Chapter - 3

THE STUDY AREA:
EASTERN UTTAR PRADESH
Eastern Uttar Pradesh is an important part of the Uttar Pradesh. It is bounded by Nepal in the North, Central region, and Bundelkhand region in the west, Madhya Pradesh and Chattisgarh in the south and Bihar and Jharkhand in the East. The northern limit of this region is bounded by Indo-Nepal International boundary which broadly cuts through the Bhabar and Terai zones of Bahraich, Gonda, Siddarth Nagar and Maharajganj districts.

Eastern Uttar Pradesh spreads from 23°45’ North to 28°20’ North latitudes and 81° 5’ E to 84°36’ East longitudes. The greatest length from north to south is about 550 kilometers and maximum width from east to west is about 375 kilometers. The region according to 2001 census, has a population of 52.93 million, spreads over an area of about 85.84 thousand square kilometers. The density of population in the region is 845 persons per square kilometer. About two-third of the total population is engaged in agricultural activity and about three-fourth of the total population lives in rural areas. The region as a whole comprises of 19 districts of Uttar Pradesh. (Fig. 3.1 and Table 3.1).
Fig. 3.1
### Table – 3.1
Agricultural and Irrigated Area in Eastern Uttar Pradesh (2001)
(Area in Hectares)

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Districts</th>
<th>Area</th>
<th>Population 2001</th>
<th>Net Sown Area</th>
<th>Area Sown more than once</th>
<th>Total Cropped Area</th>
<th>Net Irrigated Area</th>
<th>Total Irrigated Area</th>
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<tbody>
<tr>
<td>1.</td>
<td>Allahabad</td>
<td>726100</td>
<td>4941510</td>
<td>477476</td>
<td>179744</td>
<td>657220</td>
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<td>2.</td>
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<td>2727156</td>
<td>219411</td>
<td>122802</td>
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<td>171894</td>
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<td>3.</td>
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<td>3147927</td>
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<td>533131</td>
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<td>406786</td>
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<td>4.</td>
<td>Mirzapur</td>
<td>452200</td>
<td>2114852</td>
<td>210931</td>
<td>92992</td>
<td>303923</td>
<td>127116</td>
<td>191443</td>
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<td>5.</td>
<td>Sonbhadra</td>
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<td>1463468</td>
<td>191075</td>
<td>74279</td>
<td>265354</td>
<td>46872</td>
<td>70015</td>
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<tr>
<td>6.</td>
<td>Jaunpur</td>
<td>403800</td>
<td>3911305</td>
<td>291993</td>
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<td>408693</td>
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<td>Ghazipur</td>
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<td>3049377</td>
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<td>136259</td>
<td>400740</td>
<td>210065</td>
<td>319939</td>
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<td>8.</td>
<td>Ballia</td>
<td>298100</td>
<td>2752412</td>
<td>214000</td>
<td>125028</td>
<td>339028</td>
<td>151863</td>
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<td>Azamgarh</td>
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<td>3950808</td>
<td>309284</td>
<td>187417</td>
<td>496701</td>
<td>261951</td>
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<td>211536</td>
<td>112061</td>
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<td>11.</td>
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<td>3784720</td>
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<td>443159</td>
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<td>52926599</td>
<td>5428405</td>
<td>2809591</td>
<td>8229196</td>
<td>3564829</td>
<td>4833809</td>
</tr>
</tbody>
</table>

(63.23%) (32.72%) (95.86%) (41.52%) (56.30%)

**Note:** Figures in the brackets shows percentage of the total.

**Source:** Economics and Statistics Division, State Planning Institute, Uttar Pradesh, Lucknow.
A perusal of table 3.1 shows that the total area of the region is 8,584,400 hectares, while the netsown area is 5,428,405 hectares, which is about 63% of the total area of the region. The total cropped area is 8,229,196 hectares. The net irrigated area is about 41% only. It has been observed that the net sown area is only about 63 percent, while there is no doubt that the bulk of agricultural production will have to be achieved by increased yield per hectare, therefore it is very important to increase net sown area as much as possible not only for increasing production but also for providing land to landless labourers or for improving the size of existing holdings etc. These measures will in the long run help in the rural development and will reduce the regional imbalance in the region. However, before going into the details of the problem, we should study the physical conditions of Eastern Uttar Pradesh.

3.1 PHYSICAL FEATURES

The physical features of the region are similar to those found in other parts of the Uttar Pradesh. Physiographically, the region contains vast alluvial plains having gentle slope from north-west, west and south towards east. The rocks are everywhere of fluviate and sub-aerial formation – massive
beds of clay either sandy or calcareous, corresponding to the silt, mud and sand of the modern rivers. A characteristic of the clayey parts of the alluvial plains, particularly in the older part of the deposits, is the abundant dissemination of impure calcareous matter in the form of irregular concretions – Kankar. The formation of these kankar concretions is due to the segregation of the calcareous material of the alluvial deposits into lumps or nodules.

The alluvial deposits are divided into bhanger and khadar lands. The bhanger lands are older alluvium and correspond, in age to Middle Pleistocene Period, while the khadar lands are newer alluvium. The Bhangar Lands occupy the higher ground, above the general flood levels of the main rivers and their tributaries. These lands are not flooded by rivers during the rains. These lands also contain carbonate of lime in the form of small nodules of irregular shape and size – called as “Kankar”. The khadar lands form flood plains along the river bank. The most important material in bhanger lands is clay which at places becomes loam to sandy loam while the khadar lands are composed of sand, silt and clay.

Geologically, the Eastern Uttar Pradesh forms a part of the Indo-Gangetic plain, which came into existence in the
Pleistocene Period. The plain lies between the newly upheaved mountains (Himalayas) in the north and peninsular India in the south. Various hypothesis have been put forward to explain the geological evolution of the plain. Edward Suess (An Australian Geologist) has suggested that it is a ‘fore-deep’ formed in front of high crust waves of the Himalayas as they were checked in their southward advances by the inflexible solid landmass of the peninsula. On this view, the depression is of a synclinal nature—a synclinorium, (Wadia, 1981). On the basis of physical and geodetic considerations, Sir S. Burrard considers that the Indo-Gangetic plains occupies—‘rift-valley’, a portion of the earth’s surface sunk in a huge crack in the subcrust, between parallel faults on its two sides. This rift extends from the surface far down into the crust about 32 kilometers deep and is subsequently filled up by alluvium. This view has got few geological facts in its support but is not adopted by geologists, who believe that the Indo-Gangetic depression is a true ‘fore-deep’ a down warp of the Himalayan foreland, of variable depth, converted into flat plains by the simple process of alluviation. On this view, a vigorous sedimentation took place and this deposition kept pace with subsidence giving rise to this tectonic trough of India (Wadia, 1981). A third and more recent view about the origin of this
region is as a sag in the crust formed between the northward drifting Indian continent and the comparatively soft sediments accumulated in the Tethyan sea, which later on were crumpled up and lifted up in the form of a mountain system (Krishan 1982). A general accepted view about the origin of the plain is that, it has been formed by the buckling down of the northern border of the peninsular shield beneath the sediments thrust over it from the north (Krishnan, 1982). Whatever may be the cause which gave birth to this trough, but once it was formed, the depression was filled up with sediments brought by rivers flowing from the Himalayas and the peninsula (Sharma and Coutinho, 1980).

As far as the thickness of alluvial deposits is concerned, recent gravity magnetic and seismic explorations show that, it varies from less than 1,000 to over 2,000 meters (Wadia, 1981). On the basis of geodetic observation, Glennie (1932) estimated, its thickness to be about 1,950 meters. Boring done mainly for artesian wells have penetrated only upto 1,606 meters in the recent alluvium strata (Krishnan 1982). Oldham (1917), on the basis of geological considerations, postulated the depth of trough to be about 4,600 meters near its northern limit. Aero-magnetic surveys of the Gangas basin indicate that the basement rocks lie at a depth of about 7,000 meters and
the geophysical indications of the basement are at depths of 6000-7500 meters below the surface, (Krishnan, 1982). The data collected by the survey of India in Bihar show that the thickness of the deposits in the basin may be 1800 meters and probably less than 3000 meters.

Physiographically the Eastern Uttar Pradesh can be divided into four parts (Fig. 3.2):

I- The Tarai Area (Plain)

II- The Ghaghra and Rapti Plain.

III- Gomti – Tons – Ghaghra Plain.

IV- Trans Ganga Plain.

I- THE TARAI AREA (PLAIN):

The Tarai Area extends from west to East along the boundary of Nepal. This area is certainly a continuation of the Nepalese tarai belt. The tarai tract is roughly a 15 to 24 kilometers wide marshy tract and lies from the international boundary between India and Nepal. It is a low lying, marshy stretch of land with slight gradient (1.8 metre or less per km.) infested with reeds, tall grasses or forest under natural conditions. The area is marked by drainage obstructives and has a high water table (3-5 meters in summer) and fertile land
EASTERN UTTAR PRADESH
PHYSIOGRAPHIC DIVISION

Source: Field Observation

Fig. 3.2
though there is a highly leached soil saturated with moisture and high clay factor. The whole tract is a shallow basin which is frequently flooded during the wet monsoon month when a large number of streams swell considerably to submerge it under water. These swift flowing streams generally bring down an enormous quantity of silt, clay and deposit them in this track. Consequently, the area is turned to be fertile and is specially suitable for the cultivation of rice.

II- GHAGHARA AND RAPTI PLAIN:

The plain bounded by the tarai in the north, and khadar and bhangar is south. The plain laying between the Ghaghara and the Rapti rivers includes the bhangar lands of Gonda, Basti, Gorakhpur and Deoria districts. It is almost an alluvial plain. This region varies in character from tarai. Here the water level varies from place to place, though the difference is insignificant. The soil varies from sandy loam in west to silty loam in the East. Agriculturally this tract is one of the most important region for cultivation of rice and sugarcane.

III- GOMTI-TONS-GHAGHRA PLAIN:

This plain is found in the fertile part of Eastern Uttar Pradesh. This part includes the districts of Faizabad, Azamgarh, Ballia Northern part of sultanpur and some parts
of Jaunpur. In this region the khadar is very wide because rivers meander through this area. More over, they often change their courses. The fertility status of the soil goes down because of the fact that the Ghaghara brings a lot of sand in the plain as it descends from the mountains, so the command area of this river has a higher percentage of sandy silt. Soil is generally silty loam and suitable for the cultivation of rice and sugarcane.

IV- TRANS-GANGA PLAIN:

This tract laying between the Ganga and Karamnasa river, includes the areas of Allahabad, Mirzapur, Varanasi, Ghazipur and Ballia districts, excluding the Khadar land as well as the southern half of the Zamaniah Tehsil of Ghazipur district. The distinguishing feature of this area is the absence of drainage channels. There is hardly any important lake. The river Karamnasa is sometimes subjected to flood and occasionally flow over the adjoining land. The soil is good and suitable for the cultivation of rice, wheat and sugarcane.

3.2 CLIMATE:

The climate of Eastern Uttar Pradesh is characterized by seasonal rhythm, marked by south-west and north-east monsoons. The two agricultural seasons of Kharif and Rabi
closely follow the wet (S.W. Monsoon) and the dry (N.E. Monsoon) monsoons. There are four distinct seasons most commonly recognized:

I- The cold weather season (Dec.-Feb.)

II- The hot weather season (March-Mid-June)

III- The season of general rains (Mid June-Mid Sep.)

IV- The season of retreating monsoon (Mid-Sep.-Nov.)

I- THE COLD WEATHER SEASON:

This season is characterised by cold and dry air. Sky is generally clear and cloud cover rarely exceeds two-tenth. During this season, the temperature falls and pressure rises and due to this whole region comes under the influence of high pressure belt. The direction of prevailing winds is normally from east and north east to west and south-west. The winds are dry and light and generally blow at an average speed of about 3.2 kms per hours. Days are warm while night are cool. The rain fall is very small, irregular and sporadic and is caused due to western depressions. January is the coldest month when the temperature varies between 12.5°C to 17.5°C. The temperature starts to rise in the month of February and ranges between 13°C to 25°C.
II- THE HOT WEATHER SEASON:

The second half of the dry monsoon period includes the months of March to half of June. This period is characterized by rising temperature and falling pressure. The mean monthly temperature in March varies between 24°C to 29°C in different places. The temperature continues to rise during April to June. The month of May and June record exceptional high temperatures, as high as 43°C or 44°C and even more than 45°C for few days. The days are characterised by intensive heat, dry air and low relative humidity. A regular phenomena of this season in the blowing of hot and dry winds, locally called as Loo, which blow with great velocity of about 5.5 km per hour, in the month of April. It reaches its maximum in June when its velocity is about 10.5 km per hour. The humidity is occasionally falling 2 or 3 percent in the afternoon.

III- THE SEASON OF GENERAL RAINS:

On account of excessive heat of the summer months, a low pressure in developed in the northern part of India and by the middle of June it brings a complete reversal in the air movement. This is the season of general rains which is characterised by the arrival of humid oceanic currents, fall in
temperatures, cool air and rainfall. The maximum temperature decreases from about 40°C in the month of June to about 35°C in the month of July. The relative humidity increases from 30 percent in May to 75 percent in last of June and about 85 percent in July and August. The time of onset and retreat of monsoon varies from year to year. Generally, in Eastern Uttar Pradesh, it sets in by the mid of June and continues till the end of September. July and August are rainiest months. The average annual rainfall is about 110 cms out of which about 90 percent is received during this season (Fig. 3.3).

**IV- THE SEASON OF RETREATING MONSOON:**

This season is marked by hot and sticky weather and rise in temperature which starts falling by the end of October. The maximum and minimum temperatures in the month of September are about 32°C and 23°C respectively. The skies are clear and relative humidity falls to less than 50 percent. The precipitation in October is only about 3 cms. Due to clear sky, the day temperature is high but the night temperature falls.
EASTERN UTTAR PRADESH
AVERAGE ANNUAL RAINFALL

Average Annual Rainfall (MM)

Source: National Atlas & Thematic Mapping Organization, Calcutta

Fig. 3.3
3.3 DRAINAGE:

The drainage pattern of the area shows a close relationship with gentle slope of the land. All the rivers of the area have a tendency to flow in zig-zag courses across the plain except the Ghaghara which flow more or less in a straight course. The principal rivers are the Ganga, Ghaghara, Gomti, Rapti, Sarju, Tons and Gandak etc. (Fig. 3.4)

THE GANGA RIVER:

The Ganga, having its source in the snowy caps of Himalayas, in the most important river of Eastern Uttar Pradesh. The other rivers in the region are the tributary of Ganga. The Ganga traversing eastward enters the region near Allahabad and moving eastward passes the districts of Mirzapur, Varanasi, Ghazipur and Ballia. It receives all its tributaries except Karmanasa, on left side. Karmanasa rises in the Kaimur hills and moving along eastern border of Varanasi district joins the Ganga on right side at Bara-Chausa in Ghazipur district. The width and velocity of the river vary according to the season. In summer season it shrinks to 200 to 600 meters, but in the rainy season it swells to as much as one to three kilometers bed. During the rainy season, the volume and velocity of the river is considerably increased
EASTERN UTTAR PRADESH
DRAINAGE

Source: National Atlas & Thematic Mapping Organization, Calcutta

Fig. 3.4
because of which the low lying areas are frequently inundated. The land along the river is rich and produced good yield of crops with little irrigation.

**THE GHAGHARA RIVER:**

The Ghaghara, which is known as Sarabhu (Sarayu) in Pali literature is an important river of North Eastern Uttar Pradesh. It has a number of tributaries like Kauriala, Girwa, Sarda and others. These tributaries have their origin in the mountains of Kumaun and Nepal. The Ghaghara is sometime known as *Kauriala* in Bahraich district, but it is definitely known as Ghaghara, after its junction with Sarda near Bahramghat. It is also known as Sargil or Saryu at a short distance in the sacred city of Ayodhya. Ghaghara enters the Eastern Uttar Pradesh in the district of Bahraich and flowing in an easterly direction, it is joined by the Tehri river in Nawabganj block of Gonda district and further south-east by Kuwana river in Gorakhpur district. Then it further moves eastward and joins river Rapti near Dohrighat and finally it moving eastward joins the river Ganga at Chapra in Bihar. The catchment area of the Ghaghra is more than the river Ganga. Its numerous bars and channels suggest that, it is an aggrading river and has been continually shifting its course.
within a belt of about 55 km in places. Due to this, large tracts of land from time to time are transferred either to the northern or southern banks rendering the areas of the districts subject to variation.

THE RAPTI RIVER:

Rapti is also an important river of the Eastern Uttar Pradesh. It was originally known as Iravati and later its name changed to Ravati and then Rapti. Its source lies in the Nepal hills to the north of Bahraich district. It traverses the districts of Bahraich, Gonda, Basti and Gorakhpur and joins the Ghaghara in west of Gaura Barhaj a confluence town in the district of Deoria. It has three major tributaries on its left side and one small tributary on its right side. It is said that the river formerly flowed in the bed of the Barar, the tributary of the Ami river and at times, the Rapti has assumed a more northerly channel, as it is evident from the varying names of Rapti as Burhi Rapti or Old Rapti. The Old Rapti flows in a south easterly course and, while passing from the west of Gorakhpur, it is joined by the Rohini river on its left bank, and after traversing some distance from Gorakhpur, it is joined by river Ami on its right banks near Amiar-Tal and finally it joins the river Ghaghara near Gaura-Barhaj.
THE GOMTI RIVER:

The Gomti river enters the Eastern Uttar Pradesh through the district of Sultanpur and passing Jaunpur district it joins the Ganga river at Saidpur tehsil in Ghazipur district. It flows in an easterly and south-easterly direction in the region. The bed of the river is deep and its channel is well-defined, but the stream has a low velocity, which never exceeds seven kilometers per hour, even in the time of flood. During the rainy season the width of the stream exceeds three kilometer, while in the hot weather, it is not more than 100 meters. In some places, along the river bank, there may be some narrow strips of alluvial land, but they are of little value for cultivation, as the river brings little silt and much sand during high floods. On its left bank, the Gomti is joined by the river Sai, which has a deep bed and broken banks at places, by ravines. The Gomti, before emptying itself in the Ganga, receives another tributary called the Nand, which run dry during the hot weather but during the rains receives a large volume of water on either sides and swells to a considerable size. The Gomti is navigable in its lower course.
THE GANDAK RIVER:

The Gandak touches the extreme north-east corner of the region and it has a little effect in the region. Taking its rise from the snowy ranges of Nepal, it flows through a gorge and leaving its hilly course near Tirbeni about 16 km. north from its entrance into the region. The Gandak is probably most dangerous river of the region. Owing to its swift flow and changing courses, it attains greater width as it enter the region and forms a bulge towards the west for some distance and then flows south-east having most of its course in Bihar state and finally it joins Ganga near Patna. Gandak is a voluminous river with a water discharge at thousand cubic meters per second during rainy season and of hundred cubic meters per second during the dry month. The river is usually subjected to violent and sudden floods in the beginning of the monsoon season and causes great damage to Kharif crops, cattle and houses. Although Gandak feeds the Rophini and little Gandak river with a large volume of water but when it is separated from these river it submerges, extensive forest lands of Nepal and plains of North Eastern Uttar Pradesh and Bihar. It creates great problems in the villages that comes in its way.
THE SARJU RIVER:

The Sarju enters the district of Bahraich and joins one of the southerly channels of the Ghaghara known as Badrauhan Nala. Then, about 1.5 km east of the village Haraija, it leaves the Badrauhan Nala and flows towards south-east. Near Mau district, it is joined by an other important tributary, the Tons, which is perennial but maintains only a sluggish current of water in the dry months. The bed of Sarju after its confluence with the Tons becomes deep and broad. In lower course, the Sarju on its right bank, is joined by another tributary – the Bhainsali.

About six kilometers before its confluence with the Ghaghara, Sarju receives Mangai tributary on its right bank. Although the Mangai drains a fairly large area but it receives no any important tributary. The presence of numerous ox-bow lakes near the left bank of its middle and lower course suggests that formerly the river had probably a northerly course and joined the Sarju about 13 kilometers west of the present confluence.

The connection of the Sarju with the Ghaghara has led to the suggestion that the former represents an ancient channel of the Ghaghara and it is said that in future probably
the Ghaghara may again resume this course owing to the constant eastward movement of its junction with the Ganga. The gradual raising of the bed of the Ghaghra may render it more liable to break through its bank and adopt for itself a shorter and easier route to the Ganga. But it is very unlikely that the bed of the Sarju could have formed a channel for so great a river as the Ghaghara.

### 3.4 SOIL

The entire plain of the Eastern Uttar Pradesh is a broad belt of alluvial soil. The soil map of India and even that the Uttar Pradesh have been prepared from time to time by various authorities. These maps have given a generalized picture and valuable informations of the soils in Eastern Uttar Pradesh. In these maps, the classification of the soil has been attempted on the basis of colour, texture, availability of water and the level of land. This classification is mainly empirical in nature and undertaken for the assessment of revenue. Each type of soils has been given local name such as Matiyar, Domat and Dhankar which have been adopted in the region during the consolidation of holding.

The soils of the region, which are made up by the alluvium brought by the Rapti, Ghaghra, Gomti and Ganga
rivers have been greatly affected by the local climate, vegetation and topography.

The alluvial soils of Eastern Uttar Pradesh has been divided into two broad geological divisions – the Khadar soils (newer alluvium) and the Bhangar soil (older alluvium). The newer alluvium is in the process of building while the older alluvium is in the process of denudation. The newer alluvium occupies the flood plains of the rivers and their tributaries as a result of which the constituents of such lands are renewed every year where as the older alluvium occupies the level plains above the general flood limits of the main rivers and their tributaries. The alluvium chiefly consists of various grades of sand, silt and clay. A characteristics of the clayey part of the alluvial plains is the abundant dissemination of impure calcareous matter in the form of irregular concretions – Kankar. The soils differ greatly in texture and consistency ranging from the sands through loams and silt to heavy clays that are ill-drained and are sometimes charged with injurious accumulation of sodium salts producing a sterite deflocculated conditions called *Usar*.

The important soils of Eastern Uttar Pradesh are as follow (Fig. 3.5).
EASTERN UTTAR PRADESH
SOIL TYPES

Soil Types
- Loamy Soil
- Khadar Soil
- Clay Soil
- Clay Loam
- Black Clay Soil

Source: National Atlas & Thematic Mapping Organization, Calcutta

Fig. 3.5
I- KHADAR SOILS:

The soil of the khadar land is generally sandy and found adjacent to the river banks, but away from the banks it improves in texture and shows an increase in percentage of silt. The sandy soil is used for the cultivation of millets and Kharif pulses while the silty soil is used for millets in Kharif season and barley or gram in the Rabi season.

II- BHANGAR SOILS:

These soils are of various types:

a) Loamy Soil (Domat):

In the well drained part of Uttar Pradesh, dominant soil is loamy. The surface soil is yellow to brown in colour with a brownish yellow colour of sub-soil. The drainage in this soil is good. Due to the high texture of the soil, its water retention capacity is low but if irrigation facilities are available, it is capable of producing good crops.

b) Clay Loam Soil (Matiyar):

The Matiyar soil has grey or yellowish-grey color at the surface, while in the lower layers the color changes to dark grey. As compared to the domat soil, it is rich in clay and its water retention capacity is high. At depths varying from two to four feet calcareous pans (Kankar) may occur. The calcium from the surface is leached and accumulates at various depths
in the form of *Kankar* nodules. The presence of *Kankar* pan impedes the drainage with the result that during the rainy season bodies of water at places are held up and stagnate. It may be mentioned that matiyar soil responds well to rice cultivation.

c) Clay Soil (Dhankar):

The colour of dhankar soil is grey to dary grey. It has a compact and muddy structure and becomes sticky when wet and very hard when dry. This soil is largely used for the cultivation of rice. It is often characterized by salt efflorescence and wherever the salts occur in large proportion the land is not used for cultivation. In some parts there is a large amount of *Kankar* in the sub-soil which often renders the soil unfit for cultivation.

d) Black Clay Soil (Karial):

The karial soil is black in colour and predominantly clayed in texture and in appearance resembles the Indian Black Cotton Soil. Its moisture retaining capacity is large, so that after a normal rainy season the soil can produce a winter crop without irrigation. But when the soil is dry, it becomes very stiff and splits up to produce great fissures. In fact, ploughing and sowing are almost impossible in a dry karial
soil and irrigation is impracticable, since water is bound to sink all too rapidly through the cracks in the soil. Owing to the difficulties of irrigation, agriculture is dependent on rainfall and a failure of the monsoon rains involves the loss of both the Kharif and Rabi crops.