signs of excessive oxidation. At all depths, coarse sand fraction appears to be higher than fine sand. The soil profile at Kuri-bangar shows signs of illuviation between 24 to 44 inches. Iron concretions and nodules are found in all layers from 7 to 72 inches. The last layer (44" to 72") is highly mottled and shows signs of hydration of iron minerals. The surface two layers are well aerated. The deep colour of the soils, signs of illuviation and reddish mottling indicate that the soils are well drained and the angular structure of the soil is due to coarse sand and clay mixture. The soil profile at Ganwari is heavier and illuviation of clay is found between 20 to 46 inches. The soil
profile at 21 to 72 inches is highly mottled. Iron concretions are present in all layers below 9 inches. In the subsoil the soil is cemented. From the nature of the development of these profiles, it is indicated that the clay formation and profile development has taken place on alluvial sand in the presence of some colluvial fine material.

(c) Other Soils: In scattered places some soils have been found having calcium carbonate nodules in the subsoil. The textural character of these soils varies from sandy loam to clay loam. In every other aspect they are similar to those described above.

From these soil studies it is clear that the soils in the khadars of the area are mostly sands, silts and loams. In the uplands the soils are sands, loams and clays of various descriptions.

Relative Productivity of the Soils

The relative productivity of various soils has been determined in respect of the sugarcane yields by crop-cutting trials*. Crop cutting of plant and ratoon fields of 0.421 in Bangar and 0.453 in khadar soils were carried out in Seohara zone. In all 33 fields were sampled in khadar area and 63 fields in the Bangar area. The area of the plot harvested was 1/20 acre in each case. The results are summarised below:

From these figures it is clear that the best yields of both plant and ratoon have been obtained from the lighter soils in the Bangar area. But in the khadar the silty loam gave better yields than sandy loam. In respect of Bangar area, the results obtained in Seohara Zone are similar to those obtained in other zones such as Rohana Kalan, Khatauli, Mansurpur and Begamabad. Hence, this can be treated as settled that irrigated lighter soils yield better in respect of sugarcane than do the heavier ones in the upland areas. Hence, if irrigation is provided to Bhur I and Dumat II soils they can be more profitably devoted to sugarcane cultivation, than the heavier soils which are better devoted to wheat and rice. There is, in general, an increase in cane yield due to application of nitrogen in all these soils.

*Ibid. p. 259.*