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SOIL SURVEY REPORT OF DACCA DISTRICT

[Agricultural Chemist's Section]

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SOIL SURVEY REPORT OF DACCA DISTRICT

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FOREWARD

This is the first attempt to bring out a report on the results of the work carried out on Soil Survey in East Pakistan. This is a bulletin report on the soils of Dacca district. The scheme of soil survey work was initiated by Mr. M. C. Carbery in 1940, the then Director of Agriculture, Bengal, who was formerly the Agricultural Chemist, Bengal. The work was completed in 1947, but due to various difficulties the report could not be published earlier than this. Though other advanced countries like U. S. A., U. S. S. R. U. K. and Holland have extensive Soil Survey Organizations and report on almost every soil, in East Pakistan, this report on the soils of Dacca district is the first of its kind. As such, a good deal of credit goes to the first initiator of this work and also to Mr. G. B. Pal, the First Agricultural Chemist, Bengal, and late Dr. N. K. Chakladar, the First Physical Chemist whose contribution was considerable in the preparation of this report. Credit should also go to Dr. M. O. Ghani, who succeeded Mr. G. B. Pal, as Agricultural Chemist and was responsible for all the technical supervision and guidance for a considerable period till he relinquished the post of Agricultural Chemist and left for the University in 1949. The Officiating Physical Chemists, Mr. M. A. Hye and Mr. A. M. Masud and other Assistants working under the scheme have a share of the credit in this work.

The work of Soil Survey is being continued in the Province and, at present, in the district of Mymensingh. It is needless to mention that Soil Survey work is a tedious and time-consuming work and would take years to complete the survey work of the entire province at the rate at which we were proceeding. Fortunately, now it has been possible to strengthen the staff of the Soil Survey work ; and it is expected that the work will be completed for the entire Province much sooner than what was originally indicated.

It is hoped that the present report will serve the purpose for which the work was undertaken for the district of Dacca.

S. HEDAYETULLAH,
Director of Agriculture, East Bengal.

Soil Survey Report of the Dacca District

The Soil Survey of the Dacca district was undertaken with the object of systematically classifying the soil on the basis of their fundamental characteristics primarily with a view to provide a basis for experimental work in the development and better utilisation of the areas covered by different types of soil in general and the areas which are either yielding practically no crop or where the yield is abnormally poor and which may aptly be treated as culturable wastes in particular. Infromation regarding the present method of land utilisation, crops and cropping practices, manures, etc., in different parts of the district have also been collected with a view to assess the agricultural value of the land and to find out the relationship, if there be any, between the soil conditions and the differential behaviour of various field crops and orchards plants so that it may be possible to utilise the available resources for better crop production by proper adjustment of cropping schemes, manures, irrigation and drainage, etc.

There are however considerable analytical data of the soils scattered all over the district. But these data were collected and examined with a view to assess the immediate nutritional requirements of the soil and not for the study of their fundamental characteristics so as to arrive at a classification. In other words no attempts were made to study these soils from the pedological point of view.

River system.—The district is centrally situated in the eastern portion of the province of East Bengal. It has maritime boundaries all around. The rivers Meghna and the Padma which form the eastern and western boundaries of the district diagonally approach each other forming a confluence at the southern extremity of the district giving it a conical shape.

The district is intersected by a network of rivers and creeks all of which with one or two exceptions branched out either from the Ganges or from the Brahmaputra. These rivers were more powerful in the past than they are at present and left their mark throughout the length and breadth of the district. They have, therefore, played a very important role in determining the fundamental characteristics of the soil of the district. But it is difficult to trace the river geography of East Bengal in general and of the district of Dacca in particular due to their peculiar knack of changing courses constantly.

The difficulty in tracing their courses is further intensified by the fancy and figurative names given to them in different parts without any regard to etymology. Again most of the rivers are now in a decaying condition and in very many places the old beds have been so silted up as to leave no trace of their former existence. In some places again rivers forced their ways through thickly populated localities and valuable arable lands. Thus it is really a difficult job to trace the courses of even the big rivers such as the Ganges, the Brahmaputra, Ichamati, etc., moreso due to the fact that there are considerable mistakes in the Revenue maps and in many places the old beds have not been named at all. The old maps no doubt gave some valuable information but detailed informations could not be found there too. Further the old maps are not also free from criticism.

In fact even a close scrutiny of the old maps and records were not sufficient to reveal the various courses the river Brahmaputra used to follow in the past. Everyone who attempted to trace the course of the old Brahmaputra made the

common mistake of only tracing easterly course which flows along the boundary of the districts of Dacca and Mymensingh up to the river Meghna near Bhairab Bazar. But no mention of the portion passing by Panchamighat and Nangalbandha has been made. In the Revenue map a portion of the river bed in this part has been named Brahmaputra but does not show any connection further up. Another bed of the same nature has been named old Lakhya bed.

On closer examination of the surface feature and silted up river beds in this part and also from local enquiries it had, however, been possible to throw some light on the obscurity of this river which is so important in the study of soil characteristics of the district of Dacca. The old Brahmaputra after bisecting, as it were, the district of Mymensingh touched the district of Dacca near Toke and after proceeding about 4 miles easterly direction entered the district of Dacca near Aralia and made its way right across the district in a southerly direction until it passed through Panchamighat and Nangalbandha and finally emptied into the confluence of the rivers Meghna and Dhaleswari or Ichamati. It again emerged out of the confluence and after following a south-westerly course for a short distance passed by Rampal, the Capital of Ballal Sen. The river used to be known as Lohitya (Lohitya is the ancient name of Brahmaputra) and finally poured down its water into the river Meghna.

This old Brahmaputra lost its existence long ago. In many places it has become totally unknown and in some places again there is no trace of its former existence except a number of disconnected chain of morasses.

Favoured by the eastern slope of the north-eastern portion of the district towards Sylhet Jheel the river Brahmaputra after emerging out of the district of Mymensingh took an easterly direction separating the district of Dacca from Mymensingh and poured down its water into the river Meghna. The old bed gradually began to be silted up until it become totally extinct. Further shifting of the course of the river took place when the river Teesta which used to pour down its water into the river Ganges near Nator, shifted its course to join the river Brahmaputra.

The great accession of water from Teesta had a great repercussion on later river which forced its way through Jenai which was at that time an insignificant channel in comparison with it is now and is at present known as Jamuna. This is the main course of the river Brahmaputra at the present moment. The river Jamuna in its turn poured down its water into the river Ganges near Goalundo whence it is known as the river Padma. And the bed through Mymensingh gradually silted up until it assumed its present form. Changes of similar nature have also taken place in the course of the river Ganges or Padma which has also left outstanding marks on the district.

Major Rennel who made a survey of the rivers of East Bengal was of opinion that in early days the river Ganges used to pour down its water through the river Kaliganga and then through the Dhaleswari and Buriganga and finally met the river Meghna about 16 miles from the city of Dacca. According to him the present course of the Padma is of much later origin. Rennel's view may be partially true. The very name Kaliganga and Buriganga is very suggestive of the fact that they branched out of the river Ganges. But if the details of the case are taken Rennel's view cannot be accepted as it is. The river Kaliganga may derive its origin from the river Ganges but the river Buriganga appears to have no connection with the river Ganges. The river Buriganga is actually the continuation of the river Bansi. The portion of Bansi lying between Fulberia near Sabhar and Taltala

where it meets the river Dhaleswari is known as Buriganga. The river Buriganga and the river Bansi thus represent one and the same river. The red soil tract of which the river Buriganga represents the southern boundry is limited by the rivers Bansi and Banar which derive their origins from the same source, i.e., Brahmaputra, at the same place. It is therefore more probable that the river Buriganga is more closely associated with the river Bansi rather than the river Ganges. The name Buriganga has no etymological significance.

The river Dhaleswari is also of much later origin. It branched out of the river Kaliganga and appropriated much of its water from the latter river which gradually ceased to be of much importance.

If Rennel's view is accepted, the origin of Arial Beel shown as Churan Jheel in Rennel's map, cannot be accounted for. It is, therefore, more probable that the river Kaliganga used to form a confluence with the river Ichamati in the area known at present as Arial Beel. The gradual shifting of the course of both the rivers have resulted in the formation of the big jheel or swamp known as Arial Beel. The portion between Bangherghata about 4 miles to the north of Taltala and the great confluence facing the subdivisional headquarters of Munshiganj now occupied by Dhaleswari was actually the bed of the old Ichamati, since Firingi Bazar, where Portuguese Pirates were kept captive was situated on the bank of the river Ichamati.

After the great accession of water from Jamuna which appropriated a considerable portion of water of Ichamati the river Dhaleswari cut out a new channel and occupied the bed of Ichamati in this part. The river Ichamati gradually silted up and became disconnected.

Quite a good number of rivers and creeks may be found in the Madhupur Jungle area. Almost all of them derive their origin directly or indirectly from the river Brahmaputra. Before the great accession of water from Teesta and the consequent shifting of the course of the river Brahmaputra to the west of the district of Mymensingh the later river while flowing past Jamalpur threw out two branches almost from the same point. One is known as the river Bansi and the other as the river Banar. The former took a course directly towards south and the latter south-east. The river Bansi after reaching Fulberia in the district of Dacca assumed the name of Buriganga. Thus the lower portion of the river Bansi is known as Buriganga. The river Bansi on its way through the districts of Mymensingh and Dacca threw out several branches of which the river Turag with its numerous creeks deserves special mention.

The river Banar which took a south-easterly direction, immediately after reaching the district of Dacca, bifurcated into two branches. One of the branches took an easterly direction and joined the mother river near Toke, and pursued the same easterly course conjointly. After traversing a short distance the river Banar came out as Arial Khan which after covering a distance of about 10 miles joined the main stream a few miles north of Belaba. It again branched out as Arial Khan and poured down its water into Meghna near Narshingdi. In all previous maps and records the river Arial Khan has been shown as an independent branch of the river Brahmaputra. The other branch took a southerly direction and retained its old name Banar until it reached Lackpur. From Lackpur downwards the river Banar is known as the river Lakhya. Thus the rivers Bansi and Banar form the boundary of the whole of the Madhupur Jungle Tract on all sides.

The river Meghna which is more or less an estuary of the creeks in lower Assam and carries the discharges from Surma Valley is not very important in soil formation in the district of Dacca.

Physiography.—The district falls under two main divisions (i) the portion of the district included in the Madhupur Jungle Tract, (ii) the flood plain of the rivers Brahmaputra and the Ganges. These two main divisions are characterised not only by the dissimilarity in topography and surface features but also by their diametrically opposite soil characteristics and natural vegetation. Consequent upon the difference in soil characteristics the mode of cultivation and cropping practices are also different.

The division (i), i.e., the Madhupur Jungle Tract covers an area of about one-third of the total area of the district. The major portion of this area is covered by dense sal forest. This portion has well defined boundaries both in the east and the west. The river Bansi, the Arial Khan and the Buriganga mark the eastern, western and southern limits of this physiographical division. It may be mentioned here that these rivers branched out of the river Brahmaputra. In the north it extends over a considerable portion in the district of Mymensingh. Here and there this tract can be found to extend beyond the rivers Arial Khan in the east and the river Bansi on the west. In some places again the flood plain penetrated deep into the interior. The topography of this division is very rough and broken. In some places it rises up to something like hillocks to a height of aboutt 50-60 ft. from the flood plain. In some places again it consists of chains of isolated mounds of different sizes some of which do not exceed more than an acre and are the true specimens of knolls. In some places again it consists of flat lands occupying several square miles. The broken nature of the topography decreases as one goes away from the rivers and creeks that cross the area. In the centre of this area the lands are more or less flat. The high lands are never inundated even at the time of the highest flood (*see* Topographical map at the end). The very appearance of this division shows that in the past this area was subjected to the worst type of denudation but due to this stiffness of the clay this denuding action could not in many cases penetrate deep inside the area. Due to the denuding action of rivers, mainly Brahmaputra and its offshoots, the area is not infrequently interspersed by stretches of flood plains which due to continuous deposits of silt for years have sometimes been raised above the ordinary flood level.

Limited information available from deep bores does not point to the existence of bed rock in this tract except some cemented sands givings the appearance of sandy gravels. The surface soil is sandy loam with preponderance of finer materials in the lower horizons which is more or less stained with iron. In some places the accumulation of concretion of oxides of iron has attained considerable development. The clay layer is more than 100 ft. deep and stratification in this layer is totally absent. Underlying this red clay there are layers of yellow sand of different grades. These sands bear a close resemblance to the sands carried by the rivers Damodar, Bakraswar and Ajoy which derive their origin in Central India, i.e., from the Vindya Range or its outspurs. Both the clay and the sand layers are singularly absent from fossils of acquatic origin. It will be interesting to note that outcrop of rock of any description is also singularly absent.

Although at the present moment this tract is marked by well defined boundaries it was not so in the past. It was more extensive than what it is at present. The denuding action of the rivers mainly Brahmaputra played a good part in reducing the size of the tract. In fact in very many places far away from the present boundary of this read soil tract red clay of the same nature as that of the Madhupur Jungle Tract could be found underlain by light textured grey soil of the flood plain. In this connection Rampal, the old capital of Ballal Sen, deserves special

mention. While excavating a tank in that area red soil closely resembling the soil of the Madhupur Jungle Tract could be found at a depth of about 15 ft. entombed under grey soil of the flood plain.

The second division, i.e., the flood plain of the Ganges and the Brahmaputra system, consists of plain of both consolidated and unconsolidated deposits. These plains are generally extensive and have general slope towards the south. The individual flats almost in all cases consists of saucer or basin shaped depression at the centre. The isolated depressions are not generally more than 2-3 ft. below the general level. These flood plains have been formed through stream activities under different hydrological conditions. The surface soil varies from sandy loam to stiff clay. Rocky materials of any description are totally absent not only in the surface but also in the lower strata. Borings were generally made up to a depth of 5 ft. for the purpose of examination of soils. It is not therefore expected to get much information about the lower strata. Information available from deep borings chiefly for the purpose of drinking water indicates that there are alternations of clay and sand sediments of almost of the same kind and physical make up in the vertical as well as in the horizontal plane. The sediments forming both the surface and the sub-strata vary from clay loam to very coarse sand. In fact the surface strata are not marked by different from the sub-strata.

The ever changing character of the rivers played a good part in accumulating deposits of different grades in different places. In fact old river beds could be traced in very many places. The old river beds are generally the seats of coarser fractions. During the rainy season the whole of the flood plain with isolated exceptions is submerged under water. The homestead and basti lands which are built on raised grounds remain above the flood level. Submergence of the basti lands is not also uncommon. In normal years the inundation level attains as high as 20 ft. or more above ground level of the flood plain. The whole area remains submerged for a period of 4 months from July to October.

In the low-lying areas the tidal water generally enters during the first outbreak of monsoon, i.e., middle of June and sometimes early in June and evacuates late in November.

The district has a general slope towards south of the inundation level, therefore varies from place to place. Lowest inundation level is recorded in the north adjoining the Madhupur Jungle Tract. Again the nearer the area to the rivers, the lower is the inundation level. The district is not susceptible to flood as is understood in the ordinary sense. Devastating floods causing wholesale damage to the standing crop or to homesteads rendering people homeless are practically unknown.

It has already been stated that the district is intersected by a net work of rivers and creeks which are in the habit of constantly changing their courses. This has two important repercussions on the physical feature of the district. In the first place large portion of consolidated land sometimes occupied by homestead and sometimes affording valuable agricultural lands are washed away and in return char lands (islands in the rivers) are thrown either in the midst of the river bed or near the bank on the opposite side. Although these char lands are very fertile and grows varieties of field crops they never compensate the loss done by the erosion of the bank. Secondly, this changing character of the rivers has resulted in the formation of swamps and marshes scattered all over the district some of which have turned into veritable waste lands causing a considerable loss to the cultivated lands.

Climate.—The climate is sub-tropical. The year is practically divided into three well defined seasons. There is no marked difference in the climatic condition in the two physiographic divisions. The northern portion of the district which is included in the Madhupur Jungle. Tract is a bit colder than the southern portion. The rainfall is also a bit lower in this tract than in the rest of the area. The slightly lower temperature in the Madhupur Jungle Tract is partly due to the existence of forest and partly due to the proximity of the Garo Hills.

The cold weather which is pleasant and is not so intense as to cause any damage to crop generally begins from the month of November and lasts till the end of February. The minimum temperature which is recorded in the month of January does not generally fall below 50°F. The rainfall is very scarce and limited during this period. The absence of rainfall coupled with the low humidity of the air results in the rapid desiccation of the soil of the Madhupur Jungle Tract. The weeds and natural vegetation which have a vigorous growth during the rainy season begin to show the signs of wilting during this period, and in course of the cold months they completely dry up. The desiccation of the soil is accelerated by the lowering of the water table which sinks down to a depth of about 30 ft. from the surface. The growing of crops in the highlands in this part is, therefore, an impossibility. In fact the highlands remain fallow during the winter months. The summer season generally begins from the month of March and lasts till the middle of June. The wind which blows from the north during the cold months veer round to the south-west in summer. During this period the district is visited by occasional rains sometimes accompanied by hails and not infrequently by violent winds from the north-west which cause considerable damage not only to the standing crops like boro paddy (summer paddy), mustard, pulses and other cereals in the flood plains but also to the dwelling houses in the country sides. The weeds and vegetation which practically withered away and presented burnt appearance get a new fillip for vigorous growth and the fields both cultivated and uncultivated begin to assume a green appearance. This is the most critical period from the cultivators point of view since this is time for the preparation of land for the major crop of the district, paddy and jute, both in the high lands and the flood plains. Any deficiency of rainfall during this period adversely affects crop prospect of the district. Heavy precipitation at intervals during this period is the prerequisite for success in kharif cropping. Excessive rainfall without sufficient interval is equally harmful since it renders the preparation of land for kharif cropping impossible. This is the hottest period of the year. The maximum temperature which is recorded during this period attains as high as 100°F. or above. Due to the occasional rains the soil contains requisite moisture. The high temperature and the scorching rays of the sun do not, therefore, cause much harm to the standing crop.

Then comes the rainy season which extends over a period from mid-June to mid-October. During this period the rainfall is torrential and heavy downpours are very frequent. 75 per cent. of the annual rainfall is received during this period. This huge quantity of rain water is disposed of by surface drainage and thereby causing considerable erosion both in the Madhupur Jungle Tract and also in that portion of the flood plain which remain above the flood level.

The average rainfall of the district as a whole is about 30 inches during the year. This rainfall is almost evenly distributed over the district. The flood plain records only a slightly higher rainfall than the Madhupur Jungle Tract.

The table below shows the annual rainfall (10 years average) month by month in both the physiographic divisions. In each division there are three stations. The figures indicate the average of three stations.

Annual rainfall of the district month by month (10 years average in inches.)

Months.	Madhupur Jungle Tract.	Flood plain.
January	0·237	0·418
February	1·026	1·443
March	1·358	1·690
April	3·941	5·133
May	10·798	12·418
June	12·817	13·412
July	12·150	13·265
August	14·751	15·067
September	9·541	9·399
October	4·194	4·845
November	1·427	1·271
December	0·234	0·376
Total ...	72·474	78·737

The above table shows that the distribution of rainfall is very unsatisfactory. The low rainfall during the winter months renders winter cropping in the Madhupur Jungle Tract impossible but in the flood plain the winter rainfall is not so important though one or two showers during this period is no doubt highly appreciated. Rainfall during carly months of summer is very important in the flood plain for the preparation of land for kharif crops particularly jute and aus paddy and to a certain extent deep water paddy in the low lying areas. Absence of heavy precipitation during the months of July and August renders the preparation of land for transplanted paddy difficult. Lack of rainfall again during the months of October and November solely affects the seed formation of transplanted paddy. In the flood plains the October rains keep the paddy free from the attack of insects and pests.

Soils.—The soils of the district fall under two main groups. In each group again there are considerably diversities. These diversities are directly associated with topography and drainage lines. In the Madhupur Jungle Tract the character

of the soil is primarily dependent on topography and drainage condition while in the flood plain apart from drainage condition the soil characteristics are closely associated with the nature of the alluvium on which it is deposited, i.e., on the river system which are directly or indirectly responsible for their deposits.

It has already been mentioned elsewhere that the broken nature of the topography in the Madhupur Jungle Tract decreases as one goes away from the rivers which pass through the area. This topographical differences have greatly influenced the soil character. The centrally situated portion which are more or less flat and where different classes of land are practically absent are covered by a type of soil which bear a remarkable contrast to the soil occurring in situations which are very irregular and broken.

The profile examination reveals characteristics morphological differences. But it is curious that nowhere in the whole area well developed horizons could be found. In majority of cases the horizons could not be differentiated. The broken and sometimes rolling topography have considerably militated against the possibility of profile development. In some cases again erosion marked the effect of eluviation and sometimes resulted in the occurrence of truncated profiles. Partially developed horizons could be found in some places but correct line of demarcation could not be drawn. The highlands are freely drained. The absence of any bed rock in lower horizons enables the rain water to percolate down to the water table carrying with it the soluble products of weathering.

In the low-lying area, i.e., in swamps where the drainage is impeded a third type could be found. This type has a black colour which becomes lighter with the depth. This black colour is not very resistant to hydrogen peroxide or other oxidising agent. The black colour is, therefore, mostly due to the presence of humified oraganic matter. In fact in some places prominence of undecomposed organic matter could be found.

In the flood plain the soil being immature the types could not be differentiated from morphological study. Two types of soil could however be differentiated from subsequent chemical data. These two types derived their origin from two different sources (a) the Brahmaputra system and (b) the Ganges system. The bulk of the soils derived their origin from the former source while only limited areas in the west and south-west have the Gangetic influence. The soil character in this plain is constantly changing. These areas are annually inundated and get fresh deposits of silt. The annual inundation has two fold effect in modelling the soil character. Firstly, due to annual inundation during the season of the heavy precipitation the products of weathering hardly get an opportunity of accumulating in the lower horizons. Secondly, all the soluble products of weathering are washed away by the tidal water.

In the flood plain too there are certain areas which are above the flood level but the underground water table rises so high during the rainy season that the leachates hardly get an opportunity of accumulation. They are washed away by the rise and fall of the sub-soil water. Therefore, there is no fixed horizons in these areas also.

Examination of profiles and collection of soil samples.

In order to study the morphological features of the profiles pits were dug generally at a distance of 3-4 miles or more frequently whenever any peculiarity of the soil, topography or other surface feature, natural vegetation, etc., were noticed. In no case did the distance from pit to pit exceed 4 miles.

Rectangular pits generally $4\frac{1}{2} \times 2\frac{1}{2}$ ft. were dug in an open space and in such a way that one of the walls gets direct rays of the sun. Sufficient light is necessary for a clear examination of the profile. The wall of the pit which is opposite the sun is smoothed out by means of a shovel or a sharp spade so that the different horizons if any could be differentiated. The side opposite the profile face is cut in slanting position to enable the observer to get into the pit easily. After the pit is dug the profile is examined. In examining the profile the colour got the first preference then the other characteristics such as structure, nodules, streaks, etc. Some of the chemical characteristics such as the PH, carbonates, etc., were also examined. When different horizons could be differentiated samples were collected on horizon basis. When such differentiations were not possible samples from each six-inch depth were collected.

From the examination of a large number of profiles from each soil zones in the district it has been possible to group the soils into a number of genetic types. These types have been shown in the map by different colour. The immature soils of the flood plain have been shown in green and dark green colour while the red soils of the Madhupur Jungle Tract have been represented by red and brownish red colour. The difference in colour shades represent type difference in the same division. (See soil map at the end.)

The soils of the Madhupur Jungle Tract derived its origin from the same source but they developed into three distinct types due to the topographical and hydrographical conditions. The atmospheric climate as has already been shown is uniform throughout the area. But atmospheric climate is never an index of soil climate. The latter depends on topography and hydrological conditions, etc. Hence the development of different types in an area like this which have originated from the same source is due to topography and soil climate.

Description of soil types of the Madhupur Jungle Tract.

Series name—Madhupur Podsolic soils,

Type 1—Madhupur Podsolic clay loam.

Profile No. 404.

Locality ... Nasra P. S. Kapasia.

Drainage ... Free.

Topography Broken.

Depth 0″—9″—Clay loam, reddish brown, crumby, loose, interpersed with roots.

Depth 9″—18″—Loamy clay, brownish red to light brown marked with white fleck alternating with deep red streaks and veins which attain more and more prominence down the profile, crumby.

Depth 18″—48″—Loamy clay, brownish red marked with, white flecks and red streaks and veins which are more numerous than the former horizon crumby, hard when moist loose when dry.

Profile No. 408.

Locality—Bangura, P. S. Kapasia.

Drainage—Free.

Topography—Broken.

Depth 0"—9"—Clay loam, light brown lower portion stained with red streaks, crumby, loose when dry interspersed with roots.

Depth 9"—18"—Clay loam, reddish brown marked with red streaks and veins alternating with white flecks.

Depth 18"—48"—Loamy clay, brownish red with white flecks and red streaks the latter more numerous than in the former horizon. Crumby loose when dry.

Series name—Madhupur red soils.

Type H—Madhupur red sandy loam.

Profile No. 1.

Locality—Tejkunipara, P. S. Tejgaon.

Topography—Flat.

Drainage—Free.

0"—12"—Sandy loam, reddish brown, crumby.

12"—48"—Clay loam, red with increasing intensity of red colour crumby no mottlings or concretions.

Profile No. 397.

Locality—Gosinga, P. S. Sripur.

Topography—Flat.

Drainage—Free.

0"—6"—Sandy loam, yellowish red, crumby.

6"—24"—Clay loam, yellowish red with the red colour more intensified crumby loose.

24"—42"—Loamy clay, grey, crumby, compact.

Profile No. 57.

Locality—Fayzabad, P. S. Tejgaon.

Topography—Flat.

Drainage—Free.

0"—12"—Sandy loam, yellowish grey, crumby.

12"—24"—Clay loam, yellowish red speckled with brown, crumby, loose.

24"—44"—Clay loam, yellowish grey mottled with red, brown and crumby.

Type 1.

TABLE 1.

Chemical analysis of the clay fractions.

Sample No.	Locality.	Depth.	SiO_2 %	Al_2O_3 %	Fe_2O_3 %	$\frac{SiO_2}{Al_2O_3}$ %	PH
7 ...	Nasara	0″—6″	39·12	34·91	2·50	1·9	5·8
		6″—12″	38·92	39·69	3·20	1·66	6·0
		12″—18″	37·42	39·77	3·50	1·59	5·8
		30″—36″	35·57	41·30	4·18	1·46	6·2
S259 ...	Bangura ...	0″—6″	36·89	33·90	3·4	1·85	5·6
		6″—12″	38·00	34·30	4·1	1·88	5·4
		30″—36″	37·23	31·70	3·2	1·99	5·6
		36″—42″	40·13	33·90	3·6	2·0	5·6
SS32 ...	Baunia	0″—9″	34·66	33·94	4·05	1·73	5·6
		9″—30″	36·50	37·09	4·71	1·67	5·8
		30″—42″	37·40	38·91	4·19	1·63	5·8
SS201 ...	Gaorar	0″—10″	35·4	34·4	4·5	1·7	5·8
		10″—16″	36·18	35·33	5·2	1·73	5·6
		16″—48″	36·60	36·14	5·6	1·71	5·6

TABLE 2.

Machanical Analysis.

Sample No.	Locality.	Depth.	% Coarse sand.	% Fine sand.	% Silt.	% Clay.	% Loss on solution.	% Organic carbon.	% Nitrogen.	% Total exchangeable bases in M. eq. per 100 gms of soil.
SS247 ...	Nasara ...	0″—6″	7·77	47·65	20·12	23·07	1·09	0·6705	0·073	3·58
		6″—12″	4·97	33·623	24·67	38·4	0·583	0·6035	0·068	6·32
		12″—18″	4·42	28·98	20·71	46·3	0·538	0·2130	0·07	4·84
		30″—36″	3·93	24·32	20·3	51·8	0·433	0·2698	0·053	5·24
S5259 ...	Bangura ...	0″—6″	1·25	37·5	26·8	30·7	1·65	1·1454	0·179	1·04
		6″—12″	1·33	31·1	25·2	42·3	1·72	0·6348	0·125	1·64
		30″—36″	3·3	25·9	21·5	48·8	2·3	0·3726	0·102	1·62
		36″—42″	1·72	25·51	21·75	51·42	1·8	0·3312	0·096	1·55
SS32 ...	Baunia ...	0″—9″	9·08	45·85	21·80	21·15	0·84	0·781	0·0805	1·44
		9″—30″	6·45	31·29	17·26	39·22	0·69	0·454	0·0616	1·44
		30″—42″	13·14	25·53	16·45	40·08	0·59	·361	0·04	1·60
SS201 ...	Gaorar ...	0″—10″	22·5	33·9	24·2	20·2	0·44	0·828	0·076	2·29
		10″—16″	19·7	28·2	24·7	24·6	0·91	0·6887	0·078	2·24
		16″—48″	14·5	21·75	23·36	44·60	0·47	0·3266	0·0561	3·86

The above table shows, that the Silica-Aluminia ratio is below 2·0 and well above 1·33. The ratio however shows a decline in the lower horizons. In profile No. 404 there is some elluviation of silica in the lower horizons while the

sesquioxides show illuviation. Similar illuviation of sesquioxides is found in all the profiles. The elluviation of silica relative to sesquioxides in profile No. 404 shows a lateritic tendency. In fact this soil appears to be in the border line of laterisation but the elluviation of sesquioxides specially iron in the lower horizon points to the podsolic tendency. The uniformly low figures for iron clearly indicates that considerable leaching of iron has taken place down these profiles. The elluviation of iron from the top layer definitely points to the podsolic tendency.

The clay content increases with the depth there being a sudden increase in the second layer. The exchangeable bases are low. The low value for exchangeable bases show the extent of weathering these profiles have undergone.

TABLE 3.

Chemical Analysis of the clay fraction.

Sample No.	Locality.	Depth.	SiO_2 %	Al_2O_3 %	Fe_2O_3 %	$\frac{SiO_2}{Al_2O_3}$	PH.
SS10 ...	Mohakhali ...	0″—8″	49·03	31·01	9·24	2·68	5·8
		8″—38″	45·99	30·54	9·01	2·56	6·2
SS63 ...	Fayzabad ...	0″—12″	47·25	32·74	10·18	2·45	5·6
		12″—22″	48·02	32·73	7·19	2·49	5·6
		22″—44″	45·81	34·89	6·49	2·22	5·8
		44″—60″	47·86	31·13	7·45	2·61	6·0
SS1 ...	Tejkunipara	0″—6″	44·89	28·16	11·52	2·66	6·2
		6″—12″	46·49	28·67	9·53	2·75	6·2
		12″—24″	47·59	25·34	12·37	3·19	6·0
		24″—48″	43·65	30·19	12·11	2·45	6·0

TABLE 4.

Mechanical Analysis.

Sample No.	Locality.	Depth.	Coarse sand. %	Fine sand. %	Silt. %	Clay. %	Loss on solution. %	Organic carbon. %	Nitrogen. %	Total exchangeable bases. % in M. eq. per 100 gms of soil.
SS10 ...	Mohakali ...	0″—8″	7·45	51·2	15·7	21·2	0·79	0·856	0·090	2·00
		8″—38″	7·30	34·53	12·60	38·30	0·61	0·462	0·055	2·16
S63 ...	Fayzabad ...	0—12″	1·13	41·87	26·5	25·7	0·89	0·733	0·077	1·60
		12″—22″	0·68	27·54	29·00	39·70	1·08	0·332	0·046	1·45
		22″—44″	2·30	26·30	20·50	41·20	1·20	0·183	0·032	4·32
		44″—60″	2·08	25·18	23·50	44·20	1·46	0·129	0·024	5·76
SS1 ...	Tejkunipara ...	0″—6″	14·75	37·59	23·30	21·9	0·37	0·798	0·084	3·68
		6″—12″	7·75	27·35	19·24	40·60	0·69	0·502	0·070	3·52
		12″—24″	8·9	26·48	17·60	43·20	0·60	0·410	0·060	3·36
		24″—48″	8·65	32·74	12·30	40·20	0·75	0·312	0·050	2·88

These profiles are more silicious than those in Type 1. Both silica and the Fe_2O_3 content are higher in these profiles. The silica shows an upward tendency but the Fe_2O_3 content is more or less uniform [Ref:—Martin, F. J. and Dyne, M. A. (1927). Laterite soils of Sierra Leone. J. Agri. Sci. 17: 530-47.] If the defination of Martin and Dyne be accepted these soils cannot be called lateritic. Since the silica-aluminja ratio is above 2:3. On the other hand these soils conform to the requirements of red loams in the international soil classification. Although from the standpoint of silica sesquioxides ratio these soils cannot be classed as lateritic—such tendency is already in existence. The low exchangeable base saturation capacity coupled with its high acidity indicates a latricitic tendency.

The Fe_2O_3 content does not show any gradual decline down the profile. The sesquioxides do neither show any elluviation nor illuviation. Hence these profiles cannot be said to have any podsolic tendency.

Discussion of the results.

The types of soil described above occur within an area which has an uniform climatic condition rainfall and humidity, etc. But there is a great dissimilarity in topography and surface features. In one case the topography is broken and in the other it is flat. The soil belonging to type I could be found in isolate mounds which do not occupy extensive areas. The topography here is extremely broken and sometimes presents specimens of true knolls. While the soil under type II occurs in extensive flats which are at a lower level than the former. The area under both the types are sometimes covered by sal forest and sometimes by rainfed bushy vegetation which withers away during the dry season only to reappear during the rainy season.

These soils belong to the red loam group in the international soil classification. The colour of the soil is red. The intensity of the red colour is associated with the texture of the soil and also with the topography. The colour of the soil in the ridges is deeper than that in the lower elevations. From the anatomical and chemical examination of the profiles in different parts of the area it was found that they exhibit differential profile characteristics though not very remarkable. In one case (which has been designated here as type I) the profile consists of red soil capped with brownish grey soil. In the lower horizons the profile consists of red clay streaked with red and whitish colour seldom mixed with concretionary materials. In the other case while the top soil has greyish brown or reddish brown colour, the lower horizons are dotted with concretions of iron and sometimes circular mottlings. The brownish grey colour of the top soil in Type I is evidently due to the presence of a bleached horizon through the activity of the humus. Type II also shows a partially bleached horizon at the top. The absence of well developed horizons presented considerable difficulties in arriving at a definite conclusion regarding their pedological significance.

The chemical data however were very helpful in drawing up the pedological distinction. A reference to Table I shows that in type I there is definite elluviation of iron from the first layer while in the second layers the iron shows illuviation which is the characteristics of a podsolic profile. But the sesquioxide ratios are below 2·0 and well above 1·33.

Hence according to the definition suggested by Martin and Dyne for lateritic soils, these soils may be classed as lateritic. In fact, but for the decline in the silica-aluminia ratio in the lower horizons these soils could safely be classed as lateritic. Actually some of the lateritic character are present in the soil. On the other hand if they are classed as lateritic then the illuviation of iron in the

B horizon with its bleached A horizon cannot be explained. There is a definite migration of iron from the A horizon and these elluvial material have threached the B horizon.

Chemical data therefore are in favour of giving a verdict of podsolation. Further these soils have a forest cover which is so favourable for the development of podsolic profiles. These soils have therefore been classed as podsolic.

It, however, must be borne in mind that the climitic condition prevalent in the area are a bit antagonistic to podsolic development. Generally podsolic profiles are met within regions of cold and humid climates. In such climatic zones podsolic horizons develop with all their characteristics. When all these conditions are not fulfilled well developed B horizon may not be found but they may possess such characteristic which identifies them as podsolic. In this particular case there is no well-developed coffee coloured iron organic matter illuvial B horizon. Although there is no such B horizon in these profiles and there are other features which characterise them as podsolic. The lower horizons are coloured with white fleaks alternating with red streaks. Thus both the morphological and chemical features show podsolic development.

Type III.

TABLE 5.

Chemical Analyses of the clay fraction.

Sample No.	Locality.	Depth.	SiO_2 %	Al_2O_3 %	Fe_2O_3 %	$\frac{SiO_2}{Al_2O_3}$	PH.
SS177 ...	Bazail	0"—11"	39·7	31·8	3·20	2·1	5·8
SS178 ...	Ditto	11"—60"	38·06	35·95	3·25	1·79	5·8
SS227 ...	Mohani	0"—6"	44·60	26·5	4·4	2·8	5·8
SS228 ...	Ditto	6"—12"	37·8	29·69	3·15	2·16	6·2
SS229 ...	Ditto	12"—18"	38·36	29·10	3·59	2·23	6·2
SS230 ...	Ditto	32"—45"	36·10	38·76	2·63	1·57	6·4
SS5 ...	Tejkunipara	0"—6"	50·32	29·61	4·64	2·88	5·2
SS6 ...	Ditto	6"—12"	49·32	31·58	4·78	2·65	5·2
SS7 ...	Ditto	12"—18"	50·83	30·75	3·91	2·81	5·2
SS8 ...	Ditto	18"—26"	48·06	31·47	5·20	2·59	5·2
SS9 ...	Ditto	26"—48"	48·11	28·99	3·45	2·84	5·2
SS12 ...	Mohakhali	0"—6"	47·62	31·68	6·37	2·55	5·8
SS13 ...	Ditto	6"—12"	48·38	37·51	3·44	2·10	6·4
SS14 ...	Ditto	12"—30"	53·16	41·08	3·36	2·19	6·4
SS15 ...	Ditto	30"—48"	49·78	46·89	3·68	1·8	6·4

TABLE 6.

Mechanical Analysis and other data.

Sample No.	Locality.	Depth.	Coarse sand. %	Fine sand. %	Silt. %	Clay. %	Loss on solution. %	Organic carbon. %	Nitrogen. %	Total exchangeable bases in M. eq. per 100 gms. of soil.
SS177 ...	Bazail ...	0"—11"	1·63	8·8	38·45	51·5	1·08	1·6284	0·126	3·6
SS178 ...	Ditto ...	11"—60"	0·52	13·38	27·71	57·11	1·33	0·6461	0·0669	7·2
SS227 ...	Mohani ...	0"—6"	2·12	8·0	46·6	45·0	1·35	2·1183	0·17	8·64
SS228 ...	Ditto ...	6"—12"	1·09	4·14	36·83	56·68	0·87	2·1045	0·1587	15·76
SS229 ...	Ditto ...	12"—18"	0·65	3·54	27·44	62·95	1·76	3·9148	0·2256	15·92
SS230 ...	Ditto ...	32"—43"	5·23	23·84	21·92	47·90	0·40	0·2208	0·02549	6·40
SS5 ...	Tejkumlpara ...	0"—6"	1·75	8·38	24·00	57·00	2·30	4·30	0·431	9·28
SS6 ...	Ditto ...	6"—12"	0·85	7·67	22·40	59·50	1·35	1·82	0·186	8·96
SS7 ...	Ditto ...	12"—18"	2·53	12·13	20·22	54·95	0·99	1·79	0·146	6·48
SS8 ...	Ditto ...	18"—26"	3·77	12·73	25·20	49·25	0·91	2·05	0·132	8·16
SS9 ...	Ditto ...	26"—48"	0·66	7·35	24·10	55·44	2·31	5·73	0·239	13·28
SS12 ...	Mohakhali ...	0"—6"	3·55	47·18	26·9	18·9	0·75	0·858	0·094	2·0
SS13 ...	Ditto ...	6"—12"	4·00	44·42	26·8	20·2	0·44	0·398	0·048	2·80
SS14 ...	Ditto ...	12"—30"	5·25	52·31	20·5	17·8	0·55	0·203	0·028	3·44
SS15 ...	Ditto ...	30"—48"	5·8	47·47	20·9	22·5	0·44	0·121	0·018	4·8

The differential character of the profile as compared with those of types I and II is evident from the silica-alumina ratio and the Fe_2O_3 content taken together. Although this ratio in this profile is of the same order as in type II the Fe_2O_3 figures are definitely low showing that we are dealing with a different type of soil. This soil is also richer in silica than the other two types already mentioned. The silica-aluminia ratio is more or less uniform. The humus content in the 1st and the 5th layer records a higher value while in the 3rd intermediate layers they are definitely low but nevertheless they are well above 0·1 per cent. This is the characteristics of this profile. The nitrogen content is very high in the 1st layer. In the other layers though it is not as high as in the 1st layer it is well above the average. Unlike other profiles the clay content of this profile is more or less uniform throughout. This type of soil occurs in low areas which remain water-logged almost throughout the year. The parent material of this type is probably the same as that of the other two but it has developed into a different type due to the difference in hydrographical condition among them. The drainage system of this type is very poor and impeded.

A comparative study of the mineral contents of these soils as revealed by chemical analysis of the surface soil only (Table 7) shows that these soils irrespective of their genetical significance are poor in lime and phosphoric acid. The potash content though not as low as the other two constituents fails to satisfy the requirements of a good soil. The low value for calcium is manifested by the high acidity of the soil. Liming is expected to improve the soil considerably but

it is apprehended that continuous liming will cause depletion of potash whose concentration is already low. Liming should therefore be done with great caution. Further the low figures for phosphoric acid shows that these soils will greatly respond to phosphatic manures. It is therefore, apparent that these soils cannot be improved by the application of a single manure. What is needed for these soils is a balanced manure where N.P.K., Ca will be present in appropriate proportion. These soils are showing a tendency of loosing their crumby structure due to its continuous cultivation without any application of lime and organic matter.

TABLE 7.

Chemical Analysis.

Type.	Sample No.	Locality.	Loss on Ignition.	P_2O_5%	K_2O%	CaO%
I ...	S.S.32 ...	Baunia ...	3·69	0·087	0·68	0·10
	S.S.201 ...	Gaorar ...	2·844	0·098	0·4488	0·114
	S.S.247 ...	Nasara ...	3·377	0·06723	0·7534	0·1313
	S.S.259 ...	Baugura ...	4·663	0·048	0·7297	0·097
II ...	S.S.1 ...	Tejkunipara ...	3·228	0·09	0·620	0·130
	S.S.63 ...	Fayzabad ...	1·709	·029	0·623	0·1660
III ...	S.S.177 ...	Bazail	6·658	0·048	1·35	0·1680
	S.S.227	Mohani	6·507	0·033	1·340	0·475

It is also clear from tables 2 and 4 that these soils are very poor in organic matter. The addition of humus to this soil is expected to improve them to a very great extent. The chemical composition shows that these soils are badly in need of plant nutrients. From local enquiry it becomes quite clear that raising of crops from this soil without manuring is a difficult problem if not altogether impossible. But the resources are limited. The practice of green manuring is totally unknown in these parts. If green manuring is done in wide scale considerable improvement can be expected. The position is no better with regard to chemical fertilisers also. Farm yard manure is the only thing which is used as manure but the quantity is so limited that only a negligible fraction of the area gets a small quantity of this manure. In view of the fact that the soil is highly deficient in organic matter it is not possible to recommend the extensive use of fertilisers without making an adequate provision for organic matter. Attempts should therefore be made to introduce the practice of green manuring in wide scale.

The system of cropping should also be remodelled. At present jute or aus paddy are practically the only crops found in the highlands. In isolated area mustard and sessamum (til) are attempted but practically with no success. Water appears to be the limiting factor. Both rabi and kharif crops are adversely affected for want of adequate water supply. It has already been pointed out that to make provision for water supply is a difficult job. Under the present circumstances there is hardly any possibility of making the best use of these lands unless a new cropping scheme and cultural practices are evolved. The possibilities of introducing new crops other than the traditional ones should receive serious consideration. It is expected that some of the areas are likely to yield better income from some of the root crops such as ginger, turmeric, kachu, etc. These sandy lands also are not in a better position. The need for manure is felt very strong in these lands also. There are ample scope of increasing the yield of paddy if the practice of manuring gains some popularity here. Heavy dose of organic manure is expected to considerably improve the yield of paddy. Liming is also necessary for rectification of acidity. The present yield varies from 18-25 mds. without any manure. In years of well distributed rainfall the yield goes up to 30 mds. per acre. An increase of at least 20-25 per cent. can be assured if lands are properly manured and water supply assured.

The low-lying swamps where the drainage is impeded affords nice lands for boro paddy. These low-lying soils are better supplied with plant nutrients than the soils with free drainage. These soils are very rich in organic matter. In many cases these low-lying areas get washing from the highlands and are rejuvenated. The acquatic weeds that may grow in the low-lying swamps are allowed to decompose in the lands itself. In this way these soils get fresh additions of organic matter every year. In years of good rainfall these lands yield a bumper crop of boro paddy. The yield sometimes goes as high as 30-40 mds. per acre. Here also the water is the limiting factor. This crop is extensively irrigated by country method, i.e., either by done or swing basket. But the sources of water supply is in very many places limited. Hence in many cases in spite of best intentions irrigation cannot be done. There again comes the question of resuscitation of silted up canals.

Soils of the flood plains.

The soils of the flood plains are immature. These soils are annually inundated and renewed by the deposit of silt every year. Although the general topography is flat there are depressions mostly of basin or saucer shaped. These topographical differences have a direct effect on soil types. Due to the difference in drainage condition within a small area soils belonging to more than one subgroup scattered all over the flood plain. These sub-groups both genetical and textural occur sometimes in isolated patches and sometimes in compact blocks. The preparation of an exact soil map of the flood plain, therefore, presented considerable difficulties, due to the fact that the soil character is annually changing through the activities of rivers which are directly or indirectly responsible for their deposit. In fact what appears to be a nice loamy soil to-day may turn into a sandy bed in a short time incapable of supporting vegetation and vice versa. Further due to the ever-changing character of the rivers different kinds of parent materials are mixed up together to give a new character to the deposit. Therefore, though certain

areas derive their origin from the activities of a particular river and consisting of soil possessing some particular characteristics they could not maintain their inherent peculiarities due to the shifting of the courses of the river beds. Therefore, too much emphasis have not been given to the genetical side. In fact any attempt is bound to be misleading.

The soils of the flood plain fall under two genetic groups—one derived its origin from the river Brahmaputra and the other from the river Ganges. Although these two types bear a remarkable contrast to those in the Madhupur Jungle Tract they bear a close resemblance with one another. These soils have black or blackish grey colour which becomes lighter with the depth. In low-lying swamps where there are accumulation of decomposed vegetative matter the intensity of the black colour increases with the depth. In fact there is no difference in the profile characteristics except colour difference. The texture of the soil of course varies from layer to layer. These profiles consist of different strata having soils of different textural grades. Surface soils are more clayey than the sub-soil.

Of the two types mentioned above the Gangetic alluvium occupies only a limited area in the north-west while the bulk of the soil derived their origin from the river Brahmaputra. Emphasis has, therefore, been laid here on the textural and chemical classification. The stages reached under the condition of slight to considerable surface flooding led to the evolution of different types of soil with drainage condition varying from good to poor. Although sandy soils are the common occurrences in higher elevations followed by loamy soils with increasing percentage of finer materials down the depressions, regular sequences of different varieties are very often missing. In some places the low-lying area is covered by soils of heavy texture with a clod structure while there are other low-lying areas of similar nature which are occupied by sandy soils with single grained structure.

It is noticed in the flood plain that parts of the area bear some sort of resemblance with one or the other landscapes. The different types of soils in such a landscape occupies a fixed topographical position or in other words in each particular landscape there is a characteristic group of soil so as to form an association. The soils in such association bear some sort of hydrographical relationship with one another depending on their respective position in the landscape.

Unlike the soils of the Madhupur Jungle Tract which are more or less mature these soils failed to exhibit differential profile characteristic so as to form a basis of classification. The sub-soil consist of clay alternating with sands.

A full description of the soils as revealed by anatomical examination is given below.

Soils of flood plain.

Profile No. 393—Munshiganj Series.

Clay—

Locality—Tatirdi, police-station Kapasia.

Drainage—Free

Topography—Saucer shaped.

Depth—0″—6″ Clay, blackish grey, tending to cloddiness, porous.

Depth—6″—26″ Clay, black, cloddy.

26″—54″ Grey, sandy loam structureless, porous.

Loamy clay—

Profile No. 476—

Locality—Hasara, Police-station Srinagar.

Drainage—Free

Topography—Basin shaped.

Depth—0″—6″ Loamy clay, grey, cloddy.

Depth—6″—24″ Clay, blackish grey, cloddy, hard.

24″—31″ Loamy sand, grey, loose, structureless.

31″—48″ Sand, greyish white, structureless.

Clay Loam—

Profile No. 460.

Locality—Jeodhara, Police-station Narayanganj

Drainage—Frer

Topography—Flat.

Depth—0″—6″ Clay loam, blackish grey, cloddy, compact.

Depth—6″—18″ Sandy loam, grey, structureless.

Depth—18″—48″ Sandy, grey.

Silt loam—

Profile No. 462.

Locality—Panchasar, Police-station Munshiganj.

Drainage—Free.

Topography—Flat.

Depth—0″—6″ Silt loam, blackish grey, structureless, porous.

Depth—6″—12″ Sandy loam, black, structureless.

Depth—12″—24″ Loamy sand, grey, structureless, porous.

Munshiganj. senris

Loamy clay—

Profile No. 492.

Locality—Haldia, Police-station Lohajang.

Drainage—Free

Topography—Flat.

Depth—0″—6″ Loamy clay, grey, cloddy, compact.

Depth—6″—24″ Sandy loam, grey, structureless.

Depth—24″—48″ Fine sand.

Profile No. 447.

Locality—Sakta, Police-station Keraniganj.

D rainage—Free

Topography—Flat.

Depth—0″—12″ Loamy clay, grey, with rusty veins, crumby, loamy clay.

Depth—12″—24″ Sandy loam, grey structureless, porous.

Sandy loam—

Profile No. 452.

Locality—Sanmandi, Police-station Baidyarbazar.

Drainage—Free.

Topography—Flat.

Depth—0″—6″ Sandy loam, greyish black, structureless, porous.

Depth—6″—12″ Loamy sand, yellowish grey, structureless.

Depth—12″—50″ Sand, grey.

Loamy clay—

Profile No. 461.

Locality—Nateswar, Police-station Tangibari.

Drainage—Free.

Topography—Flat.

Depth—0″—6″ Loamy clay, blackish grey, cloddy.

Depth—6″—12″ Silt loam, blackish grey, cloddy, compact.

Depth—12″—42″ Clay loam, blackish grey, compact.

Loamy clay—

Profile No. 484.

Locality—Aona, Police-station Nawabganj.

Drainage—Free

Topography—Basin shaped.

Depth—0″—12″ Loamy clay, grey, crumby.

Depth—12″—36″ Sandy loam, blackish grey, crumby.

Depth—36″—48″ Sand, blackish grey, structureless.

Manikganj Series.

Silt loam—

Profile No. 444.

Locality—Bahadurpur, Police-station Harirampur.

Topography—Flat.

Drainage—Free

Depth—0″—15″ Silt loam, grey, crumby, porous.

Depth—15″—20″ Sandy loam, grey structureless, porous.

Depth—20″—48″ Loamy sand, grey, structureless, porous, loose

TABLE 8.

Munshiganj Series

Sample No.	Locality.	Depth.	% Moisture.	% Coarse sand.	% Fine sand.	% Silt.	% clay.	% Loss on Solution.	% carbon.	% Nitrogen.	C/N Ratio.	Total exchangeable base in milligrams equivalent per 100 gms. of soil.	Exchangeable calcium in milligrams equivalent per 100 gms. of soil.	% P_2O_5	% K_2O	% CaO.	% Lose on ignition.
	Clay:—																
210	Chaklatirdi	... 0″ —6″	2.18	1.94	22.0	45.4	31.8	1.06	1.0902	0.117	9.3	8.79	5.91	0.0910	1.56	0.6085	5.206
211	Ditto	... 6″ —26″	2.54	5.7	2.28	39.05	42.07	2.07	0.768	0.106	7.2	12.15	9.19	0.1353	1.296	0.4374	5.11
	Loamy clay—																
503	Aona	.. 0″ —12″	2.696	0.26	2.55	65.82	30.04	1.53	0.745	0.091	8.168	9.08	8.1	0.07204	0.8030	0.8553	4.36
429	Nateswar	... 0″ — 6″	3.67	0.81	12.73	39.56	45·36	1.6	1.145	0.1321	8.66	..	...	...	...	...	...
448	Autsahi	... 0″ — 6″	1.92	0.40	33.83	42.93	21.24	1.87	0.745	0.091	8.163	13.90	12.57	0.07204	0.8830	0.8558	4·36
494	Ahiladpur	... 0″ —14″	2.826	0.359	17.51	54.23	26.53	1.419	0.6043	.11216	14.97	16.12	13.03	0.0373	1.287	0.8714	4.328
481	Hasara	... 0″ —6″	3.778	0.35	12.46	37.57	47.62	1.95	1.196	0.1424	8.4	14.45	12.3	0.07153	1.317	0.7658	6.652
506	Bhogdia	... 0″ —6″	3.20	0.2663	17·30	45·10	35·34	1·455	0.8256	0.1040	7·94	11·14	9.89	0.03491	1.495	0.7269	4.932
509	Atpara	... 0″ —6″	3·05	.2845	36·69	28.96	32·84	1·297	1.126	0·1356	8·31	10·85	9·64	0·05396	1·216	0·7191	5·230
520	Haldia	... 0″ —6″	4·094	1·066	11·91	40·03	46·70	1·374	0·9743	0·1282	7·60	12·33	9.43	0·05048	1·512	0·5887	6·247
	Clay loam—																
108	Gazaria	... 0″ —5″	2·41	0·66	19·23	53·43	24·26	2·23	1·631	0·175	9·30	9·20	9·095	0·085	1·18	0·84	5·32
425	Jeodhara	... 0″ —6″	1·91	2·05	28·19	39·43	28·47	1·59	1·058	0·1227	8·61	8·86	8·15	0·07794	0·9554	0·7948	4·64
	Silt loam—																
165	Saturia Solohati	... 0″ —8″	1.69	0·273	36·37	40·48	20.33	2·213	1·062	·1054	10·08	6.73	4·99	0·1522	1·391	0·5440	3·88
433	Panchasar	... 0″ —6″	1·91	0·35	29·32	42·03	26·08	1·76	0·948	0·09	...	12·99	11·65	0·07526	0·9290	0·6536	4·96

Sandy loam—																
198	Dakhin Deora	...	0″—4″	2.08	0.588	28.27	32.73	36.61	0.075	1.206	0.1258	9.60	7.006	6.05	0.0745	0.9870	0.4301	5.47
393	Sannmandi	...	0″—6″	1.53	0.60	53.76	25.06	18.45	1.25	0.86	0.097	..	5.9	5.8	.077	0.723	0.478	4.23
Manikganj Series.																		
Loamy clay—																		
306	Dharra	...	...	3.56	0.34	7.16	35.23	53.01	1.66	1.206	0.1353	9.3	12.33	9.69	0.1301	1.349	0.5257	7.12
Silt loam—																		
333	Tutium	...	0″—17″	2.41	0.44	8.96	41.3	49.6	1.79	0.7866	0.094	8.366	11.12	10.12	...	...	...	...
373	Bahadurpur	...	8″—18″	3.44	0.40	8.67	52.5	38.9	0.98	0.7107	0.087	8.17	54.23	14.47	..	...	...	...
376	Dubail	...	0″—18″	3.08	0.10	6.8	30.8	59.2	0.80	1.035	0.10	10.35	19.0	16·4	...	...	...	...

Loamy clay.—This type could be found in the low-lying areas where the drainage is not very free. The inundation level here attains sometimes more than 20 ft. This type occupies compact areas in the interior of Munshiganj and Manikganj subdivisions. This is a heavy soil, the dominant fraction being silt and clay. The percentage of coarse sand is very low. Chemical analysis (Table 8) shows that they are fairly rich in organic matter which sometimes imparts a black colour to the soil. Due to the decomposition of aquatic weeds and other vegetable matters these soils are annually enriched by organic matter. The nitrogen content is also high it is always more than 0·1 per cent. But the P_2O_5 figures are not very encouraging. It is definitely low. Such low figures for P_2O_5 probably accounts for the low yield of paddy. The potash content is also fairly high. Therefore the nutrient deficient cannot be atributed to anything other than P_2O_5.

It is therefore expected that the application of phosphatic manures will greatly improve the productive power of the soil. The nitrogen and potash need be balanced by phosphate.

Paddy is the only crop grown in these areas during the year. The lands being low-lying the tidal water does not evacuate in time so as to make it suitable for the sowing of rabi crop. Late sowing cannot be resorted to since these lands require to be sown for kharif crops very early in the season. The tidal water enter these areas sometimes in May and, therefore, unless they are sown in April there are risks of young seddlings being submerged.

Early rainfall is an essential condition for the successful raising of crops in this class of land. The present yield of paddy in this area is 12 to 15 mds. per acre which can considerably be increased if properly manured. The facilities for better drainage are also essential for the improvement of these areas.

Clay loam.—The morphological features of this type is not markedly different from those of the former type except that the colour is a bit lighter. In this soil clay percentage is comparatively lower. Along with lowering of the clay percentage there is a corresponding increase in the fine sand so as to give a lighter texture to the soil.

The chemical analysis shows that the soil is well supplied with organic matter and nitrogen. Both of them are well above 0·1 per cent. The phosphate deffiCiency is the characteristic of this soil also. The potash and the phosphate contents are of the same order as in the loamy clay already described. The figures for lime is also low and does not vary much from that in the former type (Table 8). This shows that these two types of soil derived their origin from the same source.

This type of soil occurs in situations which are at a bit higher elevation at police-station Kapasia, Kaliganj at Dacca Sadar and police-stations Rupganj, Narshingdi, Raipura and Fatulla in Narayanganj subdivision. Here also the tidal water stands several feet above the surface of the soil. The drainage condition of this soil is free. This is more valued than the other type. These lands are generally double cropped. Mustard, pulses, wheat and barley are grown during the rabi season, while paddy (deep water) is very often mixed with aus paddy or til or both during the kharif season. The yield of paddy is also higher. There the tidal water enters generally in mid-June.

The practice of manuring is totally absent here. The soil is in need of phosphatic manures. Hence a heavy dose of bonemeal is expected to considerably

increase the yield of both the rabi and the kharif crops. Nitrogenous manures are not much needed for field crops.

This soil retains sufficient moisture to meet the requirements of rabi crop. In fact all sorts of rabi crops are extensively cultivated in this type of soil.

The yields of gram, keshari and pea comes to 5-7 mds. per acre while wheat and barley gives an average outturn of 6 to 8 mds. per acre. Jute is extensively cultivated during the kharif season. The yield of jute is 15-18 mds. per acre. The yield of aus paddy is 15-16 mds. per acre and that of broadcasted aman is 20-25 mds. per acre.

An examination of the chemical composition of the soil shows that there is much scope for the improvement in yield. Although for ordinary crops irrigation is not so much in need, yet resuscitation of some of the main canals that cross the areas will go a long way towards the improvement of these areas. These canals will form a good source of water for irrigating some of the vegetable crops.

Clay.—This type is very closely related to the former type both in morphology and surface feature. This type occurs in the low-lying areas in the interior or Manikganj and Munshiganj subdivisions. The exchangeable bases and other chemical constituents are of the same order as in the former type, Table 8.

Silt loam.—This is the most important type in the whole district. This type of soil could be found occupying compact blocks in the Narayanganj and Manikganj subdivisions. In the Narayanganj subdivision this type occurs in areas which either do not go under water or where the inundation level is more than 4-5 ft. In Manikganj the inundation level is more than 5 ft.

This soil has a light texture and a good water-holding capacity and is suitable for all sorts of rabi and kharif crops. The chemical composition shows that this soil is fairly rich in all the important nutrient. The $P_2 O_5$ content is much higher than that in the other types in the same plain. The lime content is also higher. The nitrogen content is above 0·1 per cent. This type is distinguished from the other types for higher contents of exchangeable calcium.

Although the general calcium deficiency is noticeable here also but the soil is highly acidic though it is on the acid side of neutrality. The soil is moderately rich in organic matter. In the Manikganj subdivision the areas under this type of soil which are at a higher elevation are extensively put under rabi crops like pea, gram, lentil mixed with mustard. During the kharif season they are put under broadcasted aman very often mixed with aus paddy and til. The peas in the rabi season are sometimes used as fodder. The lands in higher elevation are put under jute. The yields of crops are as follows:—

Broadcasted aman		15-20 mds./acre.
Aus	...	15-20 mds./acre.
Pea	...	8-12 mds./acre.
Mustard	...	3-4 mds./acre.
Gram	...	6-8 mds./acre.
Jute	...	20-25 mds./acre.

This type of soil appears to be very suitable for wheat and barley. But the cultivation of this crop is very limited. There is, therefore, ample scope for introducing these two crops in wide scale.

In the Narayanganj subdivision the same type of soil which are above flood level are almost exclusively put under sugarcane. While the areas under the same type where the inundation level is very low say below 5 ft. jute or aus paddy is followed by transplanted aman. This silt loam in the Narayanganj subdivision is the most important sugarcane-growing tract in the district.

The sugarcanes grow here are quite healthy and the yield is also high. The practice of rotation is not very common. The same kinds of crop are grown year after year. The sugracane is extensively manured with oilcake and ammonium sulphate. Other crops are not generally manured. The yields are as follows:—

Sugarcane	...	600-900	mds./acre.
Aus paddy	...	15-18	mds./acre.
Transplanted Aman	...	18-24	mds./acre.
Jute	...	12-18	mds./acre.

Rabi crops are grown only to a limited extent, chillies, onions, potatoes could be found scattered over the area. This type of soil appears to be very suitable for various kinds of rabi crop such as pulse, oil-seeds, wheat and barley. But neither wheat nor barley could be found anywhere. The people are saddled with the idea that the wheat can be grown in this plains. There are good possibilities of introducing new crops such as wheat, linseed, etc. This area may also develop into a nice cotton-growing centre in the district.

Sandy loam.—This type of soil could be found in higher elevation and in *char* lands. They generally occur along the river banks which are at a higher level than the areas away from the rivers. Here the drainage condition is very free and the inundation level during the monsoon is also low.

The chemical composition does not markedly differ from the other types in the flood plain. The potash content is slightly lower than the other types. The nitrogen content is about 0·1 per cent. and hence they cannot be called deficient in nitrogen. The general phosphate deficiency is noticed here also.

These soils are very suitable for potatoes, onions, garlic, etc. In fact extensive cultivation of potatoes could be found in this type of soil specially in the *char* lands. Onions and garlics are also extensively cultivated with a good result.

During the kharif season jute is the main crop. Aus paddy is also grown extensively. In fact this soil is more suitable for jute rather than aus paddy.

Crops.

Sugarcane.—The flood plains lying on either side of the old Brahmaputra Arihazar) up to the border of the Dacca district has since developed into a

compact sugarcane block. In fact more than 75 per cent. of the sugarcane of the district is grown there. The next compact area for sugarcane can be found in Munshiganj subdivision specially in Rampal. More than 50 per cent. of the sugarcane in the former area is crushed by the White Sugarcane Factories in the area and 50 per cent. is made into gur while in the latter case entire crop is crushed for gur-making. The Rampal gur has the widest reputation in the market and always in great demand and brings better price. Sugarcane is also grown on the bank of Balu river and in some *char* lands in the vicinity of the City of Dacca. These canes are exclusively chewing varieties. These varieties are very delicate and require special care and attention in cultivation.

Although the area mentioned above is very suitable for sugarcane and is likely to yield better return than any other crop, the area is not fully utilised for sugarcane cultivation. There is thus scope for further expansion of sugarcane cultivation in these areas. The canes grown in the old Brahmaputra valley are almost free from disease. The yield of cane is 600—900 mds. per acre. The most favourable manures are the am.-sulphate and oilcake. Planting is generally done in plough furrows and not in trenches, as recommended by the Department. In many cases the canes are more or less lodged. The lodging is, however, prevented to a certain extent by rapping the whole clump together with cane leaves. Selection of a cane that can stand water-logging to a certain extent will help a good deal in the expansion of sugarcane cultivation. There being a good market for gur the growers are more inclined to crushing their cane for gur-making rather than selling the canes to the White Sugar Factories.

Departmental Co. canes occupy only a meagre position here. Most of the area is under yellow tana. The practice of ratooning is in vogue there.

The Departmental Co. canes occupy only limited area, in the Rampal area also in the Munshiganj subdivision which is a promising cane area and produces a very nice quality cane.

Compact sugarcane areas could also be found in the *char* lands, in the Munshiganj area. Here the canes are grown in areas which go under water during the monsoon period. The cultivation of sugarcane can considerably be increased, if promising varieties capable of standing water-logging could be found out.

In the old Brahmaputra valley sugarcane which is grown in rotation is followed by jute or aus paddy. The cane fields are manured with mustard cake ammonium sulphate and also cowdung if the last named is available.

The lands are ploughed 3—4 times. Sets having 3 or 4 eyes are dibbled in the plough furrows. The spacing between the lines is 1½—2′ ft. and that within the line is 9″—1′. The seed rate is 15,000 cuttings per acre. Planting is generally done during the month of February and March. The oilcake and cowdung is applied at the time of preparation of land. The ammonium sulphate at the rate of 1—2 mds. per acre is applied as top dressing in two doses on 50:50 basis. Interculture is done when the canes attain a height of 6—8 inches.

Due to the shallow planting the canes have a tendency to lodge. The practice of wrapping the canes with leaves is a guard against jackal attack. The yeild of gur per acre is 60-90 mds. or 600—900 mds. of canes.

The practice in Rampal is quite different. Here no manure is applied in sugarcane in the 1st year. The residual effect of the manures is sufficient for the 1st year crop. In the ratoon crop manuring is done with oilcake and ammonium sulphate usual rotation being 1st year banana, 2nd year brinjal mixed with ginger or turmeric, 3rd year sugarcane, 4th year ratoon. In the sixth year the soil is rejuvenated by the addition of tank silt and then banana.

In the recent years cattle dung and urine supplemented by ammonium sulphate and oilcake (half of each per plant) is applied. It is reported that such treatment gives good result.

Such heavy doses of manure cannot be advocated. In very many places the late crop presented burnt appearances apparently as a result of excessive manuring. The early crop which got sufficient rainfall was not adversely affected by the high concentration of the manuring but the late crop which had to struggle drought are certainly adversely affected by the high concentration of these manures. A well-thoughtout manurial schedule for this area will therefore be highly appreciated.

Cotton.—In the past Dacca had the reputation of yielding large quantities of cotton. This cotton was not only sufficient in meeting the local needs but used to be exported to other parts of India and abroad. The fundamental defect of the cotton grown in the Dacca district was that they were short staple. But in other respect such as fineness, softness, etc., this cotton was excellent and was superior to the produces of many other cotton-growing centres. Many interesting accounts of the cotton and cotton industry in the district can be found on a perusal of the old reports left by foreign travellers. The world renowned muslin were spun from the cotton which had its home land in the Dacca district.

Sonargaon in police-station Baidyar Bazar had once a great reputation for cotton and cotton textiles. It is reported that the Sonargaon used to export cotton goods all over India. Ship-loads of cotton goods used to be exported oversea countries as well. Huge quantities of cotton used to be grown in the past round about Toke and Kapasia also. The name Kapasia probably originated from the fact that large quantities of cotton used to be shipped from here. But now and when the cultivation of cotton in these parts of the Dacca district has become extinct is not exactly known. At any rate Dacca has ceased to be a cotton-growing area.

Attempts should therefore be made to revive the cotton cultivation in this district. The medium land on either side of the old Brahmaputra may develop again into an important cotton-growing area if proper care and attention is devoted to it. This area no doubt is now growing an important cash crop, namely, sugarcane but cotton also deserves a sincere trial. Cotton may be grown there in rotation with sugarcane.

The red soil tract round about Toke and Kapasia may also be utilised for cotton cultivation during the kharif season. If adequate provision for water supply can be assured cotton may successfully be grown here during the rabi season also but that is a bit risky. In this connection it may also be mentioned that during the last two decades or two several attempts were made to grow cotton in the Dacca district particularly in the Madhupur Jungle Tract but the attempt ended in failure. A close scrutiny of the methods of cultivation, varieties, season, etc., is needed in order to formulate a rational technique of cotton cultivation in this parts which had so great a reputation in the past. If the so-called waste lands (high lands in the Madhupur Jungle Tract) can be utilised for cotton-growing that will mean a great advance in the economic well-being of the district. Further, the

revival of cotton cultivation in this district where so many textile industries are at work will provide self-sufficiency in the raw materials for these industries. A sincere and earnest trial on this particular crop is, therefore, strongly recommended.

Paddy.—Paddy and jute are the most widely distributed crop in the district. These two crops are grown all over the district. But the varieties grown in the different parts are not the same everywhere. They are dependent on altitude. The highlands of the Madhupur Jungle Tract where the tidal water cannot enter are put under aus paddy and jute. And in areas where the flood water enters but the inundation level is low, transplanted amans are the varieties grown. In the low-lying areas, i. e., in *byde* lands where tidal water stands up to 15 ft. or more, deep water paddy is grown. The swamps which remains water-logged throughout the year are put under boro paddy. Thus the selection of the particular variety of paddy depends not on the soil character but on the topographical position of the area.

The so-called medium lands which go under water only for a short period or which are just above the flood level grows a very nice crop of transplanted paddy. Under proper manuring and irrigation these medium lands give high yields. But the lack of irrigation facilities in this part very often result either in total failure of crop or abnormally low yield. The success of this crop, therefore, depends on the timely rainfall. The heavy precipitation in July and moderate rainfall in October and November are the essential conditions for a good harvest. This tansplanted paddy does not find any place in the flood plains exeept in some limited areas mostly in the outskirts of the Madhupur Jungle Tract. The low lying swamps lying in the Madhupur Jungle Tract and depressed areas along the bank of the river Turag grow a very nice crop of boro paddy. This crop is extensively irrigated by country method, i.e., done swing basket, etc. The yield of this variety of paddy is very high and sometimes reaches up to 40 maunds per acre.

The deep water paddy which can stand all sorts of buffeting action of monsoon are grown in the flood plain and sometimes mixed with aus paddy or til. This deep water paddy can withstand flooding to any height if the rise of water be not sudden. When mixed with aus the latter is harvested in June and the former in November. Generally the yield of this variety is not as high as the other.

Pulses and other cereals.—The soil of the flood plain particularly the silt loam, clay loam and loamy clays are very suitable for all sorts of pulses and cereals. But the growers are in painful necessity of confining the cultivation of these crops in areas which are at a higher elevation or where the drainage condition is free. Due to the impedence of drainage in various places in the flood plains there are stagnation of tidal water till mid-winter. In such area no attempts for growing rabi crops is possible. Further such areas have got to be sown for kharif crops early in the season. Therefore, such areas have got only a short span of time for the rabi crops which cannot, therefoe, be attempted. The success of the rabi crops thus depends more on the position of the area in the landscape than on the soil characteristics. The areas which go under water early in the season and dry up late cannot, therefore, yield any rabi crop.

In spite of the fact that there are scopes for new crops such as wheat, linseed, etc., other than the traditional ones there is absolutely no initiative in growing new crops which is expected to give better return. It is, therefore, desirable to convince the growers the need and possibilities of growing other crops such as wheat, lentil, gram, linseed, etc. At present pegion pea, khesari, are the only favourites in the flood plain. Other cereals are grown only to a limited extent.

Vegetable crop.—Until recently different varieties of country vegetables such as potato, sweet potato, brinjal, karala, radishes, onions, garlic, chillies, etc., used to be grown extensively in the flood plain particularly in *char* lands and along the banks of the rivers or canals or in some such areas where irrigation facilities are available. The cultivation of sweet potato is more or less confined to the sandy loams in the *char* lands. Onion and garlic are also concentrated in the sandy loam in the flood plain. Potato and radishes are extensively cultivated at Rampal in the Munshiganj subdivision. Both the potato and radishes of Rampal have great reputation in the market the former for the quantity and size the latter for size and quality. The potatoes grown in Rampal have got no keeping quality.

Brinjals and chillies are grown all over the flood plain as also in the Madhupur Jungle Tract. These two crops are grown during Kharif season while in the flood plain during the rabi season. Although these crops can be found scattered all over the flood plain compact areas can only be found in the *char* lands. While different kinds of good quality brinjals can be found to grow here. The chillies are all very small sized local varieties.

The English vegetables, which until recently used to be confined in the Dacca town proper and its suburbs, are gradually gaining some ground in the country sides through the activities of the Department of Agriculture. In this connection Rampal deserves special mention. The technique of growing English vegetables are being fully utilised by the Rampal cultivators. At present very nice quality of cabbages and cauliflowers are grown there. It is expected that the English vegetables will shortly find a place in every house in the country side if the seedlings of good varieties are available within easy reach.

Manures.—The needs for manures have been discussed while dealing with the different soil types. Truly speaking the practice of manuring is not at all widespread. Except for high grade agricultural crops and vegetables manuring is an exception rather than the rule. In the Madhupur Jungle areas the highlands which are near the homesteads get small quantities of cattle dung. It is gratifying to note that the Muslim population in this part do not use cattle dung as fuel. Whatever quantity is available are conserved and applied to the field. But the quantity available is so small that they cannot even touch the fringe of the problem. Further the method of conserving the cattle dung for manural purpose is quite unsatisfactory in this part. The cattle dung is either heaped up uncared for in an open space near the homestead where it is very often exposed to the vagaries of weather or they are directly carried to the fields where they are kept in small heaps scattered all over the field during the dry season.

These manures, therefore, very often dry up to hard cakes and lose much of their intrinsic values. The recommended method of conserving cattle dung should be brought home to the cultivators so that the maximum benefit may be derived from them.

The red soils of the Madhupur Jungle Tract are badly in need of manure. These soils are particularly deficient in organic matter, nitrogen, phosphoric acid and calcium. The practice of green manuring should be introduced in wide scale. The transplanted paddy lands will greatly be improved by green manuring. Liming is also necessary. Great improvement can be expected by the application of bonemeal. Some of the fertilisers may also be used with advantage.

The soils of the flood plain are deficient in phosphatic manure. Application of superphosphate is expected to considerably increase the yield. These soils as they appear now are not badly in need of other nutrients. The necessity of trace elements need investigations.

Waste lands.—The areas under waste lands in the district do neither occur in alarming proportion nor do they present unsurmountable difficulties in their reclamation. Two kinds of waste lands can be distinguished (1) waste lands with impeded drainage-swamps, (2) highlands susceptible to drought.

The first kind of waste lands can be found scattered all over the district both in the red soil tract and also in the flood plain. It has already been mentioned in the geography of the district that the district used to be intersected by a net work of rivers and channels which have since shifted their courses more than once. The old beds thus forsaken have turned into so many swamps. In some places these forsaken beds have been completely filled up by the annual deposit of silts and in some places the silting has not proceeded to any great extent and the area remains as culturable wastes, There are again other areas where the silting up have proceeded to a considerable extent and the partial utilisation of the land for crop production has been possible. The reclamation of such area does not present much difficulty. These types of waste lands can easily be reclaimed by the improvement of drainage. It is very often found that waste lands of this types particularly those in the Madhupur Jungle Tract occur in disconnected chains or groups. These swamps can be easily connected with one another and finally led into the adjoining or nearly rivers or canals. Some of the waste lands of this type represent the confluences of the rivers which were in existence in the past, and which have since either dried or shifted their course. The Arial Bil is a specimen of this class of waste lands There are a good number of swamp areas of this type which used to be drained in the past by a number of outlets have since silted up rendering the evacuation of water impossible. The reclamation of such areas is very easy and less costly. The resuscitation of silted up outlets which can be done at a very low cost is sufficient to convert them into highly productive areas.

Under this class may also be included those areas which in the true sense are not waste and but may actually be treated so. These are the saucer shaped depressed areas without any outlet at all or with silted up outlets. In normal years when the rainfall is not heavy during the months of April and May affords a very good crop. But if the rainfall be a bit high water accumulates so as to render sowing impossible or sometimes heavy precipitation during the early months of growth submerge the young seedlings resulting in total failure.

The second type of waste lands can only be found in the Madhupur Jungle Tract. These waste lands are isolated mounds occupying limited areas and are covered by bushes of Ariach, Mimosa, Fulkhari, etc. The soils in these areas do not widely differ from the soils of other highlands which under proper care yield goods crops. The difficulty in utilising these areas lies in the fact that there is no provision for adequate water supply. These areas being surrounded by low-lying byde lands on all sides helps in the escape of moisture not only from the surface but also from the sides. Further such areas have mild slopes towards the edges hence the rain water that fall on such areas are generally disposed of by surface drainage. These highlands dry up to a low moisture content during the dry season. Everything grownig there present a burnt appearance except the perennial trees. The natural vegetation however get a new fillip in their growth after getting one or two showers. Attempts are however made to grow aus paddy in these areas after keeping them fallow or using them as grazing grounds for a period of two or three years at a stress. The yield of paddy is very poor. Further inadequacy of rainfall during the months of April and May results in the total failure of the crop. Heavy doses of organic manure sometimes assure a good yield but the deciding factor is the water.

The greatest handicap in utilising these areas for crop production is the lack of provision for water supply. The sub-soil water table sinks down to a depth of 25-30 ft. The capillary movement of water becomes totally ineffective in supplying the water requirements of crops. On the other hand to make provision for water is by no means an easy job. The tapping of sub-soil water is not only expensive but is also of doubtful success. The great depth of water level in the wells makes it practically impossible to irrigate the land from that source either by Persian wheel or some such appliance. Tube-well irrigation may be possible but is too much expensive and sometimes well beyond the reach of the ordinary people.

There are, however, a number of rivers crossing the area length and breadthwise which may serve as a perennial source of water. In this connection the rivers Banar, Lakhya, Turag, and Bansi deserve special mention. These rivers may be utilised for irrigation purposes. The broken nature of the topography specially in the areas adjoining the river banks may present some difficulties which any engineering skill will be in a position to solve.

As will be seen later on, under horticultural plants that these highlands will form good sites for commercial orchards.

Horticultural plants.—The two great soil divisions exhibit differential behaviour towards fruit plant. Although there are only a few varieties which are not common to both the divisions, there are marked differences in frequency and quality. Jack fruit and apples are the specialities of the Madhupur Jungle Tract while banana is of special importance in the flood plains. Mango can be grown all over the district both in the red soil tract and also in the flood plains. Both the types of soil are equally suitable for mango. Pineapple is extensively grown in the red soil tract. The pineapples of Ghorasal have got good reputation in the local market. Cultivation of pineapples on commercial scale could not be found anywhere other than in Ghorasal. There is ample scope for the expansion of pineapple cultivation all over the red soil tract where tidal water has got no access. The cultivation of this particular fruit can considerably be improved by the introduction of exotic varieties such as Tezpur and Cylone varieties. In fact some enterprising cultivators produce very big Tezpur, Cylone varieties in the Kurmitola area. This enterprise was an eye-opener to many but the cultivation of this particular variety could not be expanded due to the want of seeds. Government intervention is needed in this direction. The Government should find ways to distribute good quality pineapple seeds particularly the Tezpur variety all over the red soil tract.

Jack fruit trees are the hot favourites in the red soil tract. Both the yield and quality are good. Jack fruit trees can be found in every house and scattered all over the area sometimes in compact association and sometimes in isolated individuals. It is extremely regrettable that well planned jack fruit orchard could rarely be found in the red soil tract.

The new alluvial tract along the old Brahmaputra valley near Lackpur appears to be very suitable for mango and lichi. In the Lackpur area which is situated near the junction of the rivers old Brahmaputra and the Banar which is annually inundated yield beatiful mango free from diseases and borers. Similarly the new alluvial tract on the other side of the river is also very suitable for mango and lichi. Lichi plants yielding high class lichies (seedless comparable with the Mozaffarpur and other imported varieties could be found scattered over an area of 2 to 3 square miles). In this connection the lichies of Taraganj in police-station

Kapasia and Alinagar in police-station Monohardi deserve special mention. The Mauzas Silmandi, etc., under the police-station Narsingdi are also very siutable for mango and lichi orchards. Although these areas are very suitable for fruit plants attempts are scarcely made to introduce high class imported varieties of either mango or lichi. Propagation of mango trees are exclusively done from seeds. It is expected that under proper propaganda and guidance commercial orchards may grow and flourish there. Healthy betelnut vines could also be found in the new alluvial tract almost in every house. There is, therefore, good possibilities of betelnut orchards flourishing there.

The highlands in the red soil tract though not at present yielding good varieties of mango mainly due to the lack of initiativeness does not appear to be unsuitable for mango orchards. The existing mango plants are quite healthy and present promising appearances. It is only in isolated cases that imported varieties of mango could be found. The few plants of the imported varieties that are being grown have been found to maintain the quality so far.

The best way therefore of utilising the isolated mounds in the Madhupur Jungle Tract is to put them under mango, jack fruit and lichi orchards. There may be some difficulty to establish the plants in the beginning but once they have established themselves they are expected to develop into beautiful commercial orchards and are likely to be a paying concern. It may be mentioned here that the people are quite ignorant of the cares and treatment for commercial orchards. It is, therefore, incumbent on the Government to train the people as commercial orchardists.

Papaya is also expected to do well in these chalas (flat extensive land) provided that proper manuring is given to the plants. The art of papaya cultivation is totally unknown in this part. If some pioneering effort be made to lay out commercial orchards in the highlands in the Madhupur Jungle Tract the area under waste lands will gradually disappear and the Madhupur Jungle Tract will become the seat of many valuable fruits.

Lemon, pomelo, etc., could be found in very many places. The highlands are therefore very suitable for citrus cultivation while the success of lemon and pomelo can be assured. No definite assertion is possible for oranges and mallas. Pine-apples will do excellent there.

The area under waste lands in the flood plains above flood level is practically nil. The highlands were homesteads are built have been artficially raised. These artificially raised lands are suitable for sorts of fruits and vegetables but the area is so limited that there is hardly any room for commercial orchards. Rampal and the adjoining villages are the solitary exceptions to this. Here one can find considerable areas above flood level. These areas are utilised to the best advantages. The highlands are particularly suitable for banana. In this connection Rampal and its adjoining villages deserve special mention.

In this part Rampal area presents an imposing sight. Here one can see the real technique of crop production. Each and every bit of land is being utilised to the best advantage. The Rampal cultivators are always trying to mobilise all resources for improving the quality and quantity of their produce. Their interest for the land, their method of cultivation and labour devoted for crop production are really examples to similar profession.

Rampal has got the wide reputation of producing the best quality banana. They take particular interest in the banana cultivation and get unique result.

Large quantities of potato are also produced in Rampal. Other vegetables such as radishes, cabbages, cauliflowers, etc., are also produced in huge quantity.

The peculiarity in the banana cultivation there is that the suckers are planted during the months of February and March and all the plants flowers during the months of August and September, i.e., in course of 6 to 7 months. Such early flowering is done simply by skilled cultural practices. The high price of the produce particularly banana during the last few years was an additional fillip for devoting more attention and labour to the lands.

The highlands (raised lands) are used for the cultivation of banana, sugarcane, brinjals, ginger and vegetables. Manures and fertilisers are extensively used in highlands for all sorts of crops and in lowlands for potato only. The soils in the highlands are rejuvenated every 5th year by putting in tank silt, their usual rotation and manure are as follows:—

		Manure
1st year ...	Brinjal and ginger	Nil.
2nd year ...	Banana	Cattle urine, Am.-sulph. ½ lb. oilcake 1 lb.
3rd year ...	Sugarcane	No manure.
4th year ...	Sugarcane (Ratoon)	Oilcake, Am.-sulph.

The residual effect of manure is sufficient for sugarcane during the 1st year but for the ratoon crop some oilcake is scattered over the field.

Heavy doses of oilcake and ammonium sulphate are invariably used as top-dressing followed by irrigation while oilcakes mostly mustard cakes are used at the time of preparation of land. The yield of potato is 75 to 100 mds. per acre. These potatoes have got no keeping quality.

BBGP-51/52-1274A-1M

117b

TOPOGRAPHICAL MAP
OF THE
DACCA DISTRICT

SHOWING INUNDATION LEVEL

Scale 1″ = 4 Miles

REFERENCES

- Madhupur jungle tract
- Flood plain
- Swamps or Bils
- Above flood level
- Inundation level below 5′
- ,, ,, between 5′-10′
- ,, ,, above 10′
- Rivers and canals
- Railway
- Topography broken

N

MYMENSINGH DISTRICT

FARIDPUR DISTRICT

TEPPERA DISTRICT

SRIPUR, KAORAID RIVER, BANAR R., BANAR RIVER, BRAMHAPUTRA RIVER, OLD BED OF LAKSHYA, MONOHARDI, KAPASIA, SALDHAR R., LABANDHA K., KALIAKAIR, JOYDEBPUR, TURAG R., TUNGI R., SIBPUR, PAHARIA R., ARIALKHANI RIVER, RAIPURA, MEGHNA RIVER, JAMUNA RIVER, BANSI R., SATURIA, DAULATPUR, DHAMRAI, GHIOR, OLD BED OF DHALESWARI, BANSI RIVER, SABHAR, KALIGANJ, NARSINGDI, MANIKGANJ, DHALESWARI R., SIBALAY, SINGAIR, ICHAMATI RIVER, BAKU R., LAKSHYA RIVER, RUPGANJ, ARAIHAZAR, TEJGAON, DACCA, KALIGANGA R., KARANIGANJ, BURIGANGA RIVER, HARIRAMPUR, NAWABGANJ, ICHAMATI R., GHNA R., BRAMHAPUTRA RIVER, BAIDYABAZAR, NARAYANGANJ, GANGES OR PADMA RIVER, SERAZDIKHAN, DHALESWARI RIVER, MUNSHIGANJ, SRINAGAR, TANGIBARI, MEGHNA RIVER, LOHAJANG, RAJABARI

89° 45′ | 90° 00′ | 90° 15′ | 90° 30′ | 90° 45′

24° 15′ | 24° 00′ | 23° 45′ | 23° 30′ | 23° 15′

SOIL SURVEY SCHEME
DEPARTMENT OF AGRICULTURE
EAST BENGAL

REG. No. 298 M XD. 51-1020.

PRINTED AT THE SURVEY OF PAKISTAN OFFICES MURREE.

SOIL MAP OF DACCA DISTRICT

Scale 1″ = 4 Miles

REFERENCES

- Sandy loam
- Clay loam
- Loamy clay
- Clay
- Silt loam
- Loamy sand
- Rivers and canals
- Railway
- Broken or Knoll

REFERENCES

Madhupur jungle tract
- Type I
- Type II

Flood plain
- Type III
- Type IV
- Marshy land or Bil

N

MYMENSINGH DISTRICT

TEPPERA DISTRICT

FARIDPUR DISTRICT

JAMUNA RIVER

KADRAID RIVER

BANAR R

BANAR RIVER

BRAMHAPUTRA RIVER

OLD BED OF LAKSHYA R

PAHARIA R

ARIALKHANI RIVER

MEGHNA RIVER

BANSI R

SAUGHAR R

LABANDHA R

TUNGI R

BANSI RIVER

DHALESWARI R

OLD BED OF DHALESWARI

ICHAMATI RIVER

KALIGANGA R

BALU R

RUPGANJ LAKSHYA RIVER

AURIGANGA RIVER

ICHAMATI R

MEGHNA R

GANGES OR PADMA RIVER

DHALESWARI RIVER

MEGHNA RIVER

SRIPUR
KALIAKAIR
KAPASIA
MONOHARDI
SIBPUR
RAIPURA
JOYDEBPUR
KALIGANJ
NARSINGDI
DAULATPUR
SATURIA
GHIOR
DHAMRAI
SABHAR
SIBALAY
MANIKGANJ
SINGAIR
HARIRAMPUR
TEJGAON
DACCA
ARAIHAZAR
KARANIGANJ
NAWABGANJ
NARAYANGANJ
BAIDYABAZAR
SERAZDIKHAN
SRINAGAR
MUNSHIGANJ
TANGIBARI
LOHAJANG
RAJABARI

SOIL SURVEY SCHEME
DEPARTMENT OF AGRICULTURE
EAST BENGAL

89° 45′ | 90° 00′ | 90° 15′ | 90° 30′ | 90° 45′

24° 15′ | 24° 00′ | 23° 45′ | 23° 30′ | 23° 15′

EG. No. 299 M X D'51–1020.

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CROP MAP
OF THE
DACCA DISTRICT

Scale 1" = 4 Miles

REFERENCES

- Madhupur jungle tract
- Flood plain
- Swamps or Bils
- Aus paddy
- Transplanted paddy
- Deep water paddy
- Jute
- Sugarcane
- Rabi crops
- Forest
- Topography broken

N

MYMENSINGH DISTRICT

TIPPERA DISTRICT

FARIDPUR DISTRICT

KAORAID RIVER
BANAR RIVER
BRAMHAPUTRA RIVER
OLD BED OF LAKSHYA R
JAMUNA RIVER
BANSI R
OLD BED OF DHALESWARI
ICHAMATI RIVER
GANGES OR PADMA RIVER
KALIGANGA R
BURIGANGA RIVER
DHALESWARI RIVER
MEGHNA RIVER
TURAG R
TUNGI R
BANSI RIVER
BALU R
LAKHYA RIVER
PAHARIA R
ARIAKHAN RIVER
SALDHAR R
LABANDHA R

SRIPUR
KAPASIA
MONOHARDI
SIBPUR
KALIAKAIR
JOYDEBPUR
RAIPURA
DAULATPUR
SATURIA
GHIOR
DHAMRAI
MANIKGANJ
SIBALAY
SABHAR
SINGAIR
KALIGANJ
NARSINGDI
TEJGAON
DACCA
RUPGANJ
ARAIHAZAR
HARIRAMPUR
KARANIGANJ
NAWABGANJ
BAIDYABAZAR
NARAYANGANJ
SERAZDIKHAN
SRINAGAR
MUNSHIGANJ
TANGIBARI
LOHAJANG
RAJABARI

89° 45′ | 90° 00′ | 90° 15′ | 90° 30′ | 90° 45′
24° 15′ | 24° 00′ | 23° 45′ | 23° 30′ | 23° 15′

SOIL SURVEY SCHEME
DEPARTMENT OF AGRICULTURE
EAST BENGAL

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