CHAPTER 1

STRUCTURE, RELIEF AND DRAINAGE

The state of Bihar (the area under study) extends approximately between parallels of 22° N to 27° 31' N latitude and meridians of 83° 20' E to 88° 17' E longitude. The state occupies an area of 173877 square kilometres of which 1.84 percent area was classified as urban. The maximum north-south length of Bihar is about 605 kilometres and maximum east-west width is about 483 kilometres. It is bounded by Nepal in its north, Uttar Pradesh in the west, Madhyapradesh on its south-west, Orissa on its south and West Bengal in its east.

According to the 1991 census, (For detail see Appendix A) the total Population of the state was 86374465 of which 13.14 Percent was classified as urban. During two intercensal periods, 1971-81 and 1981-91, growth rate of Population in the state was 24.06 and 23.49 percent respectively. According to the 1991 census, the general sex ratio, that is the number of females per thousand males, in the study area was 911. In the state 38.48 percent population was literate. The literacy rate among male was 52.4 percent while among females it was only 22.89 percent.

At the time of 1991 census, the state had 25619038 person as main workers which constituted 29.66 percent of the total population. The portion of cultivators and agricultural labourers to main workers was 80.70 percent, while the percentage of cultivators to main workers...
was 43.57 percent, and portion of agricultural labourers to main workers was 37.13 percent.

**RELIEF**

Physically Bihar is divided into three unequal parts which have been described as follows:

1. **Himalayan Foot Hills**

   There is a small hilly area in the north-western part of West Champaran district. This is apart of the well known extensive Siwalik Range of the Himalayan foot hills (Fig.3). This region covers an area of about 586 sq. kilometres and is roughly enclosed on the south by 152 metres contour line. The region consists of two different ranges of hills and intervening valleys, all parallel to the Nepal border in a north west to south east direction: (a) The southern range of low hills is called the Ramnagar Dun extending about 32 kilometres with an average width of 6-8 kilometres. The highest point is 241 metres near Santpur. (b) To the north east of Ramnagar Dun succeeds the Valley of Harha called the Dun valley which is only about 22 kilometres long and is distinctly higher than the main alluvial plain to the south of this hill region. (c) North of this valley lies the Sumeswar Range. The international boundary between India and Nepal run along the crest of this range. Its average width wither Bihar is 5-6 kilometres. The entire hill region in the north west of Bihar consists of relatively young sedimentary rocks of Late Tertiary times. Being young the are ill compacted and relatively soft, so that under a tropical humid climate they
BIHAR
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- YOUNG FOLDED
  SINGALIK (152-437M)
- DEPOSITIONAL PLAIN
  (30-76M)
- OUTER EROSION
  FRINGE (152-305M)
- DAMODAR TROUGH
  (152-457M)
- SUBARNAREKA
  VALLEY (152-305M)
- DEPOSITIONAL
  PLAIN
  305M
- 762-1097M
- 610 M

ESCARPMENTS

Fig. 3
have been broken into an area of very rugged relief consisting of a maze of ravines and ridges.

2. The Ganga Plain

The second major relief unit of Bihar is the Ganga plain which covers about 45080 sq. kilometres or 42 percent area of the state. It is roughly delimited in the south by the contour line of 152 metres above the sea level. The entire tract north of Ganga is absolutely alluvial and monotonously flat without a single hill appearing above the plain. South of the river Ganga, however, in what is known as South Bihar there rise in some places above the level of the plain low, small, isolated or long narrow hills as the Barabar hills of Gaya or Kharagpur hills in Munger. They are outliers of the Chotanagpur plateau. There are some differences in the relief features of the north Bihar and south Bihar portions of the Ganga plain which may be noted below:

North Bihar Ganga Plain

The area is almost a dead level alluvial plain. The only diversities seen on the surface are those due to river action - a series of raised river side uplands known as levees and alternating depressions between the streams. From the north-western to the south-eastern corner of north Bihar plain the slope is roughly 30 metres in 400 kilometres. The North Bihar plain is below 75 metres above the sea level except small tracts in West Champaran and North Saran. The rest of the plain drops imperceptibly to a height of 60 metres along the Ganga in the west and to 60 metres in the east.
Broadly speaking, the topography of the North Bihar plain consists of the following features: (a) A narrow moist *tarai* belt in West Champaran district below the foothills formed by the re-emergence of the water that is soaked underground in the upper foothill gravel zone. The true *tarai* belt which is essentially a submontane phenomenon passes into Nepal east of West Champaran district as the hills recede from the border of Bihar and is generally not found in the rest of North Bihar plain. (b) A sub *tarai* belt of marshy land in the north with intervening tracts of uplands along rivers. (c) This is succeeded in the south by a wide belt of marshy low lands notably devoid of uplands. (d) Further south nearer the Ganga the land rises and there is preponderance of uplands with a few intervening depressions and lakes.

**South Bihar Ganga Plain**

This plain is irregularly defined in the south because of the approach of the southern hills and plateau. It gradually tapers from a wide base in the west to a narrow tongue on the Rajmahal hills. The surface rises more rapidly away from the Ganga in this plain than on the north of the river. It has largely been built of the alluvium brought from the southern hills. This plain is roughly divisible into:

(i) a narrow belt of highland along the Ganga and.

(ii) The rest of the plain. In this second part behind the Ganga levee is a treeless low lying country called "*Tal*" lying in Patna district.

As we more towards south outliers of ancient crystalline rocks
appear as low hills i.e. the small hill near Bihar Sharief know as Pirhari (110 metres). There are higher hills at Rajgir (445 metres) which extend rather continuously towards Gaya. The rather extensive triangular hill of Kharagpur in Munger rises from 150 metres to 350 metres and its northern suballuvial projection is responsible for sharp bend of Ganga near Munger district. The Ganga plain of Bihar is the superficial expression of a thick body of alluvium which has been gradually accumulating in the vast depression limited in the north by the Himalayas and in the south by the Chotanagpur plateau and its outliers. The floor of the depression is asymmetrical being deepest nearer the Himalayas and thence becoming gradually shallow towards the south.

3. The Southern Hilly Region

This southern hilly region is known as Chotanagpur plateau. It consists of a series of plateaus. Each plateau occurs at a height different from that of adjoining plateau. There are four plateaus or in other words erosion surface in the region. The highest surface is formed by the higher Ranchi Plateau or "pat" region 760 metres to 920 metres above the sea level. It covers the north-western corner of Ranchi and the southern edge of Palamu district. It is believed to be composed of Deccan lava; but as a result of weathering the lava has been converted into laterite and bauxite. The second or the next lower plateau is known as Ranchi plateau and roughly covers the whole Ranchi district except the area covered by the "Pat" region. This plateau composed mostly of gneisses and granites' is about 600 metres above sea level. Ignoring minor variations the Ranchi plateau characteristically lies at an elevation
of 600 metres above sea level. The Ranchi plateau is separated from, an other surface of same elevation by Damodar trough. It is the upper Hazaribagh plateau and is probably a continuation of Ranchi plateau.

The third plateau has an elevation of 300 metres above the sea level and may be termed as the Outer or Lower Chotanagpur plateau. It consists of mostly gneisses and granites; but partly of Schists and other Dharwar rocks. This plateau covers a wide area on outer parts of Chotanagpur.

The next lower or the fourth erosion level is uniform surface formed by the river valleys; plains and lower parts of the outer low plateau lying between 150 and 300 metres above sea level. They again consists of gneisses and granites and partly of schists etc. The basaltic Rajmahal hills and the sand stone Kaimur plateau belongs to this erosion level. The different plateau surfaces in Chotanagpur are parts of same plain successively uplifted during Tertiary and pleistocene times.

**DRAINAGE**

As regards surface drainage of Bihar all surface drainage of the state except the districts of East Singhbhum; West singhbhum and most of Ranchi district i.e. about 18000 sq. kilometres ultimately goes to the Ganga or its distributary, the Hoogly. The area of about 18000 sq kilometres on West singhbhum; East singhbhum and Ranchi is directly drained to the Bay of Bengal through Sankh, South Koel and
BIHAR
DRAINAGE PATTERN

Fig. 4
Subarnarekha rivers.

Comparison between the Streams of Chotanagpur plateau and North Ganga plain:

The Ganga is the master line of drainage in Bihar. The drainage coming from Himalaya through North Bihar plain and that coming from Chotanagpur is ultimately discharged into Ganga. The northern and southern drainage, tributary to Ganga; however, has some points of comparison; but many of contrast. In the Himalayan fringe in West Champaran and East Champaran the northern tributaries of Ganga display the characteristics of young river rushing through deep and narrow gorges i.e. the Gandak at Bhainsalotan. They debouch into the plains through a series of rapids. The plateau streams display similar characteristics when they descend the scarped margins of Chotanagpur and Kaimur uplands and other hilly region of South Bihar. These southern streams pass through steep sided, narrow, rocky valleys or gorges in which they form beautiful rapids and waterfalls.

Below the Himalayan foot hills the northern streams flow through tortuous meandering courses in broad shallow channels which have been raised by large quantity of the sediments above the adjoining interfluves or doabs. The southern streams too have very tortuous courses in the plateau section and as they descend the scarps they meander in the South Bihar plains in shallow wide beds. But there are many differences between two types of streams resulting from physical differences of the area which they drain. The northern streams flow over a region of thick alluvium and there are no structural differences
from one end of plain to the other. The plateau streams traverse regions consisting of rocks of different hardness. The northern streams are of very low gradient while the plateau streams have relatively steep slopes and are characterised by rapid flow in hilly region so that floods are common in the plains and they are unknown in Chotanagpur. The larger northern streams have wide low level riverine tracts on either side but plateau streams have deep clearly defined channels with a very narrow ribbon of alluvial margins.

One of the most important differences between the northern and southern streams is that of regime i.e. the volume of water flow during the course of the year as shown in Fig.5.

The larger Himalayan streams rise in the vast snow fields of the great Himalaya and are thus fed by snow melt in spring and summer months and monsoon and rainfall at other times. The plateau streams depend entirely on rainfall. From the plateau surface rain water rapidly flows out and there is limited soakage. Moreover, the largely impervious crystalline rocks of the plateau region also stand in the way of underground storage. Thus while the streams passing through plains particularly in North Bihar receive some water in their channel from seepage of underground water, such supply is very limited so far as the plateau streams are concerned.

The regime of the snow fed rivers i.e. the Ganga, the Ghaghara, the Gandak and the Kosi is characterised by a considerable discharge during the winter season falling to a minimum in the months of March and April, after which the melting of the snow in the Himalayas gradually
raises the volume till it is complemented by the monsoon showers when the rivers rise in spate during late June, July and September.

The plateau streams on the other hand are ephemeral in character. They become disconnected pools of stagnant water during the cold and hot seasons, but immediately after monsoonal showers in the hills they come down in sudden short lived freshets. But the roaring cascade of water lasts only for a few hours, the streams subsiding again to fordability. Even during the monsoon the plateau streams donot maintain a regular flow which is of a very freakish nature, particularly on the marked slopes of the plateau where the run off is too quick to allow the streams to have a regular flow. When, however, the plateau streams have approached the Ganga, because of the presence of underground water the streams are characterised by a regular flow and larger discharge.

The drainage of Bihar is uneven in the sense that some parts are overdrained (i.e. water runs off too rapidly to allow the formation of extensive surface water bodies and to permit considerable soaking of water underground), some underdrained (i.e. the extensive surface bodies of water and water logging in conjunction with high water table) and others are well drained. Both the plateau streams when they come down to the plain and the northern streams along with Ganga itself are liable to changing its courses. They tend to raise and silt up their beds by the large amount of sediments carried during the rains. In course of time the rivers begin to flow in raised channels which lie above the surrounding region. During floods the pressure of large volume of
water causes a breach in the banks and the rivers may adopt a new course and so on the process continues. Apart from such vigorous changes alluvial and delluvial action is a regular feature, especially of the Ganga and its northern tributaries, causing minor and local changes in the river courses. The plateau streams are steeper and the diversion of their water for irrigation in South Bihar reduces the chances of changes in the river courses. But there has been considerable changes in the courses of Ganga, Son, Ghaghara, and the Gandak and immense changes in the courses of notoriously vagrant Kosi which appears to have once joined Brahmaputra. Now it flows through Saharsa district and joins Ganga in Khagaria district. Broadly speaking, the common drainage pattern in Bihar is dendritic i.e. like a tree. The homogeneous, new and soft Ganga alluvium with a more or less flat topography favours dendritic drainage pattern.

**Underground Water**

The underground water resources of the Ganga plain region are markedly different from those of Chotanagpur and adjoining hilly areas. The hilly region is an overdrained area. As the rainfalls it is quickly drained off because of considerable slopes. Few permanent water bodies are found on the surface that might by soakage, contribute to the underground reservoir. Moreover, soakage and storage by underground rocks is also checked by the impervious and crystalline rocks that predominate in the hilly south. The underground waste reservoirs in Chotanagpur, Kaimur plateau and Rajmahal Hills is limited. The level of underground water table is uncertain and deep on uplands.
The underground water resources are so limited that even deep wells, particularly in upland areas go dry during summer so that the scarcity of water in this season is as acute as in arid areas. In forested region where evaporation is limited by shade, the water table may be high.

**Flood**

The physical nature of Chotanagpur makes the region immune from floods, but certain area in the plain frequently suffer from devastating floods during rains. The areas which are more frequently liable to serious floods lie north-east of Burhi Gandak river in North Bihar. Other areas of the plain especially those north of the Ganga suffer from occasional inundation.

**CLIMATE**

The climate of the state is similar to that of the North Indian Plains and is marked by three distinct seasons in a year. These seasons are: firstly a rainy season (mid June to mid October) corresponding to *Kharif* agricultural season with clouded sky, high humidity and heavy rainfall, a cold weather season (November to mid March) corresponding to agricultural season known as *Ravi* and characterised by low temperatures, clear skies, little rainfall and low humidity and thirdly a hot weather season (mid March to mid June) corresponding to agricultural reason known as *Zaid* characterised by high temperatures very low humidity and prevalence of hot dusty winds.
Season of General Rain

The normal date of the onset of the south-west monsoon in Bihar is from 7 June in the north-east and east, to about 15 June in the western end of the state. Once the initial monsoonal showers have fallen the surface become moist in Bihar in July and August and on subsequent days even in the absence of fresh monsoon from sea, intense insolation by day causes the ascent of local moist winds and clouds and rains follow. This is what is called rain from old monsoon.

The south-west monsoons normally withdraw from Bihar in the first week of October. It is known as retreating monsoon. An important feature of the season of retreating monsoon is the tropical cyclones which originate in the Bay of Bengal about 12° N latitude and invade Bihar.

Distribution of Annual Rainfall

The distribution of annual rainfall in Bihar varies from over 1905 mm near the north-eastern corner of the state to a minimum of about 1016 mm on the western border along the Ganga axis. Most of the North Bihar has more than 1270 mm as also the Chotanagpur region. The area of lowest rainfall is a triangle with apex in south Palamu, on the Ganga near Colgong and where river Gandak touches the border of Saran district. In this triangle rainfall decreases from 1270 mm on the south-eastern and north-eastern side to about 1016 mm towards the western base of triangle. The rainfall gradually decreases both towards the west and towards the Ganga.
The higher rain towards north-east is partly due to the Nor'wester rainfall in pre-monsoon period and partly due to the relief effect of the adjoining Himalayas. The relative dryness of the region on either side of the Ganga is due to the distance of the region from Himalayas on one hand and the Chotanagpur plateau on the other. The higher rain in the submontane Bihar is partly due to condensation resulting from ascent over the Himalayas. The Chotanagpur uplands have higher rainfall than the adjoining northern and north-western plain because they are nearer to the source of the monsoon depression. They are benefited by rainfall both from Bay of Bengal and Arabian sea branches. They have a higher elevation and rain must occur by simple fact that as the winds cross the plateau they have to ascend a height of 300-900 meters and are cooled adiabatically that causes cloud formation and consequently rainfall take place. The distribution of rainfall is given in Table 1.

Table 1

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<th>District</th>
<th>Average No. of rainy days</th>
<th>Normal Rainfall</th>
<th>Actual Rainfall</th>
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<td>3. Bhojpur</td>
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<td>1143.8</td>
<td>967.6</td>
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<td>5. Gaya</td>
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<td>6. Jehanabad</td>
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<td>990.5</td>
<td>1150.4</td>
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<td>11. Gopalganj</td>
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14. Champaran West 63.1 1410.6 1559.5
15. Sitamarhi 52.6 1266.8 1212.7
16. Vaishali 56.5 1042.3 1236.4
17. Darbhanga 56.6 1204.2 1208.9
18. Madhubani 55.8 1307.3 1354.2
19. Samastipur 51.3 1168.6 1399.1
20. Begusarai 68.0 1184.2 1640.9
21. Bhagalpur 68.0 1184.2 1640.9
22. Munger 65.9 1206.7 1193.2
23. Khagaria 62.6 1186.6 1210.3
24. Dumka 62.0 1160.0 1190.3
25. Godda N.A. N.A. N.A.
26. Deoghar N.A. N.A. N.A.
27. Sahibganj N.A. N.A. N.A.
28. Saharsa 69.5 1385.4 1626.4
29. Madhepura 61.1 1367.5 1449.0
30. Purnia 75.9 1681.0 2215.1
31. Katihar 76.1 1358.0 1598.1
32. Hazaribagh 74.6 1284.5 1327.5
33. Giridih 77.5 1211.8 1604.8
34. Dhanbad 86.1 1310.6 1712.9
35. Ranchi 82.5 1454.1 1482.6
36. Lohardaga 63.8 1471.3 1115.5
37. Gumla 68.1 1543.8 139.0
38. Palamu 63.5 1335.1 1068.3
39. Singhbhum East 78.5 1334.6 1500.3
40. Singhbhum West 75.3 1330.2 1490.2
41. Kishanganj 75.3 1630.2 2145.1
42. Araria 74.1 1590.6 2260.4

Source:- Regional Meteorological Centre, Patna, 1990.

Cold Weather Season

Bihar enjoys a cold season, the major part of the State being north of the Tropic of Cancer and southern portion being an elevated plateau. By the beginning of November all vestiges of monsoon except high humidity and marked dew by night have disappeared from Bihar. The wind throughout the season is mostly slight and is predominantly north-west and west. These winds are fed by downward settling of the air over north-western India caused by low temperatures and high pressure. In January the mean temperature ranges from 15.5. °C in the
north to 18.3 °C in the southern part of the state.

Both the Ganga plain and Chotanagpur fall along the paths of western disturbances arriving in this season all the way from Mediterranean area. These shallow, extensive, temperate cyclone bring cloud, rain and cold winds particularly in January and February and are immensely important for the Rabi crops of the plain. The rainfall of this season is almost uniformly distributed in the whole state and is about 25.4 to 127 mm.

**Hot Weather Season**

The hot weather begins in March. It is a period of continuously rising temperature and falling pressure. There is a feeble anticyclones covering the Bay of Bengal. The surface wind is north-west in the plains and west in the plateau. With the rise of temperature humidity falls. In April and May the sun has advanced further north and temperature is high. The mean temperature in May ranges from about 29.4 °C in the east and north-east of the state to about 32.2 °C in the west. Bihar as the rest of Northern India, experiences storms during hot weather season. These storms may be classified as dust storms, thunder storms and dust raising winds. These storms retards the temperature and bring relief to people for short duration from scorching heat. A very hot and dry wind known as loo is soil as also experienced in the month of May and June in northern India including Bihar plain. Its temperature invariably ranges between 40 °C and 50 °C. It may cause sunstroke to people.
SOILS

The soils of Bihar may be grouped into seven broad categories:

(1) Swampy Soils       (3) Calcareous Soils
(2) The Ganga Alluvium (4) Red and Yellow Soils
(5) Red Sandy Soils    (6) Black Clayey Soils
(7) Laterite Soil.

Swampy Soils

The distribution of these soils have been shown in Fig. 6. These soils are found in the narrow belt of Tarai in the north of West Champaran district in the Siwalik region. In the extreme northern margin of this district a thin narrow belt of heterogeneous Himalayan soil is also found above the swampy soils. Swampy soil tract is conditioned by excessive moisture due to large amount of annual rainfall and continuous seepage of water from the northern sloping land. These soils remain saturated during the monsoon months and remain fairly moist during the succeeding winter owing to the presence of a high level of underground water. The soil is mostly clay to dark grey colour. Being clayey in nature. These soils are highly retentive of moisture, and are therefore most suitable for the cultivation of rice.

The Ganga Alluvium

The Ganga alluvium covers a vast area along the banks of the rivers Ganga, Gandak and Kosi. The soils of this group are generally light textured, light grey in colour and moderately alkaline in reaction
BIHAR SOILS

HETEROGENEOUS HIMALAYAN SOIL
SWAMPY SOIL
BANGAR
KHADAR
RED SANDY SOIL
REDYELLOW SOIL
BLACK SOIL
LATERITE SOIL

Fig. 6
with medium to high fertility status. The alluvium is mostly loamy in texture although sand and clay proportions vary from place to place. Variations in the fertility of soils from place to place, especially in the east where the rainfall is heaviest, are not so much due to differences in the surface soil but may be due to varying capacity of moisture retention.

The Ganga alluvium can be divided into two types:

(i) Newer Alluvium or *Khadar*

(ii) Older Alluvium or *Bhangar*

(i) **Newer Alluvium or *Khadar***: is different from older alluvium or *bhangar* in texture and chemical composition. Soils comprising the newer alluvium are grey to ash grey in colour, and clay loam to clay in texture. It is generally found along the banks of rivers and streams. It is generally highly leached and is low in hums and nitrogen and poor in lime. Newer alluvium is found along the river Gandak in the districts of West Champaran, East Champaran, Muzaffarpur, Vaishali and in a narrow belt along the river Ghaghara in Chhapra district. It is more developed in the Kosi region. This soil is suitable for the cultivation of sugarcane, paddy and root crops.

(ii) **Older Alluvium or *Bhangar***: is found some distance away from main rivers. It is heavier soil with greater clay proportion than the *Khadar*. The *bhangar* of North Bihar plain generally lies between the higher levels of streams in lowlying interfluves and is inundated by water during the rains through spill channels which cut through the
levees. *Bhangar* land forms typical paddy areas of north Bihar plain. It is richer in lime than the *Khadar*. This group of soil occupies a vast area of West and East Champaran, Sitamarhi, Madhubani, Darbhanga and Purnia districts. It is also found in Muzaffarupur, northern parts of Bhagalpur, Munger and in a small patch of Begusarai districts.

**Calcareous Soil**

The belt of this soil roughly corresponds with the *Bhangar* area in Saran, the *Bhangar Doab* between the Little Gandak and the Baghmati in Muzaffarpur and occupies the tract of newer alluvium south of Little Gandak in West Champaran and East Champaran and a small tract in Western Darbhanga. In this zone the soil is lime accumulating and contains a remarkably high percentage of carbonate of lime in sharp contrast with the soils in adjacent districts which are almost devoid of lime. The beds of *Kankar* or nodular lime stone are a common occurrence in the subsoil. The probable causes of conspicuous lime proportion seem to be poor subsoil drainage owing to impermeable strata below and lower rainfall than the adjoining areas.

**Red and Yellow Soils**

Excepting a narrow belt of Gondwana sand stones and shales in Damodar valley the entire area is composed of crystalline and metamorphic socks, mostly granite and gneiss, while a large part of the Singhbhum district is occupied by the Schistose rocks which also constitute the Kharagpur plateau and hills of South Munger and adjoining areas. Many of these gneisses and schists are highly ferruginous, the
soils derived from them are deep red and even black in colour. Archaean system results in corresponding differences in the soils derived from them, but the soil as a whole is light with a relatively high sand proportion. There are great variations in consistency, depth and fertility.

Alkaline salts are often deposited for want of subsoil drainage. Laterite is found on higher levels in certain localities i.e. in East Singhbhum, West Singhbhum, South Bhagalpur and on the 'Pat' surface. The clayey vesicular soil devoid of most plant constituents is infertile and is often given to *arhar* and castor, etc.

**Black Clayey Soil**

This residual soil is comparable to *regur*, the chernozem of India, and has developed on basic rocks on the western flanks of the Rajmahal Hills and the basic gneisses in Sahibganj, Godda, Dumka and Deoghar. It is a black clay which is hard when dry but friable. It is a sticky when wet and retains moisture for a long time. Owing to its relatively high fertility it may not require manure for a considerable time. Terrain plays an important part in the nature and thickness of the soil. It is infertile, thin and of light colour on the uplands, but on the lowlands and in valleys it is fairly deep enriched by washing from above and is given to paddy cultivation.

**Dark Reddish Brown Soil or Laterite Soil**

There are three distinct tracts of laterite soils in the state, one in Rajmahal Hilly area, in the other in south-eastern Dalbhum on Tertiary sediments and the third in the 'Pat' region of the West Ranchi and
South Palamu. The typical red colour is due to high percentage of iron oxides. The area of Rajmahal Hills which are composed of Jurassic traps are covered with laterite. The chief defect of laterite soil is its marked acid reaction. With the removal of acidity it can be rendered productive.

REFERENCES