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THE EXTENSION

OF

JUTE CULTIVATION IN INDIA.

BY

R. S. FINLOW, B.Sc., F.C.S.,

Jute Specialist to the Government of Eastern Bengal and Assam.

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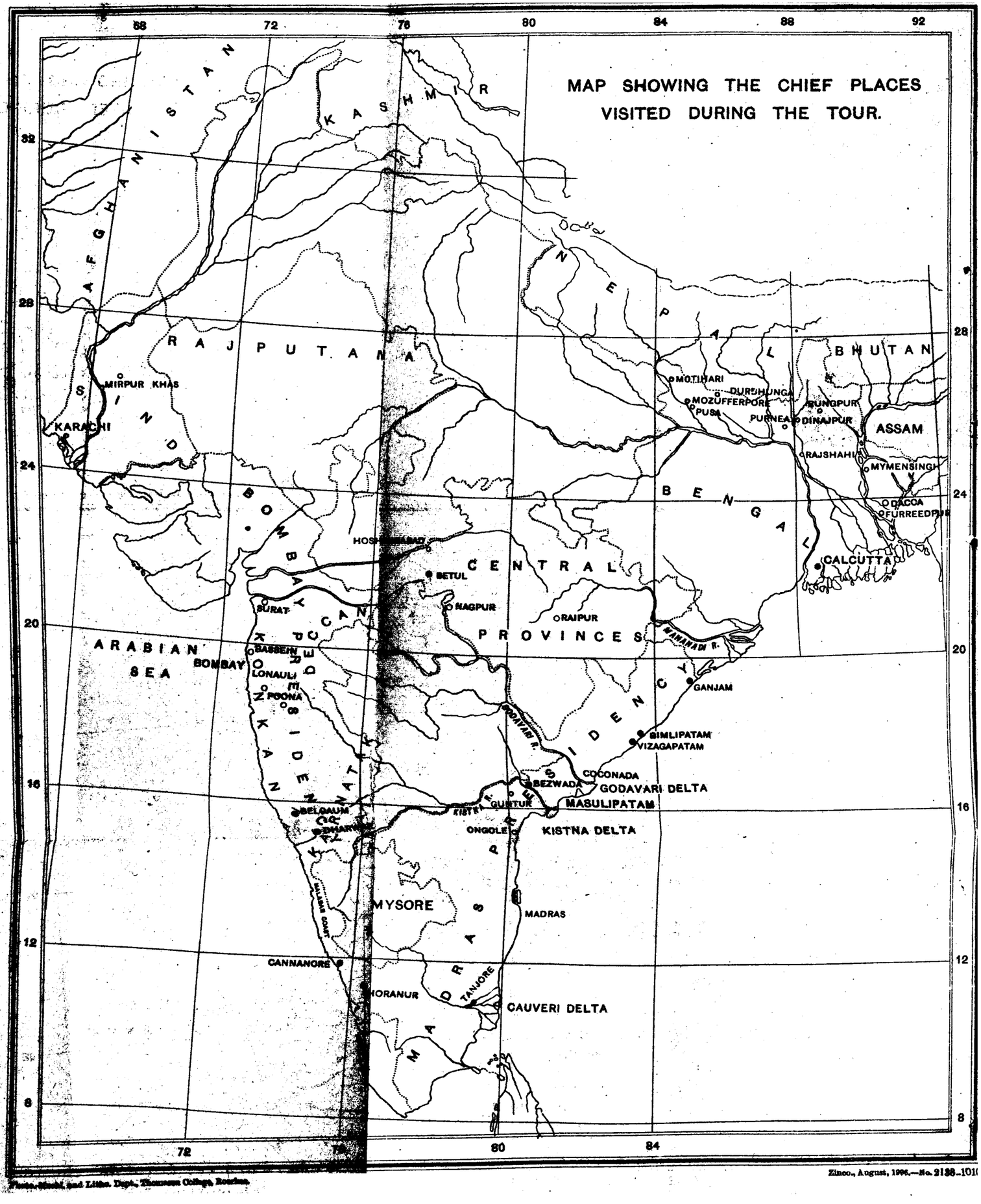
MAP SHOWING THE CHIEF PLACES VISITED DURING THE TOUR.



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THE EXTENSION

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JUTE CULTIVATION IN INDIA.

OBJECT AND SCOPE OF ENQUIRY.

THE following is an account of a tour made by me, at the instance of Mr. F. G. Sly, I.C.S., the Officiating Inspector-General of Agriculture, through the Bombay Presidency, Madras Presidency and the Central Provinces, for the purpose of investigating the possibility of extending the cultivation of jute to areas outside Bengal. My tour commenced about the middle of October 1905 and lasted till nearly the end of March 1906; but there were several interruptions amounting in all to nearly two months. The following is a list of the places visited, each one of which may be said to represent a particular type of country:—

Bombay	Lonauli, Poona, Ahmednagar	Representing typical tracts of the Deccan.
	Dharwar, Hubli, Dastikop, Belgaum	Representing the Bombay Karnatak.
	Bassein	Representing the Konkan.
	Surat	Representing Guzerat.
	Mirpur Khas, Shadipalli	Representing the irrigated districts of Sind.
Madras	Cannanore	On the Malabar Coast.
	Tanjore	In the Cauveri Delta.
	Coconada, Amalapur, Narsapur, etc., etc.	In the Godaveri Delta.
	Bezwada, Kankaped, Tenali, Masulipatam	In the Kistna Delta.

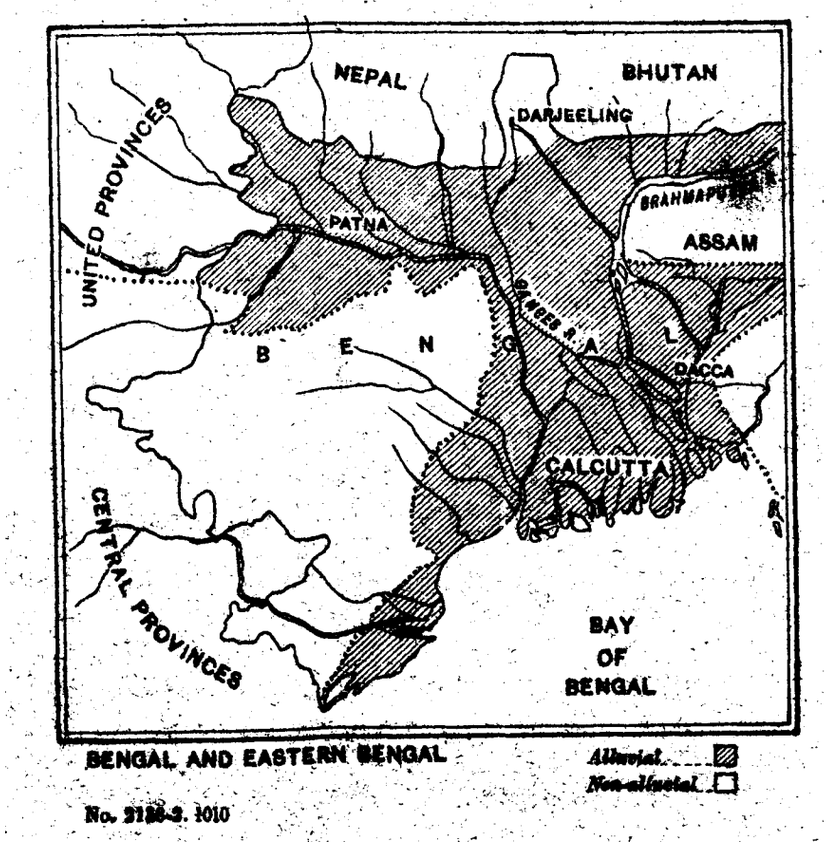
Madras—*contd.*	Guntur, Ongole, Bimlipatam, Vizagapatam, Rajam, etc.	Representing the submontane and coast districts of Vizagapatam.
	Berhampore, Injili, Kallikota, etc., etc.	In the Ganjam district.
Central Provinces	Nagpur	
	Raipur	In the Chattisgarh plain.
	Hoshangabad	In the Nerbudda valley.
	Shahpur (Betul)	In the Plateau districts.

The accompanying map shows the localities visited during the tour.

BENGAL AND EASTERN BENGAL.

2. In judging of the suitability or otherwise of any tract for jute cultivation, its physical and climatic features were compared with those of the jute-growing districts of Bengal. It seems advisable, therefore, before detailing the results of any observations with regard to other Provinces, to summarize (*a*) the soils and climate of the two Bengal Provinces; (*b*) the conditions which may be considered as favourable or the reverse for the growth of jute.

3. **Soils.**—Roughly speaking, Bengal and Eastern Bengal and Assam may, for our purpose, be divided into two portions, alluvial and non-alluvial. Included in the latter are Chota Nagpur (Bengal), and Hill Tippera, Chittagong, and the Garo, Khasi and Lushai Hills of Assam (Eastern Bengal and Assam). These are all more or less mountainous tracts and are negligible from the point of view of jute cultivation, which is practically confined to the alluvial tracts. As will be seen from the accompanying soil map of the two provinces, the alluvial tract occupies considerably more than half of this area and includes the lower courses of the Ganges and the Brahmaputra, which unite near Goalundo, as well as the delta of the Mahanadi in Orissa. It is the eastern continuation of the great Indo-Gangetic plain which occupies the whole of Northern India between the Himalayas in the north and the central table-land in the south, and which stretches for nearly 2,000 miles from Sind and Rajputana on the west to the Bay of Bengal and the borders of Burma on the east. The chief characteristic



of the Bengal portion of this plain is its low altitude. The slope of the country towards the sea is very gradual indeed—only a few inches per mile—so that places 300 miles away from the sea may be less than 150 feet above it. The consequence is, that during the rains—more so in the eastern districts than in the west—whole tracts of country many miles in extent are under water, becoming in fact an inland sea, especially in the neighbourhood of the large rivers, whose width at this season is often several miles. But the surface of the country is not entirely flat; there are "high" lands not liable to submersion in the rains and "low" lands. The latter often form part of the slopes of basin-like depressions called "chars" which exist throughout the tract. Some of these "chars" are permanent lakes of considerable size and hold a good depth of water even in the dry weather, while others are only full in the rainy season. Other low-lying lands are often formed by rivers, especially the Brahmaputra and the Megna in East Bengal. They are not permanent and may be formed one year and washed away the next. Finally, among low-lying lands must be mentioned the more or less salty swamps, which often exist on the coastline of the Bay of Bengal, and which are continually altering, according as the process of deposition or of denudation is proceeding. In the alluvial tract of Bengal, although we are dealing with soils of the same origin, as is only to be expected considerable differences are met with. Various types of soil occur, the almost pure sand sometimes deposited over whole districts by rivers in flood, the light sandy loams of the uplands of Eastern Bengal, the white almost impalpable calcareous soils of parts of Bihar, and the stiff clays of low-lying "chars" and of mud banks formed by rivers. Nevertheless, these soils have various common properties, amongst which may be mentioned their great depth, fineness of texture, and (in Bengal) the comparative nearness of the subsoil water-level to the surface. They are "a level plain lying over a fresh water sea" as the Statistical Atlas of India describes them. On this account, and because of their exceedingly fine texture, these alluvial soils, although not so retentive of moisture as the "black cotton soils" of other parts of India, are always comparatively well supplied with moisture even in the Western Districts where the annual rainfall is only

about 45 inches, and where one to two months of very hot dry weather may be expected between the middle of March and the end of May. Generally, the Bengal soils are exceedingly fertile, and the higher lands not subject to inundation are easily worked. In the drier portions of Bihar there is sometimes a slight tendency towards alkali formation, but such areas are quite limited in extent.

4. **Climate.**—As regards climate, different parts of the two Bengal provinces differ very much indeed. The whole of Eastern Bengal and Assam and the central eastern portion of Bengal are subject to a heavy rainfall, varying from the unique downfall (over 500 inches per annum) of Cherrapoonjee in the Khasia Hills to the 65 inches which is annually registered in the neighbourhood of Calcutta. The other portions of Bengal, *i.e.*, Bihar, Chota Nagpur and Orissa, have a smaller rainfall, and climatically are to a certain extent transitional between Bengal and the other provinces which they adjoin. In the first mentioned portion of the country, which exhibits the typical features of Bengal climate, the three seasons, *viz.*, hot weather, rains and cold weather, are, on account of the dampness of the atmosphere, less well marked, especially in Assam, than in most other parts of India. There are various causes for this dampness; such as (*a*) the flat low-lying nature of the country, causing the retention of large volumes of water on its surface for months together; and (*b*) the size and number of the rivers. But another important cause is perhaps the most characteristic feature of the Bengal climate, namely, the comparatively even distribution of the rainfall over the greater part of the year. In other parts of India, which receive an equal or even heavier rainfall, the tendency is for the whole of the rain to come during the three or four months of the monsoon period, the remainder of the year from the end of October to June being, to all intents and purposes, rainless. The Malabar Coast, the Cauveri Delta and the Ganjam district in Madras and a small portion of the Bombay Karnatak or Southern Mahratta country may be mentioned among the few parts of India which approach Bengal in this respect. In Bengal, while November, December and January are usually dry, showers of rain, gradually becoming more copious, are to be expected from the middle of February until the monsoon breaks in

June. In Assam, December is, practically, the only dry month of the year. The following average rainfall figures for March, April and May illustrate the way in which rain falls in Bengal during the premonsoon months:—

		March.	April.	May.	Total for March, April and May.	Total Annual fall.
Mymensingh	Representing the rainfall of the jute-growing districts.	1·85	4·31	11·32	17·48	86·6
Dhubri		1·9	5·1	15·6	22·60	93·0
Calcutta		1·3	2·3	5·6	9·20	65·6
Dacca		2·5	5·8	9·2	17·50	73·7
Sibsagar (Assam)		4·4	9·9	11·0	25·30	93·1
Silchar (Assam)		7·9	13·0	15·7	36·60	120·0

This feature of early rainfall persists, but to a diminishing extent, in the north-west of the Province in Bihar and in the south along the sea coast in Orissa as the following figures show:—

		March.	April.	May.	Total for March, April and May.	Total annual fall.
Purnea		0·49	1·57	5·42	7·48	72·5
Monghyr	Representing probable area of extension in Bihar.	0·35	0·53	2·13	3·01	49·0
Mozufferpore		0·38	0·54	2·30	3·22	45·9
Durbhangha		0·3	0·6	2·3	3·20	47·4
Champaran		0·44	0·60	2·61	3·65	53·6
Saran		0·16	0·3	1·55	2·01	45·0
Patna		0·3	0·3	1·6	2·20	42·8
Cuttack		1·1	1·5	3·2	5·80	58·4
Puri		0·89	0·59	3·13	4·61	55·3

The inland portions of Bengal south of the Ganges (Chota Nagpur) are more like Central India as regards rainfall. The figures in the above table indicate very clearly how, beginning on the far north-east with the excessively moist climate of Assam, the conditions change gradually towards west and south, the rainfall tending to become not only less in quantity but less evenly distributed.

5. **Bihar and Orissa.**—The other portions of Bengal, *viz.*, Bihar and Orissa, are from a climatic point of view intermediate between Bengal on the one hand and the United Provinces and Madras respectively on the other. Orissa as a whole is more similar to Bengal in its climate than Bihar is; but in both Orissa and Bihar, especially in their remoter districts, the hot weather season is much more pronounced owing to the smaller amount of early rainfall during March, April and May. Strong west winds, which carry clouds of dust with them, blow at frequent intervals, sometimes for days together, from the middle of March to the middle of May. At these times the temperature is high—occasionally reaching 110°—while the humidity frequently falls to 10 per cent., indicating a very dry atmosphere. Duststorms which are often accompanied by thunderstorms, with or without rain, occasionally sweep over the country from the north-west. They travel with surprising rapidity and as a rule do not last long, but they cool the air very considerably. Sometimes during April, and generally during May, the damp east winds from the Bay reach Bihar, bringing with them cloudy weather and a certain amount of rain. As a rule not much rain falls during April, except in the most easterly portions of the tract; but from two to three inches are to be expected in most districts north of the Ganges in May. Purnea of course receives considerably more than this, and is to be regarded as transitional between Eastern and Western Bengal.

Orissa is rather better off than Bihar, not only as regards annual rainfall but also in its distribution. On an average 5·9 inches, or nearly double the amount which falls in Bihar, are received in Cuttack during March, April and May.

6. **Temperature.**—Bengal and Bihar are very similar as regards mean temperature, but the extremes of heat and cold are rather greater in Bihar than in Bengal, and greater still than in Assam, whose climate is even more equable than that of Bengal. The mean annual temperatures are 77° in both Bihar and Bengal and the means for January 62° and 66°, respectively. The corresponding temperatures for Assam are 75° and 63°. In the cold season Assam and Bengal are generally warmer and damper than Bihar, where ground frosts are fairly common about the end of January and where piercing northerly and westerly winds make fires very welcome at night.

Orissa is on the whole considerably hotter all the year round than either Bengal or Bihar. Its mean temperature (81°) is 4° higher; the hot weather maximum and the minimum cold weather temperatures are also considerably higher than those of other parts of Bengal.

CONDITIONS REQUISITE FOR JUTE CULTIVATION.

7. The principal factors controlling jute cultivation are: (*a*) temperature, (*b*) soil, (*c*) rainfall or water supply, (*d*) distribution of rainfall over the period of growth of the crop, (*e*) supply of water for retting.

8. **Temperature.**—A high temperature must be regarded as the first essential for successful jute cultivation. It is probable that this condition obtains in all parts of the plains of India with the possible exception of parts of the Deccan and Karnatak.

9. **Soil.**—In Bengal jute appears to grow and thrive on soil of almost any texture varying from the heavy alluvial clay of low-lying "chars" and salty marshes to the sandy loams of the uplands. Up to the present, however, its cultivation has been confined almost entirely to the alluvium deposited by the Ganges and Brahmaputra. So the question can only be answered by experiment whether jute will thrive on such different soils as black cotton soil, for instance, even if all the other conditions are favourable. Nevertheless, it may reasonably be expected that success may be looked for in any fertile soil of fairly fine texture and good depth, provided that other conditions are favourable.

10. **Rainfall or Water Supply.**—In the past, the experiments, which have been carried out in districts right away from the jute-growing area of Bengal, have not yielded any satisfactory results; but this is

probably due at least partly to lack of information regarding other conditions necessary for successful jute cultivation. Undoubtedly the most important of these conditions (after temperature) is the rainfall or the water supply, and its distribution over the period during which the crop is to be cultivated. Outside the part of the country in which jute is actually grown, it is commonly supposed that it is a more or less aquatic plant which will, like rice, thrive on submerged or swampy land throughout its period of growth. As a matter of fact, while some varieties will, when they have attained a certain degree of maturity, say 3 to 4 feet in height, grow in submerged land, the young plants and seedlings are, without doubt, very unfavourably affected by excessive moisture and waterlogging. Indeed, in suitable land, they are perhaps more capable of withstanding prolonged drought than too much rain without danger to their subsequent development; failure to realise this has probably accounted for the non-success of more than one attempt to grow jute. As regards the actual rainfall, probably 40 to 45 inches per annum may be put down as a minimum. The maximum does not appear to be definite; jute is certainly grown in some districts where the annual rainfall exceeds 100 inches. The rainfall is more than 45 inches in most of the districts which are at present regarded as typical for jute; but there are unmistakeable indications that it can be successfully grown in Bihar for instance, where the average is in many places slightly under 45 inches.

11. **Distribution of Rainfall.**—It will be gathered from what has already been said that the distribution of the rainfall is of great importance. In the jute districts of Eastern Bengal, intermittent showers, increasing gradually in frequency, are to be expected from the middle of February. The result is a damp warm atmosphere without excessive rain to waterlog the land. Here jute is sown from the beginning of March to the end of May, according as the land is liable to be waterlogged early or not. Thus by the time the monsoon breaks, the jute plants in the low-lying lands liable to submersion are sufficiently advanced not only to withstand but to take advantage of the heavy rain and consequent floods.

12. **Summary.**—Shortly, the conditions favourable for jute cultivation

are:— (*a*) a high temperature; (*b*) a deep soil of fairly fine texture; (*c*) a rainfall of over 40 inches distributed over the period of growth of the crop, so that while the young plants have plenty of moisture to ensure vigorous growth, the bulk of the fall takes place when the crop is more mature; a regulated supply of irrigation water may act as substitute for this; (*d*) a sufficient supply of clear water for "retting" the crop after it is cut.

It may be added that experiments are being made this year to see if jute can be successfully cultivated when sown on high lands at the beginning of the rains. It is to be anticipated that a very heavy crop will not be obtained under such conditions owing to the comparatively short period of growth allowed to the plant, but the generally superior cultivation on high lands may compensate for this disadvantage.

13. **Methods of Cultivation of Jute.**—*Corchorus capsularis* is to be recommended for experiments rather than *Corchorus olitorius*. Sowing is carried out in Bengal at any time from the middle of February to the beginning of June according to the nature of the land. Jute should not be sown in land which is liable to be flooded while the plants are small. In Eastern Bengal, on low lands liable to submersion, sowing takes place in some cases as early as February. The land for such early sowing is ploughed before Christmas and about six ploughings are given altogether at intervals between the first ploughing and the time of sowing. Of course the amount of preparation depends on the nature of the land; since a fine seed bed is the object, heavy land requires more preparation than light land. In Bihar where sowing takes place in February also, but where conservation of moisture is all-important, the land is prepared at the commencement of the cold weather or as soon as it is dry enough to work, and is not again disturbed until the final ploughing before sowing. Where late sowing is practised, the land is prepared much later, *i.e.*, after the rabi crops have been reaped. As the jute seed is small and the young plant very tender, a deep and fine tilth is needed and the land should be as free as possible from weeds.

14. **Method of Sowing and Amount of Seed.**—When the land

has been prepared, the seed is sown broadcast at the rate of about 9 lbs. per acre. The sowing is carried out crosswise, *i.e.*, first from north to south and then from east to west, thus ensuring a fairly even distribution of the seed. After the sowing, the land is harrowed or a "hengha" is used—a long flat log, to the two ends of which the bullocks are yoked, and which serves the purposes of a harrow and light roller combined. If the land has any tendency to harden on the surface after germination has taken place, it is a good thing to break the crust from time to time.

15. **Weeding and Thinning.**—When the crop is about six inches high, it is weeded and thinned until the plants are about four inches apart; several subsequent weedings are given while the crop is small until its rapid growth chokes weeds.

16. **Harvesting.**—The results of experiments indicate that the weight of fibre obtained from a jute crop increases with the age of the plant, but that, when a plant is old, the fibre becomes coarser. The most suitable time for cutting so as to obtain the heaviest yield of fibre of the best quality has not yet been definitely determined. It appears, however, to be when the flowering stage is just over or when the fruits of the plants have just set.

17. **Retting.**—The plants are cut with a sickle just above the ground, and tied in bundles about eight inches in diameter. The bundles are then, as a rule, exposed to the sun for a few days in order that the leaves may wither. When this has been done, the bundles are placed upright in water about 1—2 feet deep for a day or two: this is done because the lower portion of the stem rets more slowly than the upper. Finally the whole plant is immersed completely in the clearest water available, and is allowed to remain until the fermentation which takes place has proceeded so far that the fibre separates easily from the stems.

18. **Stripping and Washing the Fibre.**—There are several methods of separating the fibre from the stem after the retting process is complete. The simplest method and one which has given quite satisfactory results when compared with others is to strip off the fibre of each retted stem by hand and afterwards to wash it by swinging it round

the head and threshing it on the surface of the water. The retting process and subsequent operations are of primary importance, as by neglecting precautions at this stage, the fibre from a thoroughly well grown crop may be reduced in value by nearly one-half. In the first place the retting should proceed evenly, therefore it is of value to allow the lower portions of the stems to commence retting first as described above. Next comes the question of clean water; there can be no doubt that clean water produces fibre of much better colour and gloss. If the water is stagnant and sufficiently great in volume, it is generally preferred, but slowly running stream-water also produces good fibre. Muddy water gives a grey tinge to the fibre. Lumps of earth are often used to keep the bundles of fibre below the surface of the water during the retting process: as the water is bound to become dirty by this practice, it is to be deprecated; logs of wood or stones should serve the purpose equally well. The retting water should be sufficiently deep to allow of the complete immersion of the bundles without touching the bottom. The bundles should not be too large; otherwise retting will not take place evenly inside and out. To judge the exact time at which retting is complete is an accomplishment only to be gained by experience. This is a point of great importance, as under-retted fibre is gummy and in ribbons, while if it is over-retted it loses its strength, gloss and colour. Men familiar with the retting process are being imported freely into Bihar this year from East Bengal by planters and others commencing jute cultivation. The fibre after stripping should always be very thoroughly washed as it is bound to take on a dirty colour if this is neglected. If it is impossible to cart the green stems far enough to get good clean water for retting, it is certainly worth while to cart the stripped fibre some distance to clean water for washing.

19. **Manuring.**—As at present grown jute is undoubtedly an exhausting crop, and it should not therefore be sown on the same land, which is not silt renewed, for two successive years without liberal manuring. About five tons per acre of cowdung is sufficient. It has been found by experiment that cowdung is the most efficient manure, producing a largely increased *net* return; but seven maunds per acre of

castor cake have proved a valuable manure in many cases. *Green manuring* is to be recommended. It is practised in the jute districts of Bengal with Sunn Hemp (*Crotalaria juncea*), Khesari (*Lathyrus sativus*) or with Mung (*Phaseolus mungo*).

20. **Jute Refuse.**—It is recommended that the stems of the jute after extraction of the fibre should not be wasted. Besides a considerable proportion of the mineral matter extracted from the soil by the crop, these stems contain a large amount of organic matter which is always valuable in Indian soils. The matter is dealt with more fully in a later section of this report (para. 45).

21. **Rotation.**—The following are types of rotations practised in the Dacca District :—

Potatoes.		Chillies.
Rice or Jute.		Jute.
	Tobacco or Pulse.	

Both these rotations include a crop which requires heavy manuring. On low land winter rice may be planted after the jute has been harvested. In this case the land should be manured if possible with cowdung before the jute is sown.

22. **Outturn of Fibre and Profits.**—At the present time the prices of jute are phenomenally high—almost double those of a year or two ago—and the profits to be derived from its cultivation are correspondingly great. ₹8 per maund of 82 lbs. is not an extravagant price under present conditions, and the best fibre is worth considerably more. If the yield be taken at 15 maunds of fibre per acre, the gross return is ₹120 per acre. The cultivation expenses may be estimated at about ₹35 per acre at the outside, so that the *net* profit for an average crop is *₹85 per acre.* Obviously there are few crops grown in India to-day which are capable of giving such a return.

BOMBAY PRESIDENCY.

23. **Elevation.**—The Bombay Presidency, like Madras, shows far greater varieties of soil, climate, and physical features generally than Bengal. In the first place, different districts vary greatly in their elevation; for while a considerable portion of its area is practically at

sea level, the whole of the Deccan and the Karnatak lies between altitudes of 1,000 feet and 2,500 feet above the sea.

24. **Soils.**—The soils of Bombay also vary considerably. Much the greater portion of the Deccan and the Karnatak consists of black cotton soil or of "murrum," *i.e.*, partially decomposed trap. This area corresponds more or less closely to the area of short rainfall in these tracts. Near the Ghats, however, where the rainfall is heavier, the soil tends to become lighter, both in colour and texture. This belt of lighter soil and heavier rainfall variously called the "Mallad," the "Mawals" or "Dangs" according to the district—in which the dry crops of the Desh or eastern portion are replaced by wet crops like rice and sugarcane—follows the whole length of the Ghats from south to north. The Bombay Gazetteer describes it as "subject to frequent and heavy rain" and "most favourable for the growth of sugarcane and rice." The black cotton soil is not confined to the Deccan and Karnatak; it prevails in the Northern Konkan and also in Gujerat. Between the Ghats and the sea, the lands are practically divided into "salt," *i.e.*, those which are more or less liable to inundation by the sea or which are under the process of reclamation, and "sweet." The soil is usually heavy, and in the north becomes black away from the coast. North of Bombay a strip of light land of considerable area runs along the coast. It is devoted to the cultivation of cocoanut palms in Thana taluk and to garden cultivation in Bassein and Mahim taluks.

25. **Rainfall.**—Between the Ghats and the sea, the annual rainfall varies between 120 inches in Kanara and 44 inches in Southern Gujerat. Northwards from this (and to the west in Sind), the rainfall diminishes rapidly to a nominal amount. In Sind the average is about 8 inches. Here, however, the cultivation depends on the inundation of the Indus and on the irrigation canals.

On the Ghats, the rainfall is, of course, exceedingly heavy, some stations receiving as much as 260 inches per annum. Portions of the Deccan and Karnatak, *e.g.*, Lonauli on the edge of the Ghats, likewise receive a heavy rainfall which diminishes very rapidly towards the east. Poona, for instance, only 40 miles from Lonauli, only averages

31 inches per annum. In the Poona district there is an extensive irrigation system, where the cultivation of sugarcane is largely practised.

Places further east receive less rain still and even this is precarious.

There is a difference between the northern and southern portions of the Presidency, in that the latter are, to a certain extent, fed by the North-East Monsoon, while the former depend to a large extent on the South-West Monsoon. In the south too, the South-West Monsoon comes rather earlier. There is, therefore, more rainfall in the south in the months of April and May and during November than in the north, where the rainy season is almost entirely confined to a short period between June and October, during which practically the whole fall is received.

26. **Temperature.**—There are naturally differences of temperature between districts whose altitude is considerable and those at sea level. These differences, however, are not very great. Comparing the Deccan tracts with the Konkan, the average deficit of the former during the months June to October may be roughly estimated at 5° in the maxima and from 5° in June to *nil* in October in the minima. The minimum temperatures of both divisions of the Presidency appear to be less than in Bengal during this period, those of some parts of the Deccan and Karnatak showing a deficit approaching 10° compared with corresponding temperatures in Bengal.

27. **Tracts possibly suited to Jute.**—Bearing in mind the conditions which have already been mentioned as essential to successful jute cultivation, we can now see how different parts of Bombay are likely to answer for the purpose. Neglecting all other criteria excepting that of water supply, whether by rainfall or irrigation, it is at once evident that the only districts which might possibly be suitable are:—

(*a*) The Konkan or Coast districts,
(*b*) The tract of the Deccan and Karnatak near the Ghats,
(*c*) The Poona irrigation district,
(*d*) Possibly parts of Gujerat,
(*e*) Sind.

28. **The Northern Konkan.**—Although the rainfall in the Konkan generally is heavy, varying from about 70 inches in the north to 120 inches in Kanara, the distribution is not very suitable for jute cultivation. This applies more especially to the northern districts. In Thana and Kolaba, for instance, where the total rainfall averages about 100 inches per annum, the fall between January and April is only about 1 inch and in May about 0·5 inch. The whole of the remainder of the rain falls between June and October. Practically, therefore, there is dry weather from October until June, when the monsoon bursts suddenly and brings heavy and continuous rain which lasts till the end of September.

The land in the Konkan may be divided into (*a*) Rice lands (salt and sweet), the combined area of which approaches 1,000,000 acres, and (*b*) Garden lands.

The garden lands, which are peculiar to the Bassein and Mahim taluks of Thana district, are light and in places almost sandy. They are in a high state of cultivation, but this area is too small to consider very seriously for jute growing.

The salt rice lands are on the coast or banks of tidal rivers. They are often liable to submersion by the sea, and are not likely to be of much value as jute-growing lands. The sweet rice lands lie further away from the coast. The soil is usually rather heavy; in the north it is lighter in colour near the coast and becomes darker and more like black cotton soil as it approaches the hills. These lands, especially the ones which are not liable to deep submersion, would almost certainly prove suitable for jute cultivation, provided the crop would reach sufficient maturity before the submersion comes. Wild jute of both varieties (*C. olitorius* and *C. capsularis*) grows luxuriantly, but it is found chiefly on the embankments of the rice-fields. This in itself is a reliable indication that the conditions generally are favourable on land which is not too wet. It has been decided to carry out experiments in the Bassein district.

29. **The Southern Konkan.**—The Southern Konkan does not differ greatly from the northern portion, with the exception that there is a rather more gradual breaking of the monsoon in the former.

While the rainfall along the whole of the Konkan is very small during the first four months of the year, there is a distinct difference in favour of the south during May, the figures being :—

	Rainfall in May.
Kanara	3·22 inches.
Ratnagiri	1·33 „
Thana	0·57 „

The difference, however, is probably only great enough to affect the prospects of a jute crop, in the case of Kanara, where the area which would be available is, on account of the hilly nature of the country, comparatively small.

30. **Deccan and Karnatak.**—It has been explained that the only part of the Deccan and Karnatak which can be classed as possibly suitable for jute cultivation, leaving out for the present the irrigated district near Poona, is the tract near the Ghats where the rainfall is heavy. This tract is quite narrow, for the rainfall diminishes towards the east with great rapidity. It is more or less rolling country which gradually merges into the hills on the west and the plains on the east, and it comprises parts of the districts of Dharwar, Belgaum, Satara, Poona and Nasik. The same distinction has to be drawn between the northern and southern portions of this tract as between the corresponding portions of the Konkan, *viz.*, that the rainfall in the south is better distributed than in the north. The following are the figures for the Dharwar and Poona districts as representing the southern and northern districts respectively :—

	Dharwar.	Poona.
	Inch.	Inch.
Rainfall from January to April	1·7	0·4
Ditto in May	2·6	1·1

The other districts are intermediate between these two. It has been decided to carry out experiments with jute at Dharwar and Lonauli. The Poona experiments will be carried out under irrigation, if necessary. The irrigation tract round Poona grows large crops of sugarcane, on the manuring of which very large sums are spent (R200 per acre in some cases). At present the rotation crops are millet and rice, but the profits on these are small compared with that on jute, especially

resent prices. There is very little doubt that jute would succeed er these conditions of a very rich soil and an ample, well regulated er supply.

The comparative lowness of the temperature during the rains in Deccan, and especially in the Karnatak, will probably affect the lopment of the jute grown in these districts, but it is probably not t enough to have more than a retarding influence.

31. **Sind.**—The whole of Lower Sind is Deltaic in formation, *i.e.*, soil is true alluvium deposited by the Indus, the channel of which gradually moved westwards. The soil is, in many respects, similar iat of the Indo-Gangetic alluvium (much more so than that of any r district in Bombay or Madras) both in appearance, texture and he fact that it extends to a great depth. The rainfall of Sind, ever, averages only about 5 to 10 inches, so that where irrigation not been introduced, the country is to all intents and purposes a rt. The absolute necessity of artificial watering is shown by the that the area under irrigation was 99 per cent. of the total cultiva- in 1886. Where there is water, sweet (not alkaline) soil and a ly of manure, excellent crops are grown ; and where the water is idant, as on the bank of the Mitrao canal, rice is cultivated to a large extent as a kharif crop. Rabi crops are not so important. he Jamrao canal where the water-supply is more strictly regulated, is not allowed to be grown, and consequently cotton, sorghum, and r kharif crops take the place of rice, while wheat is grown on a scale as a rabi crop. Generally the soil of Lower Sind (only a ion of the soil of Upper Sind is alluvial) appears to compare with eavier varieties of the Indo-Gangetic alluvium. It is not, however, ay soil, although there is a tendency for the surface to harden on sure to the sun after watering.

Where there is no irrigation the air is naturally exceedingly more so in Upper than in Lower Sind ; but in the irrigation dis-, it is quite damp when the water from the canals is pouring over and.

From the above short description of the conditions in Sind, it will en that while the soil is not unlike that of Bengal, the climate is

as different as possible in respect of rainfall and humidity. Yet the fact that where the water-supply is abundant, rice is grown to such a large extent (nearly 1,000,000 acres) shows how great has been the effect of irrigation on the land and climate generally. For these reasons, it has been decided to try experiments with jute at the Government Agricultural Station at Mirpur Khas in Lower Sind. It is of course useless to speculate as to whether or not these experiments will succeed, but it is now recognized that the requirements of jute as regards moisture conditions are not nearly so exacting as they were thought to be a short time ago. This is proved by the introduction of its successful cultivation on a large scale in Bihar. As stated elsewhere, the high temperature and the exceeding dryness of the atmosphere in this tract during April and part of May of the present year (1906) did not seriously damage the crop, which was sown in February and which has now become an exceedingly good one. These conditions are not unlike those prevailing in Sind.

It should be noted that there are, in Sind, considerable areas which have an alkaline tendency. This may prove a bar to the introduction of jute into these tracts, as all our experience goes to show that it will not thrive in alkaline land.

MADRAS PRESIDENCY.

32. As in the case of Bombay, there is not in any part of Madras such a combination of climatic and physical conditions as exists in Bengal. The part of Madras, which most nearly approaches Bengal from the point of view of climate, is the Malabar Coast where the climatic conditions are practically those of Bengal intensified. The climate of Ganjam is also similar to that of South-Eastern Bengal which it adjoins; but the remainder, comprising a large proportion of the Madras Presidency, would not need to be considered in connection with jute cultivation, except for the fact that the development of irrigation has provided an abundant supply of water to very large areas of land. Of this artificially watered area, the bulk is to be found on the East Coast, where the great canal systems of the Godaveri, Kistna and Cauveri irrigate over 2,000,000 acres. There are also many

smaller systems of irrigation, amongst which may be mentioned the Rushikulya Canal which commands about 50,000 acres in Ganjam.

33. **Rainfall.**—"Over the greater part of the Presidency the heaviest rainfall of the year is brought by the South-West Monsoon, and it is only along the Coromandel Coast that the North-East Monsoon brings any considerable amount of it." (Statistical Atlas.) The heaviest rainfall takes place on the West Coast in South Kanara and Malabar, where it exceeds 100 inches. At Palghat, further inland, in the same district, it is 75 inches. "The coast strip extending through the Chingleput, South Arcot and Tanjore districts from about 30 miles north of Madras to Point Calimere has an annual rainfall of about 50 inches," where two-thirds of the fall comes with the North-East Monsoon. Inland from this strip the fall averages about 45 inches, but here again the North-East Monsoon accounts for more than half of it.

"Besides these areas there are only two others within the Presidency where the annual rainfall reaches 40 inches. These are the northern parts of the Godaveri delta, where it is about 41 inches, and the submontane portions of Vizagapatam and the whole of Ganjam, where it varies from about 43 to 49 inches. Over these latter areas more than one-half the total fall comes during the South-West Monsoon." (Statistical Atlas.)

34. **Soils.**—Generally, the soils of the coast districts, leaving the deltas out of consideration for the present, vary between stiff coarse clay loams of yellowish or red colour and almost pure sand. Black cotton soil also occurs, but it is chiefly found in the interior. On the east coast the soil often becomes darker and heavier away from the sea towards the Ghats, and in some cases it is almost indistinguishable from black cotton soil. This is especially so in irrigated tracts.

35. **The Godaveri and Kistna Deltas.**—Regarding the soils of the three deltas, those of two—the Godaveri and Kistna—resemble each other greatly. They are of course all alluvial, and usually in the low lands are black clays of an exceedingly fine texture and very tenacious. They resemble the black cotton soil in many respects, but naturally they lack the coarser ingredients of that soil. When dried after

watering, they harden and crack in a very similar way; they have also the property of crumbling to a fine state when water is added in not too large a quantity. They are, therefore, capable of a very high state of cultivation. Near the head of the deltas the alluvial soil is of considerable depth; but near the sea coast, at the end of the channels, it gradually becomes shallower until finally there are only a few inches of the dark soil overlying the sand.

Besides the low-lying lands which are fertilized by the silt from the irrigation canals, there are the *lankas* or islands which are formed in the bed of the river by the accumulation of sand and alluvium. The nature of these soils varies considerably: they are generally lighter in colour and coarser in texture than the alluvium of the delta; in some cases they are almost pure sand, but more often they are a stiff but pliable loam of great depth and extraordinary fertility. Some are irrigable, *e.g.*, those in the Razole taluk, and others not, but in any case they grow splendid crops of great variety.

The average rainfall of both tracts is rather under 40 inches, so it is not probable that the unirrigated lands would produce good crops of true jute. They do, however, undoubtedly produce fine crops of *Hibiscus cannabinus* (Bimlipatam jute) and *Crotalaria juncea* (Sunn Hemp), but at present only on a small scale.—(See paragraphs 48 *et seq.* below.)

Besides the *lanka* lands just mentioned, there are other "high" lands in both deltas made by the inhabitants who, as the river silt gradually raises the land of the rice-fields, take off the surface soil from those intended for wet cultivation and place it on those on which they propose to grow dry crops. In this way considerable areas of high lands on which dry crops are cultivated have been formed in both deltas.

Near the sea both deltas tend to become swampy. These tracts are almost continually under water and sometimes liable to inundation by the sea. Such lands are only suitable for the cultivation of the coarsest variety of paddy. The seaward portion of the Amalapur taluk of the Godaveri district is a case in point.

The coast line of a part of the Narsapur taluk of the Kistna district

on the other hand is studded with sandy islands separated from each other and from the mainland by salt creeks. One of the staple crops of these islands is Sunn Hemp. Much the same conditions, *i.e.*, a light sandy soil, obtain on the coast of the Nagaram taluk of the Godaveri district, where Sunn Hemp is also grown.

36. **The Cauveri Delta.**—The Cauveri Delta appears to differ from the Godaveri and Kistna deltas chiefly in the nature of its soil, of which there are two chief kinds, *viz.*, (*a*) a pale red stiff clay loam which, in some situations, takes on a darker colour, and (*b*) pale yellow sand. The former occurs at the head of the delta, while the latter occurs on the coast and is of inferior quality. As in the Godaveri and Kistna Deltas, there are *lanka* lands, which are generally of high quality.

The average rainfall of the Cauveri Delta (about 44 inches) is better than in either the Godaveri or the Kistna Deltas, both of which receive 37 inches per annum; and there is a further difference in that while over two-thirds of the fall in the Cauveri on the one hand is brought by the North-East Monsoon, the Godaveri and Kistna Deltas on the other hand receive two-thirds of their rain from the South-West Monsoon. This difference in distribution of the rainfall extends to the early months of the year, during which there is considerably more rain in the Cauveri than in either of the other two deltas. The figures are:—

	January to March.	April and May.	June to September, South-West Monsoon.	October to December, North-East Monsoon.
Godaveri Delta . .	0·58	1·93	22·96	13·44
Kistna Delta . .	0·91	1·98	21·72	12·03
Cauveri Delta (Central) .	1·98	3·30	12·99	26·12

Information obtained on the spot was to the effect that the early rainfall has been precarious of late years in the Cauveri Delta.

37. **Possibilities for Jute Cultivation in the Godaveri, Kistna and Cauveri Deltas.**—As possible centres of jute production, the irrigated portions only of these great deltas can be considered.

On the irrigated lands the whole question turns upon the time of sowing, which itself depends largely on the water-supply obtained from the irrigation channels. Generally, the irrigation water may be said to be available in large quantities from June to December. Afterwards, until the middle or end of March, when the canals are usually closed for about a month for cleaning purposes, there is a more or less limited supply, and from the time the canals are re-opened until the "freshets" come down the river, the volume of water available for irrigation purposes is very small. In sowing the crop there are, therefore, two alternatives: (*a*) to prepare the land and sow before the canals are closed in March, or (*b*) to wait for rains in May, and failing these to wait for the rising river to fill the canals.

Some light is thrown on the advisability of the latter course by the jute experiments conducted last year (1905) by Mr. Barber, the Madras Government Botanist, at the Samalkota Farm in the Godaveri Delta. Plots of both varieties of jute (*Corchorus capsularis* and *C. olitorius*) were sown, the former at the beginning of June and the latter at the beginning of July. While neither variety gave satisfactory results as regards yield, the *capsularis* was much better than the *olitorius*, thus bearing out general experience as to the relative hardiness of the two. The Madras Agricultural Department do not propose to regard these results as final; they consider that the sowings may have been too late, and that the amount of water supplied to the plots may have been too great. Experiments are again being made this year with the object of testing these points, especially that of applying too much water to the young crop. If these difficulties can be overcome, there is little doubt that jute would succeed in the deltas. If the seed could be sown in February or March on land prepared after irrigation, there would, in all probability, be enough moisture retained in the soil to keep the crop going until the irrigation water becomes available again, especially as the rainfall returns indicate that there is generally about two inches of rain in April and May in the Godaveri and Kistna Deltas. The average for the Cauveri Delta is higher still. The experiments

are well worth persevering with, even in the case of only partial success again this year. The price of jute is at present so high and the delta land is so strong, that once the conditions of success are discovered, the crop would be an exceedingly paying one. Besides Samalkota, other places at which trials might be carried out are:—

Katunga, at the head of the Central Delta
Razole, irrigated *lanka* lands in Nagaram taluk } Godaveri district.

Kankipod or *Tenali* } Kistna district.

Tanjore in the Cauveri Delta.

38. **Ganjam and Vizagapatam.**—Ganjam and Vizagapatam are the two most northerly districts of Madras; they include those portions of the Eastern Ghats which belong to the Presidency as well as the coast or littoral tracts lying between the Ghats and the sea. The climate, more specially in Ganjam, is similar in most respects to that of the portions of Bengal adjoining it on the north. The climate of the whole tract is, however, affected to a certain extent by the closeness of the Ghats, which, while never more than 50 miles away from the coast, in some parts approach to within 15 miles of it. There is indeed a distinct difference in both Ganjam and Vizagapatam between the coast stations and those further inland nearer the hills. Throughout Ganjam, excepting one taluk, the annual rainfall averages over 40 inches, of which about two-thirds fall during the South-West Monsoon. This portion of the rainfall is more constant than that which is brought by the North-East Monsoon. The distribution is good on the whole during the months of April and May, and in some cases enables preparation of the land and sowing to be carried on. The following are the rainfall figures:—

		January to March.	April and May.	S.-W. Monsoon.	N.-E. Monsoon.	Total Annual Fall.
Inland	...	1·74	4·82	34·31	11·08	51·95
Littoral	North	1·34	2·65	26·18	14·89	45·06
	South	0·89	2·66	22·50	13·50	39·55

The table brings out the difference between the littoral and the inland districts on the one hand and between the northern and southern portions of the littoral district on the other.

Vizagapatam is similar to Ganjam as regards climate. The rainfall is rather less excepting in the Agency tracts, the difference being in the amount brought by the South-West Monsoon, but the distribution, as in Ganjam, is on the whole good.

	January to March.	April and May.	S.-W. Monsoon.	N.-E. Monsoon.	Total.
Submontane	1·45	3·92	27·31	11·75	44·43
Coast .	0·96	2·97	21·16	14·47	39·56

The soils of Ganjam and Vizagapatam vary considerably. Sand is common near the coast, and light sandy loams are also found inland on some higher lands and on the banks of rivers; there is also a considerable area of coarse laterite soil which is of little use from an agricultural point of view: but the soil of the bulk of the area is a rather coarse clay loam which becomes darker in colour, gradually finer in texture and deeper towards the hills. While not very rich, especially near the coast, this soil is of average fertility. It is capable of a high state of tilth and, when manured, produces crops of first class quality.

39. **Prospects for Jute Cultivation in Ganjam and Vizagapatam.**—It is certainly highly advisable that experiments with true jute should be carried out in Ganjam and in parts of Vizagapatam. With the exception perhaps of the Malabar Coast, they are the only parts of India where the conditions show a marked natural similarity to those of Bengal. Experiments are already in progress on a fairly large scale in Ganjam and to a small extent in Vizagapatam. In the latter district, true jute would probably not thrive near the coast, but might do well further inland. In Vizagapatam, however, apart from its smaller rainfall, the importance of conducting experiments is perhaps minimized by the fact that this district has already taken up the cultivation of *Hibiscus cannabinus* on a large scale

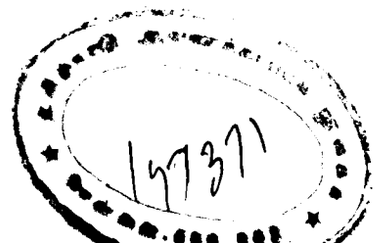
and that the area which would be likely to be available for jute cultivation, if successful, is not large, there being less than 90,000 acres of paddy in the district. In Ganjam the area of wet land is much larger, approaching 300,000 acres; Ganjam has several irrigation systems of considerable importance, including that of the Rushikulya which commands about 30,000 acres. It is, therefore, distinctly more to be recommended as a possible centre for jute extension than Vizagapatam.

40. **Malabar and South Canara.**—From the point of view of climate, Malabar and South Canara bear a considerable general resemblance to the jute districts of Bengal, the distinguishing features of which—a heavy rainfall together with a good distribution over the premonsoon months—are perhaps more nearly reproduced on the Malabar Coast than in any other part of India. This good distribution of rainfall is the great point of difference between the climate of Malabar and the more northerly portion of the West Coast. The following are the figures :—

	January to March.	April.	May.
Maximum	1·57	5·04	14·33
Minimum	0·64	0·91	2·28
Average	1·12	2·95	8·49

The physical features of Malabar, however, differ greatly from Bengal, for while the latter is a flat alluvial plain, the former is merely a narrow hilly strip about 20 miles wide between the Ghats and the sea.

The soils of Malabar may be divided into (*a*) wet, (*b*) garden, and (*c*) dry. Wet lands and garden lands form the bulk of the area, and the dry lands are continually being converted into wet lands by the system of "terracing" common in the country. There is a fringe of low-lying land inside the sandy ridge on the coast which is subject



to inundation and is devoted solely to rice cultivation. Away from the coast, the ground soon begins to rise, and the country becomes broken into hills and valleys. All the latter are carefully cultivated, chiefly with rice, of which one, two and even three crops are raised annually, where well or stream irrigation allows the cultivation to proceed during the dry weather.

The soils in the valleys are, on the whole, similar as regards consistency, being fairly heavy loams of good quality ; but they differ considerably in colour, from the red of laterite silt to yellowish brown. The depth of the soils also varies greatly : on the terraced slopes, they must be quite shallow in many cases, but in the valley bottoms the soil is of considerable depth.

There is a large area (over 600,000 acres) of rice in Malabar and nearly 500,000 acres in South Kanara. On the whole, in spite of the broken nature of the country, the conditions appear distinctly favourable for jute cultivation, and a trial—at Shoranur for instance—is certainly to be recommended.

CENTRAL PROVINCES.

41. **Soils.**—Four districts were visited, *viz.*, Raipur, Nagpur, Hoshangabad and Betul, each of these places being typical of large tracts of country.

A large proportion of the area of the Central Provinces consists of black cotton soil of which Nagpur and Hoshangabad districts are types ; the former is ordinary Deccan soil, which is dark brown or black in colour and contains a certain amount of undecomposed rock in small lumps as well as limestone nodules. The depth of the soil is usually considerable. It exhibits all the typical properties of black cotton soil in that (*a*) it is of good quality and has good moisture-retaining properties ; (*b*) when dry it hardens and cracks ; but with a moderate amount of water it is capable of taking on a very fine tilth.

The soils of Hoshangabad are typical of the Nerbudda valley. It is generally darker in colour than the Deccan soil, and rather finer in texture, for while the limestone nodules are still present, the rock

particles are not. Its depth is very great, and it is as a rule extremely fertile.

The land in the Raipur District is of three distinct varieties: (*a*) laterite gravel on the high parts of the rolling country, (*b*) yellow clay on the slopes of the ridges, (*c*) black soil in the valleys. The latter is not a true black cotton soil. The laterite gravel is practically of no use from an agricultural point of view. The yellow and black soils are both fairly stiff clay loams of good quality, and capable of excellent tilth.

The crops of the Raipur district (where rice is very largely grown) are sharply distinguished from those of some other parts of the Central Provinces, where dry crops greatly predominate.

Betul is fairly typical of the plateau districts whose elevation reaches 2,000 feet in some places. (The plains of Chhattisgarh and Nagpur are on an average just under or just over 1,000 feet.) Generally the soil of the cultivated land is a shallow clay loam mixed with stones to the depth of a foot or 18 inches. Below this is laterite gravel. Lighter soils also occur, but not to a great extent. The country is undulating and in some places mountainous, and a large proportion of its area is covered with jungle which is much cut up by the beds of mountain streams. Obviously this is not a possible jute-growing country, but the description is included here on account of the considerable and growing importance of the tract as one of the two chief centres for the production of "Jubbulpur Hemp."

42. **Temperature.**—The temperature conditions of the plains of the Central Provinces do not vary very greatly from those of Bengal. The chief differences are that the hot weather is drier, the rains are distinctly (from 3°—5°) cooler and the minimum night temperature falls more rapidly in September in the Central Provinces than in Bengal. These differences, however, are not great. In the plateau districts the April and May maximum temperatures are high ; but both maximum and minimum temperatures in the rains are several degrees lower than in the plains.

43. **Rainfall.**—As regards quantity, the rainfall over the greater portion of the Central Provinces is good. Fifty inches is a common

annual rainfall and in some parts of the Chhattisgarh division it is over 60 inches. Raipur averages 50·4 inches, Hoshangabad 49·5 inches, Betul 42·7 inches, Nagpur 44 inches.

The distribution of the rainfall over the early months of the year is not good, as the following figures show:—

	January to March.	April.	May.	June.
Raipur	1·22	0·59	0·76	9·42
Hoshangabad	0·76	0·07	0·53	6·84
Betul	1·35	0·29	0·49	7·18
Nagpur	0·89	0·46	0·68	8·20

There is, therefore, a considerable difference in this respect between Bengal and the Central Provinces.

Experiments with jute have, at the instance of the Officiating Inspector General of Agriculture in India, already been carried out at two stations—Raipur and Nagpur—in the Central Provinces.

At Raipur the experiments were not a success, probably owing to the fact that the plants were sown late and were, in consequence, more or less swamped in the rice lands by the heavy rains. The experiments are being continued this year under better conditions.

At Nagpur two experiments were laid down, one on the Nagpur Government Farm on high land and another at Telankeri on low-lying land liable to submersion. Sowing in both experiments was carried out in June, there not being sufficient moisture previously. The Telankeri experiments were a failure, the plants not exceeding eighteen inches or two feet in height: this and the Raipur result both help to prove the sensitiveness of the young jute plants to excessive moisture.

The experiment at Nagpur Farm on high land appears to have been a much nearer approach to success. The plants were grown too far apart, so that they branched considerably, but nevertheless, I understand, they were about 5 feet in height, and the vigorous growth was proved by the thickness of the stems. The fibre had unfortunately been disposed of, so that I could not examine it. This experiment is

an important one and is being repeated this year. If successful, it would open up a considerable tract for jute extension.

44. **Jute Extension in Bengal and East Bengal and Assam.**—The following table, in which are approximate figures for the areas under Jute in Bengal in 1894 and 1905 respectively, gives some idea of the rapidity with which the cultivation has expanded during the last 10 years.

Table showing estimated areas under Jute in 1894 and 1905 respectively.

	1894.	1905.	Increase or decrease.	
	Acres.	Acres.	Acres.	
Burdwan	10,900	14,500	+3,600	+33 per cent.
Midnapur	10,800	10,500	—300	—3 „
Hooghly	12,500	66,800	+54,300	+435 „
Howrah		89,900	+54,500	+154 „
24-Parganas	35,400	10,700	—7,100	—40 „
Khulna	17,800	45,000	—2,000	—4 „
Nadia	47,000	41,300	+7,700	+23 „
Jessore	33,600	40,800	+19,100	+88 „
Murshidabad	21,700	125,000	+17,500	+16 „
Dinajpur	107,500	128,000	+22,800	+22 „
Rajshahi	105,200	385,000	+98,800	+34 „
Rangpur	286,200	135,000	+60,000	+80 „
Bogra	75,000	2,200	—11,600	—84 „
Darjeeling	13,800	200,600	+26,100	+14 „
Pabna	174,500	108,100	+43,900	+68 „
Jalpaiguri	64,200	210,100	—1,100	—0·5 „
Dacca	211,200	134,000	+49,000	+58 „
Faridpur	85,000	18,000	+11,600	+165 „
Backergunj	6,400	795,200	+236,100	+42 „
Mymensingh	559,100	246,800	+34,800	+16 „
Tippera	212,000	4,200	—5,300	—55 „
Noakhali	9,500	17,900	—1,700	—11 „
Bhagalpur	19,600	269,000	+194,000	+258 „
Purnea	75,000	31,600	—3,900	—11 „
Malda	35,500	10,200	+5,700	+120 „
Cuttack	4,500	4,200	+1,600	+61 „
Balasore	2,600			
GRAND TOTAL	2,236,500	3,144,600	+908,100	+40

In 1894, the total estimated area of jute was just below 2¼ million acres. Last year (1905) it was 3,145,000 acres (nearly 5,000 square miles), an increase of 908,000 acres or over 40 per cent. Of this

increase, the three districts of Mymensingh, Purnea and Rangpur account for more than half (529,000 acres), but Hooghly, Howrah, 24-Parganas, Bogra, Jalpaiguri, Dinajpur, Rajshahi, Pabna, Backergunj, Tippera and Murshidabad have all considerably increased their jute areas. The remaining districts show decreases or only small increases. The total area of jute last year was about 10 per cent. of the total cultivable area of the districts in which it was grown; but the proportion of the area occupied by jute in individual districts was very much higher, *e.g.*, for Mymensingh the percentage is 33, and it is over 20 in several of the districts mentioned above as having largely increased their area in recent years. While it cannot be expected therefore that a further very large increase of jute cultivation can take place in these cases, it is possible that a considerable increase may be looked for in districts like Rajshahi, Jalpaiguri and Dinajpur, where the area under jute is only about 10 per cent. of the cultivated area; and in others where it is much less. But there are two practically quite new possible areas in Bengal for jute extension, *viz.*, the Assam Valley and Bihar. Attempts will be made, during the coming cold season, to introduce the cultivation on a considerable scale into the former tract, which promises to prove suitable.

In Bihar the cultivation was commenced in Champaran about two years ago, and its success has already induced both European planters and native cultivators to introduce the crops. It is estimated that the area under jute this year will be some six thousand acres.

Comparing the rainfall figures for March, April and May already given for the various districts in North-West Bengal with those for the recognized jute-growing areas, we see that there is a great difference between the two; while the latter average 16·7 inches in the three months, the former only receive 3·02 inches; moreover the hot weather is much drier and the temperatures registered are, as a rule, considerably higher in Bihar than in Eastern Bengal. Nevertheless, probably owing largely to the quite extraordinary moisture-yielding properties of the soil of Bihar (already referred to), the crop, which is sown in February like indigo but in rather lower lands, is able to withstand the hot weather with apparent ease; and as soon as the

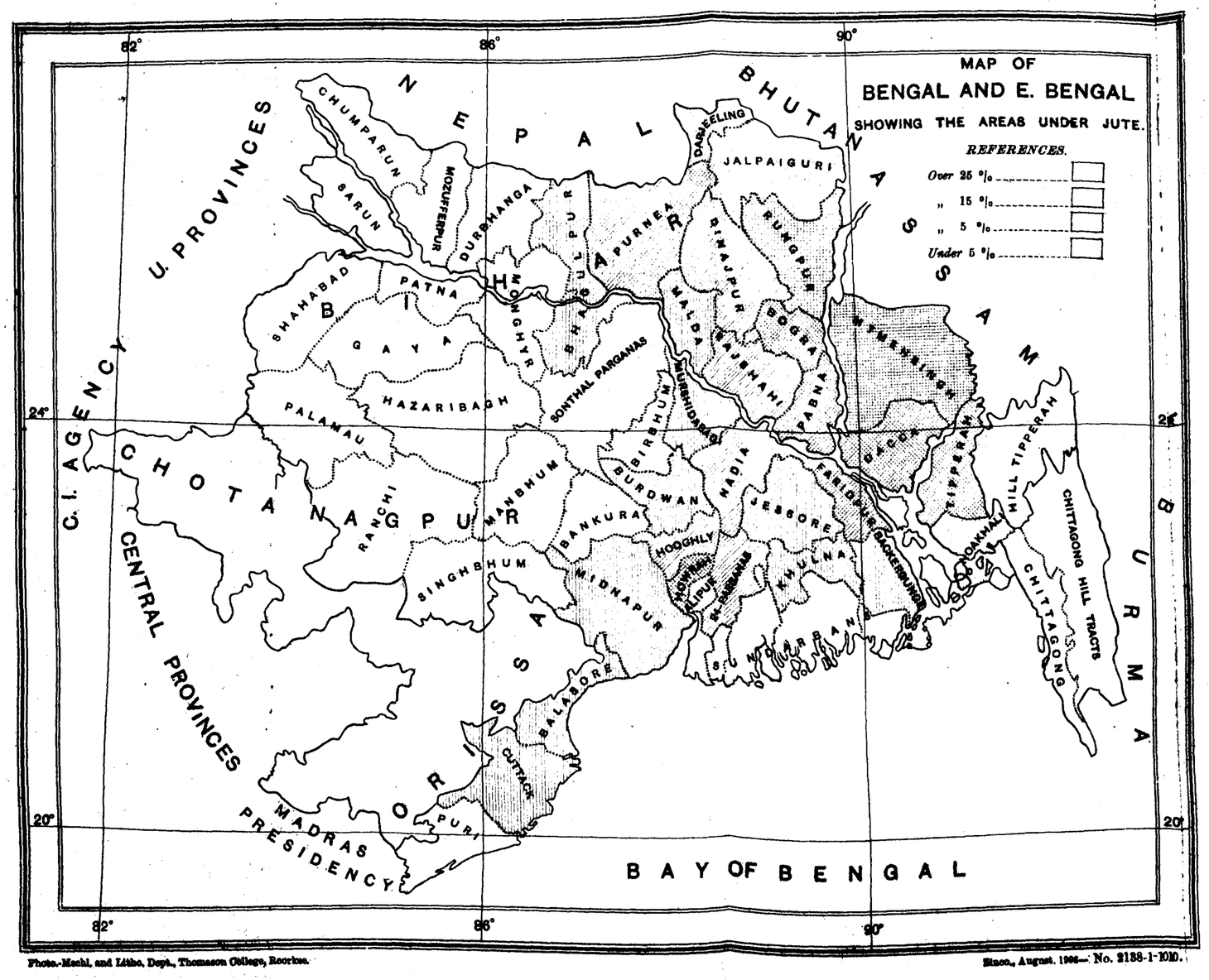


Photo.-Mechl. and Litho. Dept., Thomason College, Roorkee. Simon., August. 1908.—No. 2138-1-1010.

showers come in May, it goes forward at a great pace. The present season has been a fairly severe test of the possibilities of Bihar as a jute-growing district. April and the first half of May were on the whole exceedingly hot and dry. The maximum temperature was over 100° practically for weeks together, and the strong dry west winds with their clouds of dust often reduced the humidity to less than 20 per cent. Yet the crops, not only the experimental ones at Pusa, but those grown on a commercial scale in the district, are, as far as can be ascertained, almost uniformly excellent. It should be mentioned that the conditions of the soil at the time of sowing, as regards moisture, were probably rather better this year than usual, owing to the excessive rainfall received during the last year's monsoon; but there is no doubt also that the weather during April and May was hotter and drier than the average. If jute cultivation in Bihar proves successful, over half a million acres might be available, assuming that the same proportion of the total could be used as in Eastern Bengal. An interesting observation has been made which will receive further attention, *viz.*, that *Corchorus capsularis* seems better capable of withstanding extraordinary conditions of heat and moisture than *Corchorus olitorius*. At Pusa and also in some trials made in Champaran by Mr. Francis Murray of Kurnowl, it was noticed that *C. olitorius* showed a marked tendency to become branched and to flower and fruit while the plants were quite small, say about 2 feet high. Curiously enough, the Burdwan experiments of 1904 indicated that *C. olitorius* was incapable of growing well in waterlogged land, and this result was supported by the excellent yields obtained on high land in 1905. The question as to whether the range of suitable conditions for development is smaller in the case of *C. olitorius* than in *C. capsularis* will be an interesting point for future observation.

Attention has been drawn by Mr. Lefroy, the Imperial Entomologist, to a possible difficulty under which the jute crop in Bihar may labour, *viz.*, the extra risk of attacks from caterpillars which the crop runs by being sown early and at a time when there are not many other crops in the ground. These caterpillars have been noticed in Pusa, though they have not so far done any great damage, nor

fortunately has anything been heard as yet of their having become a serious pest anywhere. Experiments are being made in Pusa this year to see if sowing cannot be practised at a much later time; if so, the possible difficulty could be largely avoided.

45. **Suggestions for increasing the Yield of Jute.**—Side by side with the problem of the extension of the jute-growing area, and almost equally important, is that of increasing the yield of fibre from lands on which the crop is already grown. In some of the jute districts, the land receives an annual deposit of silt from the floods of the Ganges and the Brahmaputra which enables it to go on yielding crop after crop with little or nothing else in the shape of manure; but lands not subject to inundation in this way are in a very different position, for jute is known to be an exhausting crop as cultivated at present. So far cattle dung has proved much the best manure, and it is the only practicable one in the vast majority of cases. Unfortunately the supply of cattle dung is limited, being insufficient to supply all the manure that is needed. Hopes are entertained that cake manures may prove to be of considerable help, although the results of experiments have not been quite uniform.

In this connection it is worth while considering whether the residue of the jute crop itself after the fibre has been extracted cannot be put to much greater use than it appears to be at present. A few years ago indigo planters used to burn their "seet" (refuse indigo plants after extraction of the dyeing substance) in the boiler fires. Now under the stress of competition they have realized its value as a manure. For crops like tobacco, native cultivators are willing to pay in many cases as much as (and in others much more than) ₹50 per acre more rent for land which has received a dressing of about 10 tons of "seet" per acre, which expenditure is amply justified by the resulting increased yields. "Seet," in fact, is now at some indigo factories reckoned to be comparable in value with the dye produced. Like farmyard manure it is valuable not only on account of the common manurial ingredients which it supplies, *viz.*, Potash, Lime, Phosphoric Acid, Nitrogen, etc., but also on account of the fact that it is a bulky *organic* manure. What the exact effect of these bulky manures on the land is, *i.e.*, whether it is chiefly physical or not, is not definitely understood, but in India they are generally far more effective than an equivalent amount of pure manurial ingredients applied as salts to the soil.

Jute resembles indigo in this respect, *viz.*, that in each case only a portion of the crop—*i.e.*, the colouring matter in the indigo and the fibre of jute—is of commercial importance. In each case there is, therefore, a considerable residue, whereas with many other crops like sorghum and rice the whole crop is utilized. We know that jute is an exhausting crop, and we know that the fibre is practically a pure organic substance containing only a very small percentage of mineral matter. The actual drain on the soil on account of the fibre is therefore very small; so that the substances whose extraction from the soil tends to impoverish it are in the non-fibrous portions of the plant. Part of this material is lost during the retting process by disintegration and solution; but the residue must contain a considerable proportion of the mineral matter absorbed by the crop in addition to a large supply of organic matter elaborated by the plants during their growth. At present all this appears to be to a large extent wasted from an agricultural point of view. The jute sticks are used for various purposes round the homestead, such as firewood and making flimsy fences; they are also made into charcoal for fireworks, while large quantities are left to rot on the sides of the pool where retting has taken place.

Attempts will be made to show the value of this refuse as manure: it is hardly to be expected that it will prove as effective as "seet," not only on account of the prolonged steeping in water, but also because of the botanical differences between the two plants. Nevertheless, in a country like India, where organic matter is generally deficient in the soil and where the cultivator is ordinarily unable or unwilling to obtain any other manure than a scanty supply of cow-dung, such a supply of fertilizing material right at hand should be utilized to the utmost.

46. **Green manuring** with leguminous crops has already been referred to in dealing with the details of cultivation of jute. It is already practised to some extent in Bengal, and is to be recommended, especially for lands which are not liable to submersion.

JUTE SUBSTITUTES.

47. In view of the fact that the demand for jute will probably continue to increase in the future as it has in the past, it is well worth while to consider whether other fibre-producing plants cannot be encouraged, even though it may be taken for granted that a considerable area is still available for the increased cultivation of jute. It is a well-known fact that there are a great number of plants in India whose fibre has been very favourably reported on by experts in England at former periods. It is, therefore, highly advisable that the properties of these fibres and the possibility of their cultivation on a commercial scale should be investigated with as little delay as possible. Confining our attention for the present to fibres which are likely to act as substitutes for jute, two may at once be mentioned, which have always received a certain amount of serious attention and which now promise to develop at a great rate in the near future. These are:—(*a*) *Hibiscus cannabinus* ("Bimlipatam Jute," "Bombay Hemp," "Ambari" in Bombay, "Gogunara" in Madras and "Patwa" or "Mestha pat" in Bengal). (*b*) *Crotolaria juncea* (Sunn Hemp, Jubbulpore Hemp, "Sann" or "Sani" in Bengal and "Janupanara" in Madras). Both these plants have, apparently, been cultivated on a small scale for local use by the natives over the whole of India for a great many years, thus showing that they are capable of thriving under a great diversity of climatic conditions. It is, however, apparently only in comparatively recent years that an export trade has sprung up in the case of *Hibiscus cannabinus*, although Sunn Hemp has long been an article of export from India.

48. **Hibiscus cannabinus.**—The development of *Hibiscus cannabinus* as a staple for export has, up to the present, taken place almost entirely in Madras where its cultivation on a commercial scale probably commenced about 50 years ago. Since then, up to quite recent years, it has extended gradually as the wants of the gunny factories which were established at Bimlipatam and other places increased. In recent years, however, the high price of jute has caused a demand for fibre for export beyond the supply of the gunny mills and consequently the cultivation has increased rapidly. The two

districts where most of the fibre is produced at present are the Vizagapatam district and the Ongole taluk of the Guntur district, the estimated acreage under *Hibiscus cannabinus* for last year (1905) in these localities being Vizagapatam 37,171 acres, Ongole 6,000 acres, while the total estimated outturn of fibre was 80,000 bales of 400 lbs. This year the total estimated acreage is 68,201, of which 48,731 acres are in the Vizagapatam district—an increase of over 30 per cent.—and 12,914 acres in the Guntur district. Kistna has 2,243 acres, Cuddapah 1,500, Godaveri 745, Kurnool 480 acres; and the remainder is distributed in small areas over the whole presidency.

The cultivators distinguish three different kinds of *Hibiscus cannabinus* in Vizagapatam, *viz.*—

(*a*) *Salakana Vittanu* (paddy gogu), sown with the first rain on low lands in May and reaped in August or September in time to allow of transplantation of winter paddy;

(*b*) *Pedda gogu* (long "jute") or *borubu vittaneo*, sown in June or July in high lands and reaped in November; it forms the major portion of the supply of fibre.

(*c*) *Chilly gogu* or *Payra gogu*, grown chiefly as a vegetable and not as a fibre crop.

Moreover the kind grown in Ongole is said to be different from any of these. There are certainly green and red kinds, but whether these differences are merely such as exist between the various races of one of the varieties of true jute (*C. capsularis*), for instance, or whether they are real botanical differences, such as those between the two varieties *C. capsularis* and *C. olitorius* has not yet been decided. Mr. Barber, the Government Botanist, Madras, is investigating the question.

The fibre of *Hibiscus cannabinus* is of good quality, being comparable with jute in most respects. It has long been recognized as a possible substitute for jute, and though its spinning qualities are said to be not quite so good, yet the fact that it is actually used on a large scale for the manufacture of gunny bags and that its price is not greatly inferior to that of jute proves its suitability for the purpose. It is a very paying crop to grow at present prices. A fairly good yield

is given at two kandies (1 kandy = 500 lbs.) per acre, and the prices last season varied between R30 and R50 per kandy, the latter figure being the price at the end of the season. These figures indicate a *net* profit of from R30 to R50 per acre. In cases where the land is well manured the return is considerably higher.

It is not tolerant of water to the same extent even as jute. The rainfall of Vizagapatam, where the cultivation has made its greatest advance, only averages about 40 inches per annum, that of Gagapatanagaram taluk which accounts for more than one quarter of the total production being only 37·9 inches. Ongole taluk of the Guntur district, in which 13,000 acres are being grown this year, only averages 34·5 inches. Nevertheless, it grows and thrives luxuriantly in places where the rainfall is much heavier, provided the land is not constantly waterlogged. It responds well to manuring, the chief fertilisers being cattle or goat dung, refuse and tank silt. The cultivators in Vizagapatam realize the importance of manure, and they have evolved a rotation with paddy, sesamum, ginger, pea, cotton, ragi (millet), etc., which, in addition to giving the land the advantage of growing one leguminous crop in three, provides for frequent manuring.

The amount of seed sown per acre varies from 14 to 18 lbs. for a pure crop. The seed is often raised from plants grown in nursery beds used for chillies, which being watered and manured produce a vigorous development of the plant and therefore healthy seed. The details of cultivation and extraction of the fibre are similar to those of jute (see paras. 13 *et seq.*).

From what has been said above concerning *Hibiscus cannabinus*, it will be seen that it possesses the properties which render it a reasonably efficient substitute for jute. It can be grown with success under the conditions of soil and climate which obtain in most parts of India and consequently is capable of much greater extension than jute which requires, it would appear, more favourable conditions of soil and moisture for its development. While the slightly coarse nature of the fibre renders it not so suitable in some ways for spinning, it is said to be stronger than jute. "It seems to be but little inferior to

an average specimen of Calcutta jute and has the advantage of being pale in colour . . . . in composition and properties the two fibres . . . . . both also resemble ordinary jute . . . . . this fibre is deserving of attention in India." (Prof. Wyndham Dunstan.—Agricl. Ledger, 1903, No. II.)

There can be no doubt, therefore, that the extension of the cultivation of "Bimlipatam jute" should be encouraged, especially in Madras, where it has already established itself in the favour of the cultivators and where it is (in the opinion of the Honourable Mr. Castlestuart-Stuart, to whom I am indebted for the figures quoted above and also for those referring to sunn hemp in Madras) capable of being produced on such a scale as to afford considerable relief to the present position in the jute trade. On lands like the *lankas* of the deltas, whose soil is as a rule far richer than that of Vizagapatam, it could produce very big returns.

But it is not only in Madras that "Bimlipatam jute" can be successfully grown as a pure crop. It is common throughout Bengal, Bombay, Madras and the Central Provinces as a mixed crop, and as the figures already quoted show that its cultivation as a pure crop returns a good profit—better than most other field crops—there is no reason why there should not be an almost unlimited supply of its fibre.

49. **Sunn Hemp.**—As already stated, *Crotolaria juncea*, like *Hibiscus cannabinus*, is grown throughout India more or less extensively as a fibre plant, but it is also cultivated on a much larger scale for two other purposes, *viz.*, (*a*) fodder, (*b*) as a green manure. The extent of the cultivation in Madras for fodder purposes may be gauged from the fact that of the 205,000 acres returned as being under sunn hemp this year (1906), much the greater portion of the crop will be used as fodder. The seed is sown just before the rice crop is reaped and is allowed to grow during the whole of the remainder of the rabi season. It is then cut and stacked. It is not possible to gauge the area on which sunn hemp is grown as a green manure; but it is undoubtedly considerable. The advantages of this practice of cultivating sunn hemp, either as a fibre or fodder crop or for green manuring purposes,

due to the fact that the plant is a papilionaceous legume whose roots are capable of absorbing nitrogen from the atmosphere, will be referred to later.

It is as a fibre crop that we are for the present especially concerned with sunn hemp, the fibre of which has been an article of export from India for many years. The following figures are given by Royle as representing the export trade of India in raw sunn hemp and in goods manufactured from the fibre in 1851-52:—Madras 4,861, Bombay 16,895, Calcutta 17,936, total 39,692 maunds of 82 lbs. The quantity estimated to have been exported from India during 1903-04 was nearly 650,000 maunds.

The chief centre of production of sunn hemp appears to be the Central Provinces, where 72,738 acres were sown in 1904-05, of which 47,000 acres were in the plateau districts. Roxburgh distinguishes between "Jubbulpore Hemp," which he says is *Crotolaria tenuifolia*, and ordinary sunn hemp, which is *Crotolaria juncea*. Other botanists, however, dispute the distinction. Efforts will be made to clear up this doubtful point.

In Madras, according to this year's (1906) estimates, about 23,000 acres of sunn hemp are being grown for fibre; of this area 20,000 acres are distributed over five districts as indicated by the figures in the margin. The remainder of the area is distributed in small amounts over the whole Presidency.

	Acres.
Ganjam	2,313
Kistna	4,500
Godaveri	2,854
Guntur	9,204
Tanjore	1,067
Total	19,938

It is also grown on a considerable scale in Bombay, in the United Provinces and in Bengal. Watt in 1889 estimated the total acreage in India at 150,000 acres. It is probably much greater than this now. The area under sunn hemp in the Central Provinces has more than doubled during the last ten years as the following figures show:—

1895-96	29,094
1896-97	42,149
1897-98	52,575
1898-99	36,838

1899-1900	41,731
1900-01	47,967
1901-02	73,301
1902-03	83,241
1903-04	67,961
1904-05	72,738

50. **Soils.**—The conditions of soil and climate of the plateau districts of the Central Provinces have already been described. The following are a few general details concerning the cultivation of sunn hemp. As it is grown throughout India, it is obvious that it is capable of thriving on almost any soil; it grows luxuriantly in the rich heavy alluvial soil of the Godaveri and Kistna Deltas; but it also grows, though not so vigorously of course, on almost pure sandy lands on the East Coast and in the shallow stony soils of the plateau districts in the Central Provinces. Generally when grown for fibre it is sown as a monsoon crop on high land with the first rains; but it is also cultivated as a cold weather crop in the Konkan. About one maund (82 lbs.) of seed per acre is usually sown. On account of the fact that it is allowed to grow so thickly to prevent branching, very little after cultivation is required, as the thick growth (2 to 3 inches apart is a suitable distance) tends to stifle weeds from the commencement. The crop indeed is recommended in some parts as an efficient means of ridding the land of noxious weeds. Usually the crop is cut when the seed is ripe; so that besides the fibre, a good yield of seed is also obtained, which is esteemed as a cattle food. It is however fairly certain that if the plant is not cut until the seed is dead ripe, the fibre suffers in quality. As in the case of jute, the best quality of fibre would probably be obtained by cutting just after the flowering stage.

51. **Retting.**—In some districts the plant is retted green and in others it is dried before being steeped; Roxburgh advocated the former plan for Bengal, a damp region, and Royle the latter for Madras, a dry climate. In either case, the stems are stacked erect, for a few days, to kill the leaves, and afterwards the bases of the stems are—as with jute—allowed to stand in water for a day or two, in order that

the process of retting may be complete, at the same time, over the whole length of the plant. The period of steeping varies between about five days and twelve days, or longer, according to the temperature of the water. The water used should be clear, if possible, and the same care is necessary as with jute to avoid " under-retting " or " over-retting ."

Stripping.—The separation of the fibre from the stem is a more difficult matter in the case of sunn hemp than with either jute or *Hibiscus cannabinus*. In some cases the fibre is stripped from the stem and washed afterwards, but in others the whole is threshed on the surface of the water, until all adherent matter has been washed away. Stem and fibre are then dried, after which the fibre is stripped from the stem. The yield of fibre varies with the kind of land on which it is grown : in the Betul district the average yield is from 5 to 7 maunds of 82 lbs. per acre, but on good land or with manure it reaches double this amount.

52. **Profit to be made.**—The crop is a valuable one from an agricultural point of view ; the cultivators in the Betul district say it adds 20 per cent. to the outturn of the next crop. It is, moreover, in itself, a paying crop, especially at present prices. Taking the average yield of sunn hemp on good land at 10 maunds per acre, and the price at ₹9 per maund, the gross return will be ₹90 per acre, giving net profit per acre of over ₹50. On inferior land without manure the yield may fall to 5 maunds giving a probable net return of ₹15 per acre which is more than would be obtained from most other crops on the same land.

While it is for the spinner to say whether or not sunn hemp is suitable for *all* the purposes for which jute is used, there appears to be no doubt that it is an efficient substitute in at least a portion of them. It is undoubtedly a stronger and more durable fibre than jute, and on this account it is utilized in cases where jute could not be employed, *e.g.*, for sails, ship's cordage, etc., because of the rapid deterioration which takes place in jute when in contact with water.

Roxburgh, Royle and, more recently, Cross and Bevan have all declared sunn hemp to be superior to jute. The latter, in their report

on the fibres at the Indian and Colonial Exhibition of 1886 say :—" It is impossible to urge too strongly the claims of this much neglected fibre, which seems to have suffered severely, through the immense success of jute obscuring, for a time, the properties of all other fibres . . . From these and many other considerations, we strongly commend this well known fibre . . . . . "

It has already been remarked that sunn hemp grows all over India, it is a paying crop to grow, it improves the fertility of the land and it will grow on almost any soil which is not swampy. There is no doubt that like *Hibiscus cannabinus* it is capable of helping to relieve the present pressure in the jute trade.

53. **Investigation of other Fibre-yielding Plants.**—It is hardly necessary, at this stage, to mention other fibres, which may possibly prove useful as substitutes for jute. It is sufficient to say that various other fibre-yielding plants are being investigated with this object in view.

CONCLUSIONS.

54. In the foregoing pages, I have described the physical and climatic conditions of the various tracts visited, and mentioned those into which it would appear that the cultivation of jute might possibly be successfully introduced. The tracts are :—

- **Bombay**
  - The Konkan.
  - The wet tract of the Deccan and Karnatak near the edge of the Ghats.
  - The irrigated country round Poona.
  - The irrigated districts of Sind.
- **Madras**
  - The Malabar Coast.
  - The Cauveri Delta.
  - The Kistna Delta.
  - The Godaveri Delta.
  - The Ganjam district.
- **Central Provinces**
  - Nagpur Plain.
  - Chhattisgarh Plain.

I have in addition mentioned two parts of Bengal and East Bengal, *viz.*, Bihar and the Assam valley, respectively, neither of which at present grows jute on a large scale, but both of which appear capable of supporting very successful jute cultivation.

55. **Bihar.**—Of all these, the one which must come first as holding out prospects of speedy success as a jute-growing district, is Bihar. Bihar indeed may now safely be said to have passed the experimental stage, and the great success which has attended the efforts of the pioneers—among whom Mr. Francis Murray should be mentioned—to introduce jute, is reasonably sure to cause a rapid expansion in the next year or two. The certainty with which the planters anticipate success may be gauged from the fact that in four estates the areas under jute this year (1906) are 1,000 acres, 500, 400 and 300 acres, respectively. The crops moreover are very good.

56. **Madras.**—Outside Bengal, the climatic conditions in Madras seem to be more favourable than in any other part of India visited by me. The Malabar Coast has already been described as having a climate similar in many ways to that of Bengal. The physical features of this district are very different ; but there is no apparent reason why jute should not thrive on a considerable scale in the large area of rice land in Malabar and South Kanara. In Ganjam again, the condition appear fairly favourable. The rainfall while not heavy is probably sufficient to raise the crop, and it is well distributed ; the soil, especially inland, is distinctly good ; and the district is well supplied with irrigation, the Rushikulya scheme being the biggest. The three great deltas of the Godaveri, Kistna and Cauveri Rivers, whose irrigation systems command over 2,000,000 acres, would appear at first sight to be ideal centres for jute cultivation. In practice the great difficulty will probably be the question of the time of sowing, especially in the low lands.

57. **Bombay.**—In Bombay the conditions generally do not seem so favourable as in Madras. The distribution of the rainfall, when sufficient, is not good in any but the most southerly districts ; so that the question of sowing in time to let the crop attain sufficient maturity

to withstand the torrential monsoon rainfall of the Konkan and the northern part of the Deccan near the Ghats, is a difficulty. It is not easy moreover to gauge the effect of the altitude of the Deccan and the consequent lower prevailing temperatures ; it is not, however, to be anticipated that it will be very great. The experiments in Sind will be interesting. It would be rash to prophesy the result, knowing how the natural conditions in Sind differ from those where jute is ordinarily grown ; but these conditions have been greatly modified by irrigation and it would have been a mistake not to carry on experiments in this province.

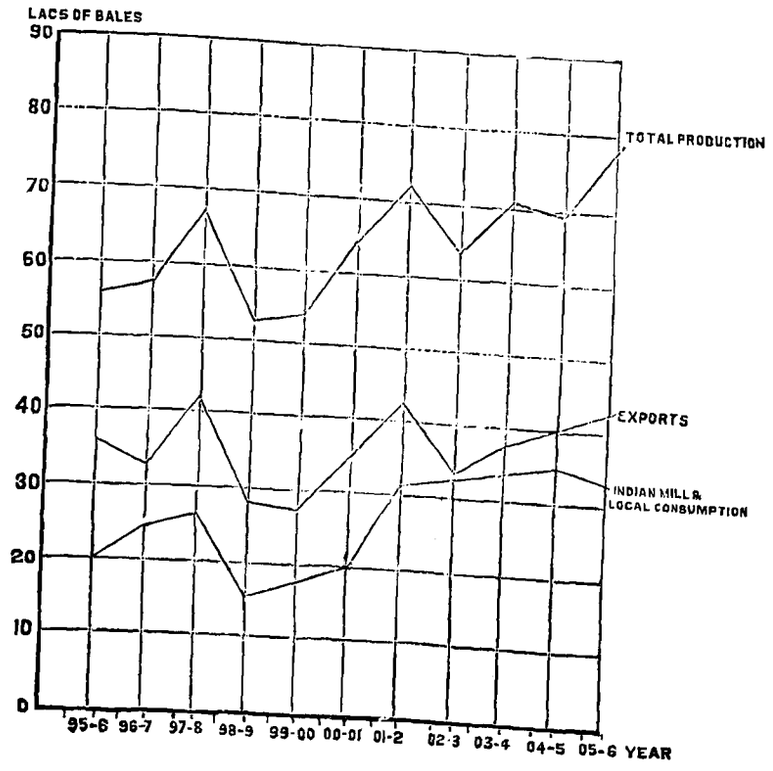
On the whole the districts which appear most favourable for jute cultivation in Bombay are :—

(*a*) The irrigated district round Poona ; (*b*) the most westerly portion of the Deccan and the Karnatak, especially the latter, *e.g.*, at Belgaum and to the west of Dharwar ; (*c*) the higher lands in the Konkan.

58. **Central Provinces.**—In the Central Provinces, the experiments last year at Nagpur on high land gave indications of success and are well worth persevering with. At Raipur, it will probably be, as at Nagpur, impossible to sow before the commencement of the monsoon. The outlook is therefore not so encouraging as at Nagpur, as the rice lands will tend to become inundated at once.

59. **Expansion of Trade in Jute.**—The present position of the jute trade is clear testimony of the great expansion in volume which has from various causes taken place during the last few years. The area under jute cultivation has increased year by year—over 40 per cent. in the last decade—yet, on account of the numerous and increasing applications of the jute fibre together with its comparative cheapness, the demand has outstripped the supply and, as a consequence, prices are higher to-day than they have ever been before. Nor is the demand for gunny bags, in which form the great bulk of jute ultimately appears, likely to diminish, for it is more or less intimately connected with the volume of the world's carrying trade. The following graph shows how the total production of jute has increased since 1895, and

how this production has been divided between exports and Indian mill and local consumption :—



It is estimated by Mr. Nicoll, the late Chairman of the Indian Jute Mills Association, "that a sum of 10 to 12 crores of rupees (about seven and one-third millions sterling) *more* has been paid in this year (1905-1906) than in former years for the whole jute crop." Mr. Birkmyre, the present Chairman of the Indian Jute Mills Association, says "undoubtedly we have now got to the point when the production of the raw article is not equal to the demand, and the most strenuous efforts should be put forward by every one interested, to have the production increased. The great value of jute has always been its cheapness; but we are rapidly reaching the point when this value disappears. There are many other questions which crop up when the demand becomes greater than the supply . . . notably that of adulteration . . . ." Such a state of affairs is not economically healthy. In this case, the competition has been transferred entirely to the buyers, who have therefore been constrained to take whatever the sellers care to offer, in order to fulfil their contracts. Herein lies the whole gist of the question of "fraudulent watering," which is causing such anxiety and which threatens such damage to the trade. Now, if this be so, the only *permanent* cure is, obviously, to increase the area under jute cultivation, or to introduce substitutes for jute, to such an extent as to do away, as far as possible, with the present discrepancy between supply and demand; in other words, to transfer part of the competition from buyers to sellers. "Fraudulent watering" would then vanish automatically. Whether or not it is necessary to curb the watering of jute, for the present, by other means, until a sufficient extension of the area under the crop or its substitutes has taken place, is a point under discussion.

60. **Prospects of extending Cultivation.**—There are indications that what are at present the jute-growing districts of Bengal and Eastern Bengal are approaching the limit of their productive power for jute, and it is extremely doubtful whether any expansion of the jute-growing area which is likely to take place, will proceed with sufficient rapidity to ease by itself the present state of the market. Outside Bengal it has to be decided which of the possible centres for extension yields the best results; then, even when this

has been done, and the paying nature of the crop has been proved, the lethargy of the cultivators as regards the introduction of new crops has to be overcome. In reality the raiyat is, in most cases, anything but slack ; he is naturally cautious and conservative and he cannot afford to speculate ; but if it be demonstrated to him that a crop can be made to pay, *on a commercial scale,* better than the ones he is growing,—this involves a *ready market* for his produce, a very important point—he will take up its cultivation quickly enough. The experience of the last two years with jute in Bihar is a case in point. If therefore a rapid introduction of jute cultivation into entirely new districts is to take place, it will probably be found necessary to supply the equivalent to the cultivator of the demonstration which the planter has given in Bihar. With this difficulty in view, the development of other fibres becomes increasingly important, for, in at least two cases, *viz.*, Sunn Hemp and *Hibiscus cannabinus*, we have plants which have been firmly established throughout India, as fibre producers, for many years. The development of these crops would therefore probably take place with much greater ease than that of true jute, an entirely new crop, with whose cultivation no one is familiar outside Bengal. But the two plants mentioned above are not the only ones worthy of attention; all authorities, from the time of Roxburgh to the present day, have urged that India is particularly rich in fibre plants, and it is estimated that at least thirty of these are capable of commercial exploitation. The present is a particularly favourable time for bringing them forward, and efforts are being made to investigate them, for—apart from any intrinsic value they may possess for special purposes—though they may not be suitable for all the uses to which jute is at present put, their substitution for even a portion of these is obviously equivalent to a virtual increase in the production of jute.

G. I. C. P. O.—No. 23 I. G. Agri.—10-11-06.—1,010—W. J. D.