

# NATIONAL COMMISSION ON AGRICULTURE 1976

## RAINFALL AND CROPPING PATTERNS

Volume II

**ASSAM**

सत्यमेव जयते



GOVERNMENT OF INDIA  
MINISTRY OF AGRICULTURE AND IRRIGATION  
NEW DELHI

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## RAINFALL AND CROPPING PATTERNS--STATE SERIES


### *VOLUME NO*

### *STATE*

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II	ASSAM
III	BIHAR
IV	GUJARAT
V	HARYANA
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# RAINFALL AND CROPPING PATTERNS

## ASSAM

### INTRODUCTION

1.1 The human population of the country is estimated to rise from the 1971 Census figure of 548 million to 935 million in 2000 AD. This rise calls for increased production. Land resources being limited emphasis has to be placed on increasing productivity per unit area. Temperature and other climatic conditions being favourable for crop production throughout the year over most parts of the country, it is possible to grow more than one crop in a year provided water, the most important input, is available. In some parts of the country, the rainy season is long enough to provide scope for double cropping. This potential is yet to be fully exploited. There is scope for increasing irrigation resources in the country, but our estimates show that the area under irrigations is not expected to be more than 42 per cent of the total cropped area even in 2000 AD as against 22 per cent in 1970-71. Therefore, judicious utilisation of direct rainfall and irrigation water, singly and in combination, will have to be thought of for increasing production.

1.2 Farming technology has so advanced that it is possible to increase crop yields even under rainfed conditions, but the choice of crops would have to depend upon the amount and distribution of the prevailing rainfall. Additionally, it will be necessary that the maximum possible quantity of rainwater is conserved in ponds and pools situated either within the farm area or elsewhere, in soil profiles and underground storages so that the same could be readily used to save crops in times of water stress. Not only in rainfed farming but even under irrigated conditions, one will have to plan for the most economic and efficient use of water so as to derive maximum possible benefit from rainfall and reduce dependence on irrigation. This necessitates a close study of the existing

cropping patterns vis-a-vis rainfall patterns aimed at determining the nature of changes needed in the former. The cropping patterns depend primarily on the soil and climatic factors but the evolution of a cropping patterns in course of time is the combined effect of soil, climate, food habits and requirements and economic factors. In the context of increasing production, it is necessary to examine the cropping patterns from a scientific angle and find out possible alternative patterns having higher potential. Accordingly, the Commission undertook a comprehensive study of the rainfall and cropping patterns of the country using taluk or tehsil as unit of area. It covered several other relevant factors such as orography, land use data, human and livestock populations, soil and climate, the object being to make, as far as possible, an integrated assessment.

1.3 Chapter 14 on Rainfall and Cropping Patterns of the Commission's Report presents a consolidated account of the data collected together with analysis of their inter-relationships on all-India basis. In this analysis the Commission has been greatly benefited by the discussions with the concerned officers of State Governments. It was realised that by condensing the vast amount of information collected from each State into the small space of a chapter, many important and peculiar features of individual States were likely to be missed and hence the data and analysis of each State have been presented in separate volumes. The manner of presentation is similar to Chapter 14. It has also been considered desirable to include in each State volume the methodology and suggestions for future cropping patterns, which are practically the same as given in Chapter 14.

### 2 METHODOLOGY

2.1 The chief features of the study are (a) use of taluk or tehsil as unit of area for all basic data and analysis (in the case of Assam data on land-use, area under crops and livestock population are available at the district level only and as such, for cropping and livestock patterns district is used as the unit of area). For rainfall patterns, police stations have been used as the unit of area; (b) introduction of coded numerical forms to express patterns of distribution of monthly rainfall throughout the year, crops and livestock; (c) inclusion of information on orography, temperature, evapotranspiration, rainfall, soil, irrigation, land use, human and livestock population and yield performance of crops, all of which influence in

different ways and degrees the cropping patterns of a place and (d) presentation of coded information on rainfall, crops and livestock on 1:1 million scale maps.

#### Rainfall Patterns

2.2 A major feature of Indian rainfall is that the southwest monsoon season (June to September) accounts for 70 to 95 per cent of the annual rainfall throughout the country except in the south east peninsula and Kashmir and adjoining hill areas. The monsoon as well as the annual rainfall show large fluctuations from year to year but, as stated in Chapter 13 on Climate and Agriculture, there is no

significant evidence of any trend or periodicity in either of them. Considered in relation to crop production, the total annual or seasonal rainfall does not have much significance and what is important is its distribution during the period of growth of different crops. A relevant question, therefore, is whether rainfall should be examined on a weekly, fortnightly or monthly basis. The coefficient of variation (CV) of monthly rainfall is as high as 40-50 per cent even in the rainiest month of July over most of the central, northern and eastern India. In the south excluding the west coast, CV is higher and varies from 60 to 100 per cent. The variability of weekly or fortnightly rainfall being still greater, makes the use of either of them undependable as indicators of rainfall distribution. For a macro-study like the present, monthly rainfall data which are more dependable and also the most convenient to handle have been used.

2.3 In order to relate crop production with rainfall, certain norms have to be assumed depending on the duration of the crops and their water requirements. On the basis of available information and the fact that most crops mature in about 90 days, the following broad norms have been drawn up :

- (i) Rainfall greater than 30 cm per month (cm pm) for at least three consecutive months would be suitable for a crop like paddy whose water need is very high.
- (ii) 20-30 cm pm for not less than three consecutive months would be suitable for crops whose water need is high but less than that of paddy, for example, maize and black gram.
- (iii) 10-20 cm pm for at least three consecutive months would be suitable for crops requiring much less water, e.g., bajra and small millets.
- (iv) 5-10 cm pm for three consecutive months would be just sufficient for crops which have low water requirements, e.g., *moth* (*P. aconitifolius*) and ephemeral grasses.
- (v) Rainfall less than 5 cm pm for three consecutive months is not of much significance for crop production.

2.4 For denoting the year's rainfall distribution using monthly totals, a convenient code in letter symbols with numerical subscripts explained below, has been evolved. The letters A to E in Table 1 indicate the ranges of monthly rainfall and the subscripts to these refer to the number of months having these ranges of rainfall e.g. A<sub>2</sub> indicates two months with rainfall greater than 30 cm pm. The ranges correspond to those stated in the preceding paragraph.

TABLE 1  
Code for Rainfall Data

Symbol	Monthly rainfall cm pm
A+	Greater than 30
B	20—30
C	10—20
D*	5—10
E*	Less than 5

+An examination of monthly rainfall in the country shows that except for areas in the west coast and some hill stations in extreme north-east, normal monthly rainfall seldom exceeds 30 cm.

\*In distributions containing ranges of rainfall covered by A or B termed briefly as A & B types amounts less than 10 cm are not so significant and their frequency is generally small. To reduce the number of combinations, D is omitted in A or B type distributions, instead E is used to denote less than 10 cm pm. Thus B<sub>2</sub>E<sub>2</sub> would denote two months of 20—30 cm pm and two months less than 10 cm pm rainfall.

The southwest monsoon months of June to September being the principal rainy season dominate the rainfall distributions of the country. To indicate the season's importance, monthly rainfall distribution during June to September is shown in brackets in the annual pattern. To the right of the bracket is the distribution for the post-monsoon months, namely, October to January and to the left that for the pre-monsoon months, namely, February to May. In order to explain how such a coded rainfall distribution written in symbols with numerical subscripts has to be interpreted, a hypothetical example may be considered. D<sub>1</sub> E<sub>3</sub> (A<sub>2</sub> B<sub>1</sub> C<sub>1</sub>) C<sub>1</sub> D<sub>3</sub>, in which for each of the three periods, the symbols are in order of decreasing rainfall which is not necessarily the calendar sequence, can be explained as under :

- (i) D<sub>1</sub>E<sub>3</sub> represents the period February to May in which one month's rainfall (usually May) is in the range of 5-10 cm and the remaining three months get less than 5 cm pm.
- (ii) A<sub>2</sub> B<sub>1</sub> C<sub>1</sub> represents the period June to September, in which two months (usually July and August) get more than 30 cm pm rainfall, one month (September) gets 20-30 cm and the remaining month, i.e. June gets 10-20 cm.
- (iii) C<sub>1</sub> D<sub>3</sub> represents the period October to January in which October gets 10-20 cm rainfall and the rest 5-10 cm pm.

#### Boundaries of Rainfall Zones

2.5 Since differences in monthly, seasonal and annual rainfall are not large within short distances, linear interpolation of rainfall data is permissible. Rainfall data being point measurements, isolines for the same or nearly the same type of distribution of monthly rainfall can, therefore, be drawn. These isolines may not necessarily follow the boundaries of

taluks which are taken to be unit of area in this study and hence for delineation of boundaries the following procedure has been adopted :

- (i) Where variations are small, isolines follow the taluk boundaries;
- (ii) where variations are large, isolines delineate the zone boundaries; and
- (iii) any taluk, more than three quarters of which lies outside of a zone is not considered a part of that zone.

2.6 If an identical distribution is observed over two or more adjacent taluks a pattern is said to have evolved and the area covered by it is distinguished as a zone and indicated suitably by a Roman numeral. Rainfall patterns have been identified for the whole country using the methodology described above. The data used for the analysis are the monthly normals of rainfall (1901 to 1950)<sup>1</sup> and the patterns and zones are depicted on all India map which forms part of Chapter 14 on Rainfall and Cropping Patterns of the Commission's Report.

### Cropping Patterns

2.7 The basic data for the study of cropping patterns of the country are the areas under different crops in each of the taluks. A large number of crops are grown in a taluk but most of them occupy small areas, often less than one per cent of the total cropped areas of the taluk. With a view to limiting the number of crops constituting a pattern only those crops are considered which individually occupy 10 per cent or more of the gross cropped area of the taluk. In this process, several crops have to be excluded, even though they may be otherwise important. The minimum limit has been fixed at 70 per cent, so that the number of crops, which together cover at least 70 per cent of the gross cropped area, and in which none occupies less than 10 per cent, is not large. Trial computations have shown that in such distributions any crop occupying more than 10 per cent area is rarely omitted and the number of crops hardly exceeds five. When the same distribution holds good for two or more adjacent taluks, a pattern is obtained.

2.8 As in the case of rainfall, percentage area coverage by crops is expressed by means of numerical subscripts affixed to crop symbols shown in Table 2. The list of crops given below is comprehensive and will hold good for all the States.

TABLE 2  
Crop Symbol and Area Intervals

Crop	Symbol
1 rice	Pd
2 wheat	W
3 jowar (kharif)	Jk
4 jowar (rabi)	Jr
5 bajra	B
6 maize	M
7 ragi	R
8 small millets	Mt
9 barley	Ba

TABLE 2—(Contd.)

Crop	Symbol
10 oats	Oa
11 gram	G
12 pigeonpea (tur)	T
13 pulses other than pigeonpea and gram	Pu
14 groundnut	Gn
15 oilseeds other than groundnut	O
16 cotton	C
17 jute	Ju
18 other fibres	Fb
19 sugarcane	S
20 potato	Pt
21 vegetables	V
22 fruits	Fr
23 tapioca	Ta
24 plantations	L
25 fodder	F
26 chillies	Ch
27 tobacco	To

Area interval (per cent)	Subscript
70 or more	1
50—70	2
30—50	3
10—30	4
less than 10	5

The crop code contains the crop symbol and the appropriate subscript. In writing crop distribution, the first crop has always the highest area but the rest may not necessarily follow the order of decreasing areas. For example, crop distribution, C<sub>3</sub> Jr<sub>4</sub> Mt<sub>4</sub>, means that cotton area is 30-50 per cent, and jowar rabi and millets each occupies 10-30 per cent of the gross cropped area, the total being 70 per cent or more. Two or more taluks having the same distribution of crops constitute a pattern. Cropping patterns so derived have been indicated on maps of 1 : 1 million size.

### Relative Yield Index of Crops

2.9 Besides the absolute figures, the yield of a crop has also been expressed as per cent of all-India average which is called Relative Yield Index (RYI). Relative Yield Index values have been computed for the principal crops on the basis of (1968-69 to 1970-71) data available in the records of the Directorate of Economics and Statistics, Ministry of Agriculture and Irrigation.

### Livestock Patterns

2.10 The livestock patterns are relevant only insofar as these are related to production of fodder and feeds. As talukwise data were not available for the livestock Census, 1972, those of 1966 Census as published by the States have been used. The animals considered for livestock analysis are shown in Table 3 together with their symbols.

TABLE 3  
Livestock Symbols

Category	Symbol
cattle	
male	Cm
(over 3 years)	
female	Cf
(over 3 years)	
young stock	Cy
(under 3 years)	
buffaloes :	
male	Bm
(over 3 years)	
female	Bf
(over 3 years)	
young stock	By
(under 3 years)	
sheep	S
goats	G
horses, mules and ponies	H
donkeys	D
camels	Ca
pigs	P

The livestock patterns are expressed in coded form in the same manner as the cropping patterns.

### Soils

2.11 Soil data on a taluk basis are not available for all the areas of the country. As such, soils have been discussed in a general manner using the traditional nomenclature in describing their characteristics.

### Other Data

2.12 The sources of other data featuring in the study are given below :

item	source
taluk area	States' Census Reports 1971 or from data furnished by the States in their land-use returns.
orography	Maps of the Survey of India and National Atlas Organisation.

item	source
temperature	Climatological Tables of Observatories in India, India Meteorological Department, 1931—1960 normals
evapotranspiration	Scientific Report No. 136 of the India Meteorological Department, 1971
human population	Census of India, 1971
irrigation and land-use statistics	basic data pertaining to land utilisation statistics obtained from the State and refer mostly to 1969-70.

### Presentation of Information

2.13 The tables required for following the text are given in the text itself at appropriate places, whereas the basic data are appended as follows :

APPENDIX 1	Districtwise Land Use (1968-69) and Population Statistics.
APPENDIX 2	Districtwise Livestock Population 1966.
APPENDIX 3	Zonewise Information on Rainfall, Rainy days and Cropping Patterns.
APPENDIX 4	Districtwise area under Principal Crops (per cent of Gross Cropped Area).

2.14 Rainfall, cropping and livestock patterns of each State are indicated on maps in the 1 : 1 million scale and given in Appendices 5, 6 and 7 respectively. In the case of rainfall patterns, the zonal numbers in State maps have been given in Roman numerals and their all-India equivalents as used in Chapter 14 of the Commission's Report have been shown in three digit Arabic numerals within brackets.

## 3 GENERAL FEATURES

3.1 The State of Assam comprises the ten districts of Goalpara, Kamrup, Darrang, Lakhimpur, Sibsagar, Nowgong, Cachar, Dibrugarh and the two hill districts—North Cachar Hills and Mikir Hills. However, in the present study, Lakhimpur & Dibrugarh have been retained as one district. Land-use data relate to the year 1968-69. The unit of area for population data is the police station. Both subdivisional (consisting of number of police stations) and police station density value have been analysed. Irrigation data are scanty. Livestock Census, 1972 data have been analysed at the district level. For rainfall, police stations form the boundaries of zones as far as possible.

3.2 The State comprises of 10 districts and covers an area of 78,523 sq km. Districts of Mikir Hills and North Cachar Hills with areas of 10,332 and 4,890 sq

km respectively consist of hill areas. Lakhimpur district before bifurcation had the largest area of 12,792 sq km followed by Goalpara and North Cachar Hills both having 10.3-10.4 thousand sq km each. Area-wise distribution of districts (counting Lakhimpur and Dibrugarh as one district) is given below :

Area '000 Sq Kms	No. of dists
below 5	1
5—10	5
10—13	3

The State has 102 police stations grouped into 20 subdivisions. One-third of the subdivisions are less than 5,000 sq. km in area and half of them between 500 and 1,000 sq km. Areas of police stations in



the hill districts range between 2 and 3 thousand sq km.

### Elevation

3.3 The minimum elevation in Goalpara is 40 to 60 masl (metres above sea-level) in Barpeta and Nalbari subdivisions; the heights varying between 50 and 200 masl and the elevated parts being in the South. In Gauhati sub-division, the lower elevations are 60 masl and the higher rise to several hundred metres, the maximum being 735 masl in the southeast. Elevations in Darrang vary between 60 and 200 masl, the higher elevations being in the South. In Nowgong the elevations range from 150 to 350 masl. Along the southern and eastern boundaries the elevations rise to 600 to 850 masl. In Lakhimpur the general elevation is 100 masl but in Margherita area it goes upto 240 masl. The elevations in Sibsagar are mostly less than a hundred masl. The whole district of North Cachar Hills has elevations ranging between 300 and 1700 masl. In Cachar, north of lat. 25°N, the area is hilly, elevations ranging from 1600 to 1700 masl. The rest of the district is plain with elevations of 60 to 200 masl.

### Population

3.4 Assam State has a total population of 14.6 million. The density is 186 per sq. km which is about the same as the all India average Rural population in Assam constitutes 91 per cent of the total. Population density in the plains is 221 persons per sq km and in the hill districts of Mikir and North Cachar 37 and 16 only respectively.

### Land Use

3.5 In the plains of Assam, forests occupy more than one-fourth of the total cropped area. Land not available for cultivation constitutes 23 per cent. Fallow lands constitute another 8 per cent of the cropped area. Net sown area is only one-third of the gross cropped area in the plains. In the hill districts, 75 per cent of the land is not available for cultivation and 22 per cent is under forests, leaving the net sown area at less than 5 per cent. In Cachar and Lakhimpur districts, 35 per cent of the total area is under forests. In other districts, area under forests vary between 18 and 29 per cent. Land not available for cultivation constitutes 35 per cent of the total area in Goalpara and from 14 to 27 per cent in the other districts. The area under fallow lands varies from 3 to 10 per cent. Net sown area is around 45 per cent in Kamrup and Nowgong followed by 30 to 36 per cent in Sibsagar, Darrang and Goalpara and 23 per cent and 29 per cent in Lakhimpur and Cachar respectively. Area sown more than once as percentage of net sown area is around 35 per cent in Goalpara and Kamrup, 24 per cent in Cachar and Nowgong and 15 per cent in Darrang and Lakhimpur. In Sibsagar, it is only eight per cent. Taking the State as a whole, forests occupy a quarter and land not available for cultivation a third of the total area. Fallow lands constitute only 6 per cent. The area under the remaining land use categories totals to 6 per cent. This leaves the net sown area at 28 per cent of geographical area. Area sown more than once is 23 per cent of the net sown area. Districtwise land use statistics are given in Table 4.

TABLE 4  
Districtwise Land Use Statistics (1968-69)

(Per cent of total reporting Area)

District	Forests	Land put to non-agricultural uses	Barren and unculturable land	Permanent pasture and other grazing land	Land under miscellaneous trees, crops, graves not included in net area sown	Fallow Lands			Net area sown	Area sown more than once as per cent of net area sown
						Culturable waste	Other fallow lands	Current fallows		
1	2	3	4	5	6	7	8	9	10	11
Cachar	35.1	8.6	11.4	1.0	4.6	1.5	4.6	4.0	28.5	24.3
Goalpara	24.1	11.4	24.0	3.2	1.1	1.6	1.2	0.4	32.3	35.8
Kamrup	28.9	6.5	7.8	3.6	2.8	1.8	2.6	2.1	43.9	34.7
Darrang	18.2	18.8	8.0	5.0	3.5	3.7	3.2	3.0	35.3	16.6
Nowgong	20.3	9.6	6.8	5.5	4.0	2.9	2.4	2.6	45.9	23.7
Sibsagar	26.4	11.8	4.7	3.6	5.8	4.5	4.1	2.1	35.8	8.1
Lakhimpur	35.7	15.8	9.1	4.0	4.0	4.0	1.9	1.3	22.7	12.9
Plains	27.6	12.1	10.6	3.7	3.6	2.9	2.7	2.1	33.9	23.8
United Mikir Hills & North Cachar Hills	22.1	—	74.2	—	—	—	—	—	4.5	13.4
State	26.5	9.8	23.0	3.0	2.9	2.3	2.2	1.7	28.2	23.4

‡As constituted prior to 1971.

NOTE : Due to rounding off of figures the percentages of areas under different land use categories may not add up to 100.0 in all cases.

### Soils

3.6 The extreme northern parts of Goalpara, Kamrup and Darrang have terai soils. But for this small area, the districts of Goalpara, Kamrup, Darrang, Sibsagar, Lakhimpur and Northern half of Nowgong have recent alluvial soils. Parts of Nowgong district are also covered by laterite soils. Cachar district has generally old alluvial soils. The southern portion of North Cachar Hills consists of laterite and the northern half and Mikir Hills of red loamy soils.

### Irrigation

3.7 The net irrigated area is 0.23 million ha in the plains and 11 thousand ha in the hills. The total net irrigated area was 0.24 million ha in 1968-69.

### Rainfall

3.8 The monthly and annual rainfall normals are given in Table 5 below. Rainfall during the month

of January-February is more than 10 cm pm to the east and north of Dibrugarh, 5 to 10 cm pm in Sibsagar and Lakhimpur and 2.5 to 5 cm pm in the rest of the districts. During March-May monthly rainfall exceeds 75 cm in Cachar and North Cachar Hills and North Goalpara, 30-50 cm on the leeward side of the Khasi Jaintia Hills and 50 to 75 cm in the other areas. The period June to September accounts for two-third of the annual rainfall, with monthly rainfall varying from less than 100 cm in southern parts of Nowgong to over 250 cm in northwestern parts of Goalpara and in extreme northeast. In the rain shadow area, rainfall is less than 100 cm per annum. October to December rainfall is 10-20 cm pm in general with 20 to 30 cm pm in Cachar and adjoining North Cachar Hills. The average annual rainfall varies from 125-130 cm in south east Nowgong to over 400 cm in parts of Cachar, North Cachar Hills, Goalpara & Dibrugarh.

TABLE 5  
Normals of Monthly and Annual Rainfall/Rainy Days

											Unit—Rf*=mm Rd†=No. of days			
		Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Annual
Assam (including Manipur, Tripura, etc.)	Rf	18.4	38.4	81.5	212.6	337.6	484.3	446.8	395.9	317.1	144.1	30.8	8.9	2516.4
	Rd	1.6	3.3	5.5	11.0	14.7	18.1	18.5	17.2	14.0	7.0	1.9	0.8	113.6
Mikir and North Cachar Hills														
Haflong	Rf	19.6	37.3	107.7	249.7	350.8	461.8	306.6	264.2	237.0	172.5	62.0	8.6	2277.8
	Rd	1.2	3.2	7.1	12.8	14.5	19.0	18.8	17.7	13.2	7.6	2.4	0.7	118.2
Jatinga Valley	Rf	25.9	55.1	209.8	474.5	490.3	891.3	805.2	778.3	591.6	280.9	56.4	8.1	4767.4
	Rd	1.7	3.7	8.4	15.9	17.6	23.3	24.1	23.9	18.0	9.0	2.3	0.6	148.5
Harangajao	Rf	20.1	44.7	175.8	451.4	587.0	856.0	543.3	467.4	357.9	216.4	56.4	10.2	3786.6
	Rd	1.4	3.1	7.1	14.2	16.8	22.3	23.4	21.3	15.1	7.9	1.9	0.5	135.0
Maibong	Rf	9.4	27.7	55.1	106.9	212.9	338.8	186.7	163.8	163.8	134.9	50.3	4.1	1454.4
	Rd	0.7	2.4	4.1	7.2	10.9	15.2	12.3	11.4	10.4	6.9	2.5	0.4	84.4

\*Rf=Rainfall

†Rd=Rainy days.

### Rainfall Variability

3.9 In January, CV (Coefficient of variation) is 60 to 80 per cent in Dibrugarh area and 80 to 100 per cent elsewhere. It is 50 per cent in Dibrugarh area in February and increases to 80 to 100 per cent in the Western districts. CV in the month of March is 60 to 80 per cent up to Darrang and 80 to 100 per cent in other parts. With heavier rainfall in April, CV is 50 to 60 per cent from Darrang to Dibrugarh and 60 to 80 per cent in other areas. May rainfall is substantial and consequently CV is also less being of the

order of 40 to 50 per cent only. June is the month of heaviest rainfall over large parts of the State. CV is less than 30 per cent in Lakhimpur and 30 to 40 per cent in the other districts. Rainfall pattern during July and August is nearly similar. CV in September is 40 to 50 per cent, in October 60 to 80 per cent, and in November and December 100 per cent. Assam is a State with low variability in rainfall, about the lowest in the whole country. If we consider the variability of the State as a whole, CV is less than 10 per cent. Table 6 gives the CV of monthly & annual rainfall in North & South Assam.

TABLE 6  
Co-efficient of Variation of Monthly and Annual Rainfall

Sub-division	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Annual
North Assam	75	56	59	34	30	17	18	21	22	41	90	110	8
South Assam	134	73	64	37	35	19	21	20	22	46	107	151	9

## Temperature

3.10 Normals of maximum, minimum and mean daily temperatures are given in Tables 7—9 at the end of this para. The monthly averages vary within one degree during June to September. Over most of the area, the hottest month is July or August, though in some of the southern areas April is nearly as hot. This is so in Dhubri. Normal maximum temperatures in Silchar from April to October vary from 31 to 32°C. December normal maximum temperature is the lowest at 23.7°C in Dhubri & Dibrugarh. January is the coldest month of the year with minimum temperatures ranging from 9 to 12°C. The State average is about 10°C. While minimum temperatures rise rapidly to an average of 20°C by April, there is near uniformity during June to September. The State averages are 24-25°C. The annual minimum temperature varies between 18 to 20°C. The annual maximum temperature averages vary from 28° to 30°C, with the State average at 30°C. Mean Normal temperature in

January ranges from 16 to 19°C rising by March to 21 to 24°C. June to September State average mean temperatures are uniform being 27.9 to 28.5°C. During these months, the normal mean temperatures in various districts vary in a very narrow range i.e. from 27.2° to 29°C.

## Potential Evapotranspiration (PE)

3.11 Potential evapotranspiration data is given in Table 10 below. PE is 4 to 6 cm per month during December and January and much higher than rainfall in these months. PE rises rapidly and there is near uniformity of distribution from April to September, ranging between 10 to 14 cm per month. Rainfall in all these months is much higher than PE specially during June to August when it is two to four times the PE. October PE is about 10 cm and rainfall 14 cm. The annual PE is 100 to 126 cm and rainfall about twice the PE. This State has a water surplus and the climate is humid.

TABLE 7  
Normals of Maximum Daily Temperature (°C)

Station	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Annual
Dhubri	22.9	25.3	30.1	31.6	29.9	29.8	29.6	30.7	38.7	29.1	26.3	23.7	28.3
Gauhati	23.4	26.7	38.0	31.9	31.1	31.2	31.7	32.1	31.7	30.1	27.5	24.8	29.4
Tejpur	23.7	25.4	29.0	38.3	30.3	31.6	32.1	32.2	31.7	30.2	27.6	24.7	29.1
Lumding	23.9	26.2	30.9	33.0	32.5	32.5	33.0	32.9	32.3	30.2	27.1	24.4	29.9
Sibsagar	22.7	23.9	27.3	28.7	29.7	31.5	32.4	32.1	31.5	29.7	26.8	23.8	28.3
Dibrugarh	22.5	23.7	26.5	28.5	28.6	30.9	31.1	31.3	31.1	28.8	26.8	23.7	27.8
Silchar	25.5	27.1	38.4	31.5	31.2	31.3	31.6	31.2	31.8	31.1	29.2	26.3	29.9
Average	23.5	25.5	29.2	30.8	30.5	31.3	31.7	31.8	31.5	29.9	27.3	24.5	29.9

TABLE 8  
Normals of Daily Minimum Temperature (°C)

Station	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Annual
Dhubri	11.8	14.2	18.1	21.5	23.0	24.6	25.8	26.0	24.7	23.0	17.8	14.3	20.4
Gauhati	9.8	11.6	16.0	20.1	22.8	24.9	25.7	25.8	24.7	22.1	17.3	11.9	19.4
Tejpur	11.4	13.7	17.1	20.2	22.5	24.7	25.3	25.4	24.7	21.8	16.5	12.4	19.6
Lumding	8.6	10.6	14.7	19.1	22.1	24.2	24.8	24.7	24.1	21.3	15.4	10.6	18.4
Sibsagar	9.9	12.8	16.1	19.3	22.4	24.8	25.4	25.4	24.7	21.8	16.0	11.4	19.2
Dibrugarh	9.1	12.3	15.5	19.0	21.5	24.0	24.3	24.7	23.8	20.7	14.3	9.7	18.2
Silchar	11.7	13.6	17.5	20.8	22.8	24.6	25.1	24.5	24.7	22.7	17.6	13.3	19.9
Average	10.3	12.7	16.4	20.0	22.4	24.5	25.2	25.2	25.3	21.9	16.4	11.9	19.3

TABLE 9  
Normals of Daily Mean Temperature (°C)

Station	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Annual
Dhubri	17.4	19.8	24.1	26.6	26.5	27.2	27.7	28.4	27.7	26.1	22.1	19.0	24.4
Gauhati	16.6	19.2	23.8	26.0	27.0	28.1	28.7	29.0	28.2	26.1	22.4	18.4	24.4
Tejpur	17.6	19.6	23.1	25.5	26.4	28.2	28.7	28.8	28.2	26.0	22.1	18.5	24.4
Lumding	16.3	18.4	22.9	26.1	27.3	28.4	28.9	28.8	28.2	25.3	21.3	17.5	24.2
Sibsagar	16.5	18.4	21.7	24.0	26.1	28.2	28.9	28.0	28.1	25.8	21.4	17.5	23.8
Dibrugarh	15.8	18.0	21.0	23.8	25.1	27.3	27.7	28.0	27.5	24.8	20.6	16.7	23.1
Silchar	18.6	28.4	24.0	26.2	27.0	28.0	28.5	27.9	28.3	26.9	23.4	19.9	24.9
Average	16.9	19.1	22.8	25.4	26.5	27.9	28.4	28.5	28.0	25.9	21.9	18.2	24.2

TABLE 10

Normal Monthly and Annual Potential Evapotranspiration (PE)

(mm.)

Station	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Annual
Dibrugarh	43.7	58.3	91.4	104.3	105.3	104.4	105.7	104.9	96.2	80.7	59.1	41.6	996.2
Sibsagar	44.1	70.6	108.2	129.5	135.3	139.6	144.3	137.8	121.4	99.7	72.3	53.4	1256.8
Tejpur	53.3	70.9	116.5	135.4	125.2	113.6	116.5	114.5	104.6	97.5	69.0	51.1	1166.6
Gauhati	47.0	66.2	101.5	124.7	120.7	102.2	101.4	102.2	93.6	88.2	66.3	46.4	1061.0
Dhubri	57.6	80.2	133.3	152.1	132.1	113.1	115.1	113.4	103.0	104.1	74.4	57.5	1236.5
Silchar	60.7	76.9	117.4	126.4	136.1	104.1	128.6	100.5	97.5	100.3	78.0	58.9	1185.9

#### 4 RAINFALL ZONES AND THEIR CROPPING PATTERNS

4.1 The State is divided into 18 rainfall zones. The number of police stations and the approximate

area of each zone is given below :

Rainfall Zone	Rainfall Pattern	Area (sq km)	Number of police stations
I	C <sub>1</sub> D <sub>1</sub> E <sub>2</sub> (A <sub>1</sub> B <sub>2</sub> C <sub>1</sub> ) C <sub>1</sub> E <sub>3</sub>	679	2
II	C <sub>1</sub> D <sub>1</sub> E <sub>2</sub> (A <sub>1</sub> C <sub>3</sub> ) C <sub>1</sub> E <sub>3</sub>	1133	1
III	C <sub>1</sub> D <sub>1</sub> E <sub>2</sub> (A <sub>2</sub> B <sub>2</sub> ) C <sub>1</sub> E <sub>3</sub>	471	2
IV	C <sub>1</sub> D <sub>2</sub> E <sub>1</sub> (B <sub>1</sub> C <sub>3</sub> ) C <sub>1</sub> E <sub>3</sub>	795	2
V	B <sub>1</sub> C <sub>1</sub> E <sub>2</sub> (A <sub>1</sub> B <sub>2</sub> C <sub>1</sub> ) D <sub>1</sub> E <sub>3</sub>	2973	6
VI	B <sub>1</sub> C <sub>1</sub> E <sub>2</sub> (A <sub>2</sub> B <sub>1</sub> C <sub>1</sub> ) D <sub>1</sub> E <sub>3</sub>	1909	4
VII	B <sub>1</sub> C <sub>1</sub> E <sub>2</sub> (A <sub>3</sub> B <sub>1</sub> ) C <sub>1</sub> E <sub>3</sub>	7706	13
VIII	B <sub>1</sub> C <sub>1</sub> E <sub>2</sub> (A <sub>4</sub> ) C <sub>1</sub> E <sub>3</sub>	4522	6
IX	B <sub>2</sub> E <sub>2</sub> (A <sub>3</sub> B <sub>1</sub> ) C <sub>1</sub> E <sub>3</sub>	1935	4
X	B <sub>2</sub> C <sub>1</sub> E <sub>1</sub> (A <sub>4</sub> ) C <sub>1</sub> E <sub>3</sub>	7415	13
XI	A <sub>1</sub> C <sub>1</sub> E <sub>1</sub> (A <sub>2</sub> B <sub>1</sub> C <sub>1</sub> ) D <sub>1</sub> E <sub>3</sub>	1191	2
XII	A <sub>1</sub> C <sub>1</sub> E <sub>2</sub> (A <sub>3</sub> B <sub>1</sub> ) C <sub>1</sub> E <sub>3</sub>	9813	14
XIII	A <sub>1</sub> C <sub>1</sub> E <sub>2</sub> (A <sub>4</sub> ) C <sub>1</sub> E <sub>3</sub>	3445	6
XIV	A <sub>1</sub> B <sub>1</sub> E <sub>2</sub> (A <sub>4</sub> ) C <sub>1</sub> E <sub>3</sub>	11,775	11
XV	A <sub>1</sub> B <sub>1</sub> C <sub>1</sub> E <sub>1</sub> (A <sub>1</sub> B <sub>3</sub> ) C <sub>1</sub> D <sub>1</sub> E <sub>2</sub>	1,879	½
XVI	A <sub>1</sub> B <sub>1</sub> C <sub>1</sub> E <sub>1</sub> (A <sub>4</sub> ) C <sub>1</sub> E <sub>3</sub>	1,725	2
XVII	A <sub>2</sub> C <sub>1</sub> E <sub>1</sub> (A <sub>4</sub> ) C <sub>1</sub> E <sub>3</sub>	5,556	9
XVIII	A <sub>2</sub> C <sub>1</sub> E <sub>1</sub> (A <sub>4</sub> ) B <sub>1</sub> E <sub>3</sub>	3,264	4½
		68,186	102



4.2 Zonewise land use patterns, area under different crops, relative yield index and livestock distribution have not been worked out for the State of Assam.

A summary of rainfall, cropping and livestock patterns, together with the police stations included in each zone are given below:

Zone	Rainfall pattern	Police station	District	Cropping pattern	Livestock pattern
I	C <sub>1</sub> D <sub>1</sub> E <sub>2</sub> (A <sub>1</sub> B <sub>2</sub> C <sub>1</sub> ) C <sub>1</sub> E <sub>3</sub>	Jamunamukh Kampur	Nowgong	Pd <sub>2</sub> Ju <sub>4</sub>	Cm <sub>3</sub> Cf <sub>4</sub> Cy <sub>4</sub> /G <sub>4</sub>
II	C <sub>1</sub> D <sub>1</sub> E <sub>2</sub> (A <sub>1</sub> C <sub>3</sub> ) C <sub>1</sub> E <sub>3</sub>	Maibong	N.C. Hills	Pd <sub>1</sub>	P <sub>4</sub> G <sub>4</sub> Cf <sub>4</sub> Cy <sub>4</sub> Bf <sub>4</sub> /By <sub>4</sub>
III	C <sub>1</sub> D <sub>1</sub> E <sub>2</sub> (A <sub>2</sub> B <sub>2</sub> ) C <sub>1</sub> E <sub>3</sub>	Murajhar Hojai	Nowgong	Pd <sub>2</sub> Ju <sub>4</sub>	Cm <sub>3</sub> Cf <sub>4</sub> Cy <sub>4</sub> /G <sub>4</sub>
IV	C <sub>1</sub> D <sub>2</sub> E <sub>1</sub> (B <sub>1</sub> C <sub>3</sub> ) C <sub>1</sub> E <sub>3</sub>	Lanka Lumding	Do.	Do.	Do.
V	B <sub>1</sub> C <sub>1</sub> E <sub>2</sub> (A <sub>1</sub> B <sub>2</sub> C <sub>1</sub> ) D <sub>1</sub> E <sub>3</sub>	Loharighat Dhing Rupalihat Kalaigaon Dalgaon Mangaldai	Do. Do. Do. Darrang Do. Do.	Do. Do. Do. Pd <sub>2</sub> L <sub>4</sub> Do. Do.	Do. Do. Do. Cm <sub>4</sub> Cf <sub>4</sub> Gy <sub>4</sub> Do. Do.
VI	B <sub>1</sub> C <sub>1</sub> E <sub>2</sub> (A <sub>2</sub> B <sub>1</sub> C <sub>1</sub> ) D <sub>1</sub> E <sub>3</sub>	Gauhati Jhalukhari Palasbari Kamalpur	Kamrup Do. Do. Do.	Pd <sub>1</sub> Do. Do. Do.	Do. Do. Do. Do.

NOTE : The rotations used for rainfall, cropping & livestock patterns are explained in Section 2.

Zone	Rainfall pattern	Police station	District	Cropping pattern	Livestock pattern
VII	B <sub>1</sub> C <sub>1</sub> E <sub>2</sub> (A <sub>3</sub> B <sub>1</sub> ) C <sub>1</sub> E <sub>3</sub>	Marigaon	Nowgong	Pd <sub>2</sub> Ju <sub>4</sub>	Cm <sub>3</sub> Cf <sub>4</sub> Cy <sub>4</sub> /G <sub>4</sub>
		Mikirbhata	Do.		
		Nowgong	Do.		
		Kaliabor	Do.		
		Samaguri	Do.		
		Raha	Do.		
		Deogaon	Sibsagar	Pd <sub>1</sub>	Cm <sub>4</sub> Cf <sub>4</sub> Cy <sub>4</sub> /G <sub>4</sub>
		Golaghat	Do.		
		Sarupathar	Do.		
		Dokakhat	Do.		
		Tejpur	Darrang	Pd <sub>2</sub> L <sub>4</sub>	Cm <sub>4</sub> Cf <sub>4</sub> Cy <sub>4</sub>
		Udalguri	Do.		
		Majbat	Do.		
VIII	B <sub>1</sub> C <sub>1</sub> E <sub>2</sub> (A <sub>4</sub> ) C <sub>1</sub> E <sub>3</sub>	Dhekiajuli	Darrang	Pd <sub>2</sub> L <sub>4</sub>	Cm <sub>4</sub> Cf <sub>4</sub> Cy <sub>4</sub>
		Rangapara	Do.		
		Chutia	Do.		
		Charali	Do.		
		Behali	Do.		
		Golipur	Do.		
IX	B <sub>2</sub> E <sub>2</sub> (A <sub>3</sub> B <sub>1</sub> ) C <sub>1</sub> E <sub>3</sub>	Jorhat	Sibsagar	Pd <sub>1</sub>	Cm <sub>3</sub> Cf <sub>4</sub> Cy <sub>4</sub>
		Teok	Do.		
		Titabar	Do.		
		Mariani	Do.		
X	B <sub>2</sub> C <sub>1</sub> E <sub>1</sub> (A <sub>4</sub> ) C <sub>1</sub> E <sub>3</sub>	Amguri	Sibsagar	Pd <sub>1</sub>	Cm <sub>4</sub> Cf <sub>4</sub> Cy <sub>4</sub> /G <sub>4</sub>
		Nazira	Do.		
		Moranhat	Do.		
		Sonari	Do.		
		Moran	Lakhimpur	Pd <sub>2</sub> L <sub>4</sub>	Cm <sub>4</sub> Cf <sub>4</sub> Cy <sub>4</sub> /G <sub>4</sub>
		Bardubi	Do.		
		Chabug	Do.		
		Thinsukia	Do.		
		Sadiya	Do.		
		Doomdooma	Do.		
		Digboi	Do.		
		Marghenita	Do.		
		Jaipur	Do.		
XI	A <sub>1</sub> C <sub>1</sub> E <sub>2</sub> (A <sub>2</sub> B <sub>1</sub> C <sub>1</sub> ) D <sub>1</sub> E <sub>3</sub>	Rangia	Kamrup	Pd <sub>1</sub>	Cm <sub>4</sub> Cf <sub>4</sub> Cy <sub>4</sub>
		Hajo	Do.		
XII	A <sub>1</sub> C <sub>1</sub> E <sub>2</sub> (A <sub>3</sub> B <sub>1</sub> ) C <sub>1</sub> E <sub>3</sub>	Paneri	Darrang	Pd <sub>2</sub> L <sub>4</sub>	Cm <sub>4</sub> Cf <sub>4</sub> Cy <sub>4</sub>
		Chhayagaon	Kamrup		
		Boko	Do.	Pd <sub>1</sub>	Do.
		Borama	Do.		
		Barpeta	Do.		
		Tamulpur	Do.		
		Nalbari	Do.		
		Talabari	Do.		
		Baghbor	Do.		
		Sarbhog	Do.		
		Patacharkuchi	Do.		
		Abhaypuri	Goalpara		
		Goalpara	Do.		
		Dudhnai	Do.		

Zone	Rainfall pattern	Police station	District	Cropping pattern	Livestock pattern
XIII	A <sub>1</sub> C <sub>1</sub> E <sub>2</sub> (A <sub>4</sub> ) C <sub>1</sub> E <sub>3</sub>	Lakhimpur	Goalpara		
		Dhubri	Do.		
		Golokganj	Do.		
		Bilasipara	Do.		
		South Salmara	Do.		
XIV	A <sub>1</sub> B <sub>1</sub> E <sub>2</sub> (A <sub>4</sub> ) C <sub>1</sub> E <sub>3</sub>	Mankachor	Do.		
		Bokakhat	Sibsagar	Pd <sub>1</sub>	Cm <sub>4</sub> Cf <sub>4</sub> Cy <sub>4</sub> /G <sub>4</sub>
		Dibrugarh	Lakhimpur	Pd <sub>2</sub> L <sub>4</sub>	
		Dhemaji	Do.		
		Jonai	Do.		
		Bhipuria-tinali	Lakhimpur		
		North Lakhimpur	Do.		
		Dhakuakhana	Do.		
		Kokrajhar	Goalpara	Pd <sub>1</sub>	Cm <sub>4</sub> Cf <sub>4</sub> Cy <sub>4</sub>
		Gossaingaon	Do.		
XV	A <sub>1</sub> B <sub>1</sub> C <sub>1</sub> E <sub>1</sub> (A <sub>1</sub> B <sub>3</sub> ) C <sub>1</sub> D <sub>1</sub> E <sub>2</sub>	Sidhli	Do.		
		Bijni	Do.		
XVI	A <sub>1</sub> B <sub>1</sub> C <sub>1</sub> E <sub>1</sub> (A <sub>4</sub> ) C <sub>1</sub> E <sub>3</sub>	Half long (½N)	N.C. Hills	Pd <sub>1</sub>	P <sub>4</sub> G <sub>4</sub> Cf <sub>4</sub> Cy <sub>4</sub> Bf <sub>4</sub> /By <sub>4</sub>
		Majuli	Sibsagar	Pd <sub>1</sub>	Cm <sub>3</sub> Cf <sub>4</sub> Cy <sub>4</sub>
XVII	A <sub>2</sub> C <sub>1</sub> E <sub>1</sub> (A <sub>4</sub> ) C <sub>1</sub> E <sub>3</sub>	Sibsagar	Sibsagar	Pd <sub>1</sub>	Cm <sub>4</sub> Cf <sub>4</sub> Cy <sub>4</sub> /G <sub>4</sub>
		Hailakandi	Cachar	Pd <sub>1</sub>	G <sub>4</sub> Cm <sub>3</sub> Cy <sub>4</sub>
		Katlichora	Do.		
		Patharkandi	Do.		Cm <sub>4</sub> Cf <sub>4</sub> Cy <sub>4</sub> /G <sub>4</sub>
		Badarpur	Do.		
		Ratabari	Do.		
		Silahar	Do.		G <sub>4</sub> Cm <sub>4</sub> Cf <sub>4</sub> Cy <sub>4</sub>
		Udaiband	Do.		
		Lakhimpur	Do.		
		Sonai	Do.		
XVIII	A <sub>2</sub> C <sub>1</sub> E <sub>1</sub> (A <sub>4</sub> ) B <sub>1</sub> E <sub>3</sub>	Haflong	N.C. Hills	Pd <sub>1</sub>	P <sub>4</sub> G <sub>4</sub> Cf <sub>4</sub> Cy <sub>4</sub> Bf <sub>4</sub> /By <sub>4</sub>
		(1/2 S)			
		Karimganj	Cachar	Pd <sub>1</sub>	Cm <sub>4</sub> Cf <sub>4</sub> Cy <sub>4</sub> /G <sub>4</sub>
		Katigora	Do.		G <sub>4</sub> Cm <sub>4</sub> Cf <sub>4</sub> Cy <sub>4</sub>
		Borkhola	Do.		
		Mikir Hills	N.C. Hills	Pd <sub>1</sub>	P <sub>4</sub> G <sub>4</sub> Cf <sub>4</sub> Bf <sub>4</sub> /By <sub>4</sub>

4.3 Area under different crops in the districts and relative yield Index are discussed with district as the unit since zonewise averages have not been calculated. The gross or total cropped area of the State was 2.77 million ha in 1969-70. Of this total, 2.69 Mha represents the contribution from the plains districts and only 86 thousand ha from the two hill districts. The percentage area under each crop in the plains and hill districts is given in Table 11. The major feature of crop distribution in the State is that rice occupies 71 per cent of the total cropped area. The other crops grown in the State have only small areas, and none of them exceed 10 per cent of cropped area. Plantations including tea occupy an area of 7.4 per cent; tea being the major plantation crop occupying an area of 6.5 per cent. The cropping pattern at the State level is Pd<sub>1</sub>.

TABLE 11  
Crop Distribution  
(Per cent of gross cropped area)

Crop	State	Plains districts	Hill districts
rice	71.0	71.0	69.0
maize	0.1	0.3	4.0
wheat	0.3	0.3	—
gram	0.1	0.1	—
tur	0.1	0.1	0.5
other pulses	0.3	3.2	1.4
sugarcane	0.1	0.1	1.0
fruits	1.3	1.2	4.6
potato	0.9	1.0	0.6
vegetables (including potato)	3.1	3.2	3.2
other oilseeds	5.2	5.2	5.0
tea	6.5	6.7	—
plantations (including tea)	7.4	7.7	0.4
jute	4.6	4.4	1.4
cotton	0.2	—	5.7

4.4 Crop data are available for the districts only and the cropping patterns at that level are as follows :

<i>District</i>	<i>Cropping pattern</i>
Goalpara	Pd <sub>1</sub>
Kamrup	Pd <sub>1</sub>
Darrang	Pd <sub>2</sub> L <sub>4</sub>
Nowgong	Pd <sub>2</sub> Ju <sub>4</sub>
Sibsagar	Pd <sub>1</sub>
Lakhimpur	Pd <sub>2</sub> L <sub>4</sub>
Cachar	Pd <sub>1</sub>
Mikir Hills	Pd <sub>1</sub>
North Cachar Hills	

4.5 Paddy is the major crop in all the districts with areas ranging between 66 and 79 per cent of their respective total cropped areas. Pulses in Kamrup and Nowgong occupy 5 per cent in area and elsewhere 1 to 3 per cent. Oil seeds other than groundnut cover 6 to 7 per cent in Goalpara, Darrang and Nowgong. Plantations account for 12 to 18 per cent of cropped area in Lakhimpur, Sibsaagar and Cachar and 10 per cent in Darrang. Area under tea in Lakhimpur and Sibsaagar is 15-17 per cent and 12 per cent in Cachar. Jute is significant only in Nowgong (11 per cent). Vegetables account for between 2 to 4 per cent of cropped area in all the districts and fruits from 1 to 2 per cent.

4.6 The yields of rice and a few other crops have been analysed, though most of them cover only small areas. As stated earlier, yield data are available for district units only. The State and all-India yields of the crops are given in Table 12.

4.7 Area and yield of rice are given in Table 13. The State average yield of rice is about 92 per cent of the All-India yield and has been affected by the low yields in Nowgong, Kamrup and Goalpara.

4.8 Area and yield of pulses are given in Table 14. The State yield is only about three quarters of the all-India level. Yields in certain districts are particularly low being of the order of 60 per cent of the all India level in Kamrup which has the largest area under pulses.

4.9 Area under and yield of jute are given in Table 15. The area under jute is small, only 1.2 lakh hectares which corresponds to 4 per cent of the total cropped area of the State. Yields in all the districts are above the all-India level and the State yield is of the order of 115 to 120 per cent of the all-India level.

4.10 Area under and yield of sugarcane are given in Table 16. The area under sugarcane is hardly 1 per cent of the cropped area. The yields are less than the all-India level but equal to those in some of the north Indian States.

4.11 Area under and yield of potato are given in Table 17. Potato yields are low being half of the all-India yield. Area and relative yield Index of rape

and mustard are given in Table 18. None of the districts with 10 thousand ha or more has yield exceeding even 90 per cent of the all-India yield. Kamrup with the largest area has a relative yield Index of 50 and the State average is about 70.

4.12 The total livestock population of the State of Assam according to 1966 census was 9.3 millions. The major feature is the dominance of cattle which form nearly 71 per cent of the total. Male cattle are the largest in number contributing 27 per cent to the total. Female and young-stock of cattle each account for 22 per cent. Goats are next in importance being 17 per cent. The number of sheep is negligible being less than 1 per cent. Buffaloes total to about 6 per cent of the livestock population. A significant point is that pigs account for nearly 5 per cent of the total. The livestock pattern at the State level is Cm<sub>4</sub> Cf<sub>4</sub> Cy<sub>4</sub>.

The district distributions are summarised below :

<i>District</i>	<i>Pattern</i>
Goalpara } Kamrup } Sibsagar }	Cm <sub>4</sub> Cf <sub>4</sub> Cy <sub>4</sub> /G <sub>4</sub>
Nowgong	Cm <sub>3</sub> Cf <sub>4</sub> Cy <sub>4</sub> /G <sub>4</sub>
Darrang } Lakhimpur }	Cm <sub>4</sub> Cf <sub>4</sub> Cy <sub>4</sub>
Cachar	Cm <sub>4</sub> Cf <sub>4</sub> G <sub>4</sub>
North Cachar Hills	P <sub>4</sub> G <sub>4</sub> Cf <sub>4</sub> Cy <sub>4</sub> /Bf <sub>4</sub>
Mikir Hills	Cm <sub>4</sub> P <sub>4</sub> G <sub>4</sub> Cf <sub>4</sub> /Cy <sub>4</sub>

TABLE 12

## All-India and State Yield of Principal Crops in Assam\*

<i>Crop</i>	<i>All-India yield kg/ha</i>	<i>State yield kg/ha</i>	<i>RYI@</i>
rice	1070	982	92
maize	1079	539	50
pulses (all combined)	513	376	73
rapeseed and mustard	520	381	73
jute	1187	1399	118
sugarcane	5014	4113	82
potato	8661	4789	55
coconut	5700	3059	54
banana	14120	13555	96
tobacco	795	746	94
arecanut	864	985	114

\*The yields are averages of 1968-69, 1969-70 and 1970-71.

@RYI or Relative Yield Index represents State Yield expressed as percentage of the corresponding all-India average.

TABLE 13

## Area and Yield of Rice in Assam\*

District	Area '000 ha	Per cent cropped area	RYI
Kamrup	430	74	72
Goalpara	326	72	77
Sibsagar	247	71	109
Darrang	242	67	96
Lakhimpur	223	68	109
Nowgong	210	66	86
Cachar	192	74	100
Mikir & North Cachar Hills	56	71	130

TABLE 14

## Area under and Yield of Pulses\*

District	Area '000 ha	RYI
Kamrup	30	63
Goalpara	17	73
Nowgong	15	87
Darrang	12	88
Sibsagar	6	69
Lakhimpur	5	76

\*Average during 1968-69 to 1970-71

TABLE 15

## Area under and Yield of Jute in Assam\*

District	Area '000 ha	RYI
Nowgong	35	105
Goalpara	30	141
Kamrup	28	112
Darrang	17	117
Lakhimpur	4	118
Sibsagar	2	119
United Mikir and N.C. Hills	1	118
Cachar	1	

TABLE 16

## Area and Yield of Sugarcane\*

District	Area '000 ha	RYI
Sibsagar	9	87
Kamrup	5	75
Cachar	4	58
Nowgong	3	86
Lakhimpur	3	99
Darrang	3	97
Goalpara	3	98
United Mikir & N.C. Hills	2	89

TABLE 17

## Area under and Yield of Potato\*

District	Area '000 ha	RYI
Goalpara	7	60
Kamrup	5	56
Darrang	4	41
Lakhimpur	3	57
Cachar	2	34
Nowgong	2	29
Sibsagar	1	52
United Mikir & N.C. Hills	0.4	

TABLE 18

## Area under and Yield of Rape and Mustard\*

District	Area '000 ha	Per cent cropped area	RYI
Kamrup	31	5	50
Goalpara	27	6	76
Nowgong	24	8	72
Darrang	22	6	83
Sibsagar	14	4	83
Lakhimpur	11	4	89
United Mikir & N.C. Hills	3	4	143
Cachar	2	1	—

\*Average during 1968-69 to 1970-71.

## 5 FUTURE CROPPING PATTERNS—SOME OBSERVATIONS

## General

5.1 In the foregoing sections we have dealt with the rainfall, cropping and livestock patterns which emerge from the existing information. We have also grouped the rainfall patterns into zones and indicated how the other patterns viz crops and livestock feature in those zones. Among other information that on soils, which ought to play an important role in determining cropping patterns, is lacking in such details as is required for this analysis. Data on orography and population density have featured in this analysis but their exact role on cropping and livestock patterns could not be brought out owing to lack of detailed information. We are, however, convinced that studies and analysis indicated in the preceding sections are important for guidance in decision making on cropping and livestock patterns vis a vis rainfall patterns. The greater the accuracy of the primary information, and the more detailed

such information is, the more useful the data would be in indicating the most efficient cropping and livestock patterns in an area or a zone. With this purpose in view the following procedure is suggested :

- (i) Delineation of rainfall zones;
- (ii) Identification of the existing cropping patterns;
- (iii) Assessment of area needed for each crop and its ideal distribution;
- (iv) Comparison of (iii) with (ii) in order to determine possible changes; and
- (v) Consideration of other related factors like soil, irrigation facilities, density of population, livestock patterns and then arriving at the future cropping patterns.



5.2 The methods of delineating rainfall patterns or zones and cropping patterns have been fully discussed in Section 2. For the purpose of locating suitable areas for a crop, soil and topography of the land are important factors. The approximate area to be put under each crop will be decided by the demand for it not only at the state level but also at the national level, both for internal consumption and for the purpose of export. The departments responsible for crop planning of a State should, therefore, be cognisant of the demand for a crop, so that production efforts are not rendered futile because of lack of demand and marketing avenues. The part each of the factors mentioned in item (v) of para 5.1 is likely to play in deciding cropping patterns has already been discussed. For this purpose not only detailed data but also knowledge about the correlation between these factors and crop performance would be necessary. Knowledge gained, through long experience, by farmers would also be most helpful.

5.3 It may be mentioned that the rainfall intervals which form the basis of identifying rainfall patterns are subject to minor modifications. Thus, the condition that not less than 30 cm of rainfall for three consecutive months is good for paddy may not be rigorously adhered to. If the soil is favourable with a high water retention capacity or, what is more important, water management is efficient with an eye to economise water use, rainfall lower than 30 cm for three months may sustain a good crop of paddy.

5.4 The choice of a cropping pattern is not decided by the farmer only on technical grounds. He is also guided by the profitability of the crops or requirements for his household consumption. Farmers may not be inclined to accept a crop unless the necessary inputs and infrastructure are assured. Of all the inputs water is the most important as is made evident by the spread of groundnut in the country, sugarcane in Gujarat, maize and cotton in Karnataka and recently of wheat in West Bengal. These are excellent instances of the manner of introduction of new crops in the cropping patterns of a State or a region.

#### **Some Observations pertaining to Assam & North Eastern Region**

5.5 The Brahmaputra valley experiences serious floods during the kharif season. There is always some damage to paddy and jute crops. Agricultural scientists in the Assam Agricultural University are

conducting experiments with a view to developing cropping plans that fit into flood free seasons. Such restructuring of cropping programmes will enable growing of many crops other than rice.

5.6 In the Assam valley, tea is an important crop. There are thousands of hectares of surplus land in the tea gardens available in this State which could easily be utilized for expanding tea cultivation. Some areas in Manipur and Tripura are also suitable for tea cultivation. Assam and Tripura have also been found to be suitable for plantation crops like coffee, rubber, cashew and black pepper.

5.7 The hills in Assam, Meghalaya, Nagaland, Manipur, Tripura and Mizoram are all suitable for forests, plantation and fruit crops and grasses. Among the fruit crops, oranges and pineapple are well-known. There is great scope for increasing area under pineapple in Meghalaya and Tripura provided processing, transport and marketing facilities are developed. Industries based on forest products could also be developed with advantage provided the required infrastructure for marketing is built up.

5.8 Natural flora could also be easily developed in the hills for export. Many kinds of wild bulbous ornamental plants could be utilized for developing the flower industry. So is the case particularly with the orchids. Various kinds of aromatic and medicinal plants could also profitably be included in the cropping patterns of these States in the hilly regions.

5.9 The hills of the north eastern region, as a whole, have been denuded in the process of shifting cultivation. However, there is awareness now that this practice has to be arrested and the area so freed should be restored to natural vegetation or fruit or plantation crops in the higher reaches and in the lower slopes some crops like maize, potato, pineapple and ginger could be cultivated in a methodical manner. In the revised scheme of cropping patterns, it is desirable that paddy cultivation is confined to valleys only.

5.10 The population in the north eastern region, particularly in and around hills, consists of meat eaters. Piggery and poultry are the specialities of the region. It is desirable to grow fodder and feeds for the livestock locally. Some tropical legumes or other suitable crops can always be taken in various kinds of plantations for providing fodder and feeds in addition to encouraging cultivation of local grasses in a systematic manner.

## APPENDIX 1

## Districtwise Land Use (1968-69) and Population Statistics

## ASSAM

(Thousand hectares)

District/taluk	Population 1971		forests	nac	cw	pp & gl	mtc&g	fallow lands	net area sown
	total	per sq km							
Cachar	1713318	246	244 (35)	140 (20)	11 (2)	7 (1)	32 (5)	62 (9)	196 (28)
Goalpara	2225103	215	250 (24)	368 (36)	16 (1)	34 (3)	12 (1)	17 (2)	335 (33)
Kamrup	2854183	289	285 (29)	141 (14)	17 (2)	35 (4)	29 (3)	48 (5)	430 (43)
Darrang	1736188	198	159 (18)	233 (27)	32 (4)	44 (5)	31 (4)	56 (6)	307 (36)
Nowgong	1680895	302	114 (20)	92 (16)	16 (3)	31 (6)	22 (4)	28 (5)	257 (46)
Sibsagar	1837389	204	236 (27)	148 (17)	41 (5)	32 (3)	52 (6)	57 (6)	318 (36)
Lakhimpur	2122719	166	456 (36)	319 (25)	50 (4)	51 (4)	51 (4)	49 (4)	282 (23)
United Mikir & NC Hills	455357	30	336	1131*					67
Garro Hills	—	—	79	660*					78
U. K. and J. Hills	—	—	108	1250*					80
Mizo Hills	332390	16	1298	752*					42

— = nil or negligible

nac = not available for cultivation

cw = cultivable waste

pp&amp;gl = permanent pastures and other grazing lands

mtc&amp;g = miscellaneous tree crops and groves not included in net area sown.

NOTE : Figures in brackets represent percentages to total reporting area.

\*Includes the area under col. cw, pp&amp;gl, mtc&amp;g and fallow lands in respect of which the areas have not been recorded separately.

NOTE : Data on geographical area of hill districts not available; hence percentages have not been calculated.

**APPENDIX 2**  
**Districtwise Livestock Population (1966)**

**ASSAM**

district	cattle				buffaloes			sheep	goats	horses & ponies	mules	donkeys	camels	pigs	total live- stock
	m		f		m	f	ys								
	m	f	m	f											
Lakhimpur	291 (29)	227 (22)	228 (22)	24 (2)	28 (3)	24 (2)	20 (2)	2 (Neg)	147 (15)	6 (1)	Neg (Neg)	Neg (Neg)	— (—)	45 (4)	1018
Sibsagar	318 (29)	226 (20)	260 (23)	18 (2)	25 (3)	18 (2)	22 (2)	1 (Neg)	202 (18)	7 (1)	Neg (Neg)	Neg (Neg)	— (—)	28 (3)	1107
Nowgong	320 (34)	215 (22)	223 (23)	11 (1)	15 (2)	11 (1)	8 (1)	3 (Neg)	141 (15)	3 (—)	Neg (Neg)	Neg (Neg)	— (—)	17 (2)	956
Cachar	181 (23)	182 (23)	168 (21)	35 (4)	35 (4)	35 (4)	19 (3)	2 (—)	170 (21)	1 (—)	Neg (Neg)	Neg (Neg)	— (—)	4 (1)	797
Kamrup	483 (29)	404 (24)	409 (24)	14 (1)	25 (1)	14 (1)	8 (—)	19 (1)	300 (18)	7 (—)	Neg (Neg)	Neg (Neg)	— (—)	31 (2)	1700
Darrang	306 (26)	237 (21)	260 (22)	30 (3)	42 (4)	30 (3)	24 (3)	5 (—)	224 (19)	5 (—)	Neg (Neg)	Neg (Neg)	— (—)	37 (3)	1170
Goalpara	416 (30)	325 (23)	297 (21)	29 (2)	40 (3)	29 (2)	16 (1)	15 (1)	225 (16)	5 (—)	Neg (Neg)	1 (Neg)	— (—)	46 (3)	1415
Garohills	68 (25)	52 (19)	49 (18)	7 (3)	11 (4)	7 (3)	7 (3)	Neg. (Neg)	36 (13)	1 (Neg)	Neg (Neg)	Neg (Neg)	— (—)	40 (15)	271
Khasi & Jaintia Hills	68 (16)	104 (25)	74 (18)	5 (1)	4 (1)	5 (1)	4 (1)	20 (5)	63 (15)	9 (2)	Neg (Neg)	Neg (Neg)	— (—)	69 (16)	420
United North Cachar & Mikir Hills	52 (18)	38 (13)	41 (14)	20 (7)	15 (5)	20 (7)	18 (6)	0.4 (Neg)	53 (18)	Neg (Neg)	Neg (Neg)	0.4 (Neg)	— (—)	56 (19)	294
Mizo Hills	7 (5)	18 (14)	19 (15)	0.3 (Neg)	0.2 (Neg)	0.3 (Neg)	0.2 (Neg)	3 (2)	34 (26)	0.4 (Neg)	Neg (Neg)	Neg (Neg)	— (—)	50 (38)	131

m = male

f = female

ys = youngstock

— = nil or negligible

NOTE : Figures in brackets represent percentages to total livestock population.

**APPENDIX 3**  
**Rainfall and Cropping Patterns**  
**ASSAM**

Cropping patterns	District	Area (sq km)	Elevation		Annual Rainfall		mmr	nr	md	*Consecutive Months			
	Police Station		(masl)		total (cm)	rd				a	b	c	
			max	min									
1	2	3	4	5	6	7	8	9	10	11	12	13	
Pd <sub>2</sub> Ju <sub>4</sub>	Rainfall Zone—I	..	..	..	..	..	..	..	Rainfall Pattern—C <sub>1</sub> D <sub>1</sub> E <sub>2</sub> (A <sub>1</sub> B <sub>2</sub> C <sub>2</sub> )C <sub>1</sub> E <sub>3</sub>				
	Nowgong								n. a.				
	Jamunamukh	280											
	Kamrup	399			154	95	7'		60	32	4-7	144	86
Pd <sub>1</sub>	Rainfall Zone—II	..	..	..	..	..	..	..	Rainfall Pattern—C <sub>1</sub> D <sub>1</sub> E <sub>2</sub> (A <sub>1</sub> C <sub>3</sub> ) C <sub>1</sub> E <sub>3</sub>				
	N. C. Hills												
	Maibong	1133			145	84	6'		55	26	4-7	131	74
Pd <sub>2</sub> Ju <sub>4</sub>	Rainfall Zone—III	..	..	..	..	..	..	..	Rainfall Pattern—C <sub>1</sub> D <sub>1</sub> E <sub>2</sub> (A <sub>2</sub> B <sub>2</sub> ) C <sub>1</sub> E <sub>3</sub>				
	Nowgong								n.a.				
	Murajhar	207											
	Hojai	264											
Pd <sub>2</sub> Ju <sub>4</sub>	Rainfall Zone—IV	..	..	..	..	..	..	..	Rainfall Pattern C <sub>1</sub> D <sub>2</sub> E <sub>1</sub> (B <sub>1</sub> C <sub>3</sub> ) C <sub>1</sub> E <sub>3</sub>				
	Nowgong												
	Lanka	383			124	67	6		40	21	4-7	113	58
	Lumding	412			132	83	6		44	25	5-6	109	63
Pd <sub>2</sub> L <sub>4</sub>	Rainfall Zone—V	..	..	..	..	..	..	..	Rainfall Pattern—B <sub>1</sub> C <sub>1</sub> E <sub>2</sub> (A <sub>1</sub> B <sub>2</sub> C <sub>1</sub> ) D <sub>1</sub> E <sub>3</sub>				
	Darrang												
	Kalaigaon	422							n.a.				
	Dalgaon	526							n.a.				
	Mangaldai	932							n.a.				
Pd <sub>2</sub> Ju <sub>4</sub>	Nowgong												
	Laharighat	453							n.a.				
	Dhing	205			160	89	7'		58	29	4-6	141	75
	Rupalihat	435							n.a.				
Pd <sub>1</sub>	Rainfall Zone—VI	..	..	..	..	..	..	..	Rainfall Pattern—B <sub>1</sub> C <sub>1</sub> E <sub>2</sub> (A <sub>2</sub> B <sub>1</sub> C <sub>1</sub> ) D <sub>1</sub> E <sub>3</sub>				
	Kamrup												
	Kamalpur	422			175	84	6*		64	27	4-6	155	71
	Gauhati	769							n.a.				
	Jhalukbari	39							n.a.				
	Palasbari	679			174	91	6'-7'		67	31	4-6	156	78

masl = metres above sea level

rd = rainy days

mmr = month of maximum rainfall

nr = total rainfall of mmr plus that of preceding or following month, whichever is higher, in cm.

md = number of rainy days of mmr plus that of preceding or following month, whichever has higher rainfall.

\* Consecutive months with rainfall of more than 10 cm per month.

a = Initial month with more than 10 cm of rainfall and number of consecutive months with more than 10 cm/month, separated by hyphen.

b = Total rainfall of consecutive months in 'a' in cm.

c = Total number of rainy days of consecutive months in 'a'.

na = not available.

NOTE : Information on rainfall and rainy days are based on the Memoirs of India Meteorological Department, Vol. XXXI, Part III as on 12th May, 1961.

## APPENDIX 3 (Contd.)

1	2	3	4	5	6	7	8	9	10	11	12	13
	<i>Rainfall Zone—VII</i>		..	..	..	..	..		<i>Rainfall Pattern—<math>B_1 C_1 E_2 (A_3 B_1) C_1 E_3</math></i>			
Pd <sub>2</sub> L <sub>4</sub>	Darrang							n.a.				
	Udalguri	391										
	Majbat	381			199	102	6'	77	32	4-6	178	84
	Tezpur	733			185	106	7'	67	32	4-7	173	94
Pd <sub>1</sub>	Sibsagar											
	Deogaon	736						n.a.				
	Golaghat	1256			189	115	7-8'	67	35	4-7	172	99
	Sarupathar	888						n.a.				
	Bokakhat	661						n.a.				
	<i>Rainfall Zone—VII</i>	..	..	..	..	..	..		<i>Rainfall Pattern—<math>B_1 C_1 E_2 (A_3 B_1) C_1 E_3</math></i>			
Pd <sub>2</sub> Ju <sub>4</sub>	Nowgong											
	Marigaon	943						n.a.				
	Mikirbheta	192						n.a.				
	Nowgong	383			202	104	7'	86	35	4-7	190	93
	Kaliabor	474						n.a.				
	Samaguri	414						n.a.				
	Raha	254						n.a.				
	<i>Rainfall Zone—VIII</i>	..	..	..	..	..	..		<i>Rainfall Pattern—<math>B_1 C_1 E_2 (A_4) C_1 E_3</math></i>			
Pd <sub>2</sub> L <sub>4</sub>	Darrang											
	Dhekiajuli	1267						n.a.				
	Rangapara	852						n.a.				
	Chutia	945						n.a.				
	Charali							n.a.				
	Behali	865			246	122	7'	91	38	4-7	230	107
	Golipur	593			234	116	7'	83	36	4-7	217	101
	<i>Rainfall Zone—IX</i>	..	..	..	..	..	..		<i>Rainfall Pattern <math>B_2 E_2 (A_3 B_1) C_1 E_3</math></i>			
Pd <sub>1</sub>	Sibsagar											
	Jorhat	593			221	121	7'	78	37	4-7	202	104
	Teok	458						n.a.				
	Titabar	404						n.a.				
	Mariani	479						n.a.				
	<i>Rainfall Zone—X</i>	..	..	..	..	..	..		<i>Rainfall Pattern—<math>B_2 C_1 E_1 (A_4) C_1 E_3</math></i>			
Pd <sub>1</sub>	Sibsagar											
	Amguri	355			227	123	7'	76	36	4-7	206	104
	Nazira	534			237	124	7'	81	37	4-7	216	105
	Moranhat	298						n.a.				
	Sonari	616			246	126	7'	84	37	3-8	233	114
Pd <sub>2</sub> L <sub>4</sub>	Lakhimpur											
	Moran	404			247	126	7'	88	38	3-8	235	114
	Bardubi	697						n.a.				
	Chabug	324						n.a.				
	Tinsukia	433						n.a.				
	Sadiya	914			269	127	7'	100	36	3-8	252	112
	Doom-Dooma	813			254	133	7'	93	39	3-8	240	118
	Digboi	663			256	139	7'	96	40	3-8	241	124
	Margherita	528						n.a.				
	Jaipur	837			257	141	7'	90	41	3-8	242	126
	<i>Rainfall Zone—XI</i>	..	..	..	..	..	..		<i>Rainfall Pattern—<math>A_1 C_1 E_2 (A_2 B_1 C_1) D_1 E_3</math></i>			
Pd <sub>1</sub>	Kamrup											
	Rangia	510			195	95	6'	73	30	4-6	174	81
	Hajo	681			190	87	6'	72	28	4-6	171	74

## APPENDIX 3 (Contd.)

1	2	3	4	5	6	7	8	9	10	11	12	13
	<i>Rainfall Zone—XII</i>	..	..	..	..	..	..	<i>Rainfall Pattern—A<sub>1</sub> C<sub>1</sub> E<sub>2</sub> (A<sub>3</sub> B<sub>1</sub>) C<sub>1</sub> E<sub>3</sub></i>				
Pd <sub>1</sub>	<b>Goalpara</b>											
	Abhayapuri	886					n.a.					
	Goalpara	611			244	95	6	99	33	4-7	235	89
	Dudhnai	648					n.a.					
Pd <sub>1</sub>	<b>Kamrup</b>											
	Sarbhog	969					n.a.					
	Patacharkuchi	619			237	89	6	94	30	4-7	225	82
	Baghbor	650					n.a.					
	Tarabari	300					n.a.					
	Borama	738					n.a.					
	Tamulpur	769					n.a.					
	Nalbari	515			235	98	6'	93	33	4-7	222	89
	Chhayagaon	451			202	96	6	78	34	4-7	190	88
	Boko	1075			214	96	6	86	34	4-7	201	89
	Barpeta	769			229	95	6	91	31	4-7	217	86
Pd <sub>2</sub> L <sub>4</sub>	<b>Darrang</b>											
	Paneri	813					n.a.					
	<i>Rainfall Zone—XIII</i>	..	..	..	..	..	..	<i>Rainfall Pattern—A<sub>1</sub> C<sub>1</sub> E<sub>2</sub> (A<sub>4</sub>) C<sub>1</sub> E<sub>3</sub></i>				
Pd <sub>1</sub>	<b>Goalpara</b>											
	Golokganj	471					n.a.					
	Dhubri	430			259	98	6	107	34	4-7	251	92
	Bilasipara	953			262	96	6	108	34	4-7	252	90
	South Salmara	728					n.a.					
	Mankachar	163			206	82	6	86	30	4-7	199	79
	Lakhimpur	699			244	104	6	100	37	4-7	236	97
	<i>Rainfall Zone—XIV</i>	..	..	..	..	..	..	<i>Rainfall Pattern—A<sub>1</sub> B<sub>1</sub> E<sub>2</sub> (A<sub>4</sub>) C<sub>1</sub> E<sub>3</sub></i>				
Pd <sub>1</sub>	<b>Goalpara</b>											
	Gossaingaon	1287					n.a.					
	Sidli	1080					n.a.					
	Bijni	1039			318	109	6	130	36	4-7	305	101
	Kokrajhar	1311					n.a.					
	<b>Sibsagar</b>											
	Bokakhat											
Pd <sub>2</sub> L <sub>4</sub>	<b>Lakhimpur</b>											
	Bhipuriatinali	798					n.a.					
	North	1526			349	133	6	131	40	4-7	324	113
	Lakhimpur											
	Dhakua-Khana	1202			260	126	7 <sup>1</sup>	89	37	4-7	237	106
	Dhemji	1122					n.a.					
	Dibrugarh	1412			280	135	7'	103	41	3-8	265	121
	Jonai	1000					n.a.					
	<i>Rainfall Zone—XV</i>	..	..	..	..	..	..	<i>Rainfall Pattern—A<sub>1</sub> B<sub>1</sub> C<sub>1</sub> E<sub>1</sub> (A<sub>1</sub> B<sub>3</sub>) C<sub>1</sub> D<sub>1</sub> E<sub>2</sub></i>				
Pd <sub>1</sub>	<b>N. C. Hills</b>											
	Hailong (1/2 N)	1879			228	118	6'	81	34	3-8	215	111
	<i>Rainfall Zone—XVI</i>	..	..	..	..	..	..	<i>Rainfall Pattern—A<sub>1</sub> B<sub>1</sub> C<sub>1</sub> E<sub>1</sub> (A<sub>4</sub>) C<sub>1</sub> E<sub>3</sub></i>				
Pd <sub>1</sub>	<b>Sibsagar</b>											
	Majuli	925					n.a.					
	Sibsagar	800			254	128	7	89	38	3-8	241	116

## APPENDIX 3 (Concl'd.)

1	2	3	4	5	6	7	8	9	10	11	12	13
	<i>Rainfall Zone—XVII</i>	..	..	..	..	..	..	..	<i>Rainfall Pattern—<math>A_2C_1E_1(A_4)C_1E_3</math></i>			
Pd <sub>1</sub>	<b>Cachar</b>											
	Hailakandi	474			299	135	6	105	44	3-8	288	128
	Katlichara	852						n.a.				
	Patharkandi	679			307	123	6'	110	36	3-8	295	117
	Badarpur	143			335	137	6	116	44	3-8	323	130
	Ratabari	642						n.a.				
	Silahar	679			335	138	6	116	45	3-8	323	130
	Uderband	433						n.a.				
	Lakhipur	712						n.a.				
	Sanai	943						n.a.				
	<i>Rainfall Zone—XVIII</i>	..	..	..	..	..	..	..	<i>Rainfall Pattern—<math>A_2C_1E_1(A_4)B_1E_3</math></i>			
Pd <sub>1</sub>	<b>Cachar</b>											
	Karimganj	376			387	141	6	137	46	3-8	375	134
	Katigera	648						n.a.				
	Borkhola	363			368	134	6	125	43	3-8	356	127
Pd <sub>1</sub>	<b>N. C. Hills</b>											
	Haflong	1878			228	118	6'	81	34	3-8	215	111
	(1/2 s)							n.a.				
	Mikir Hills											



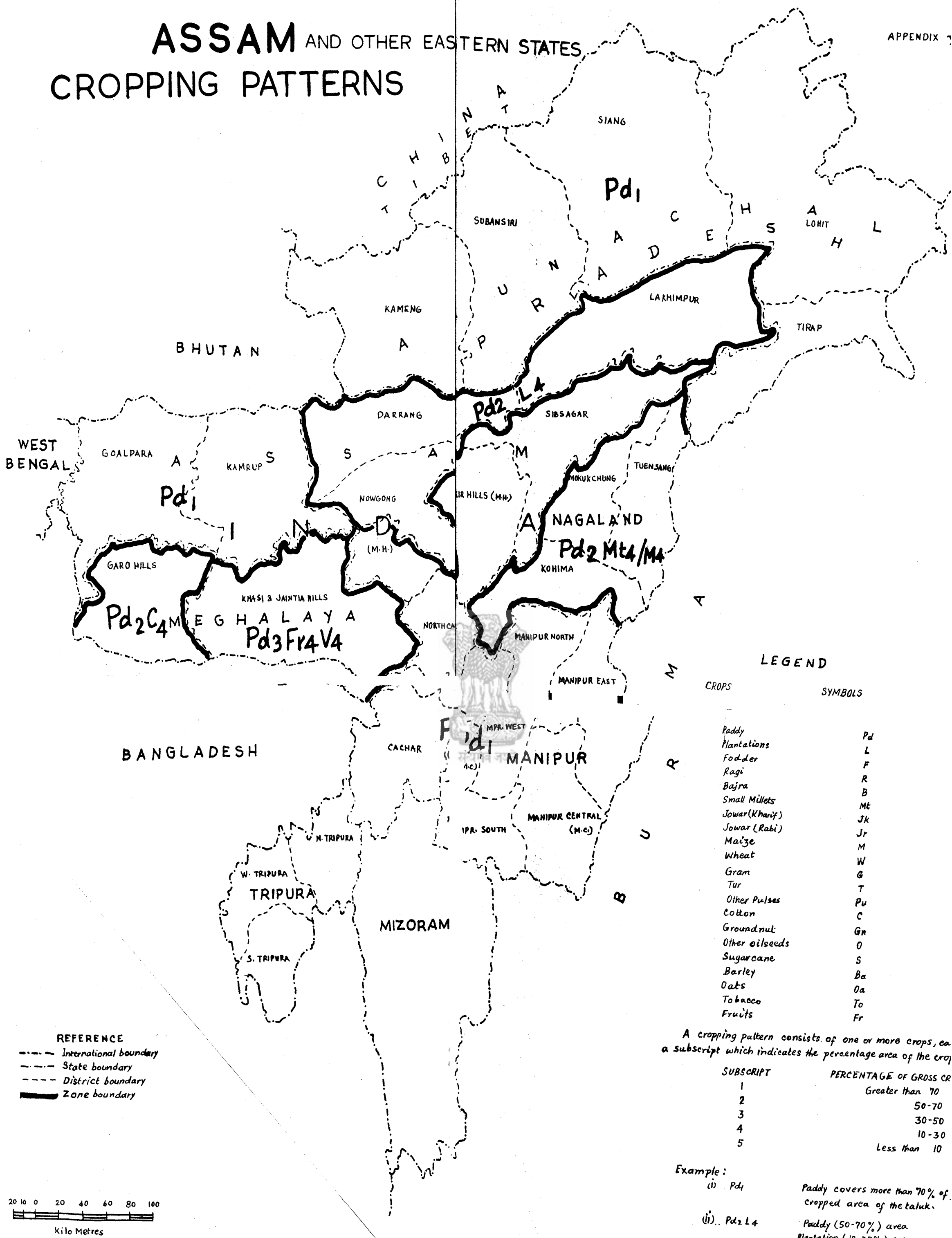




# ASSAM AND OTHER EASTERN STATES

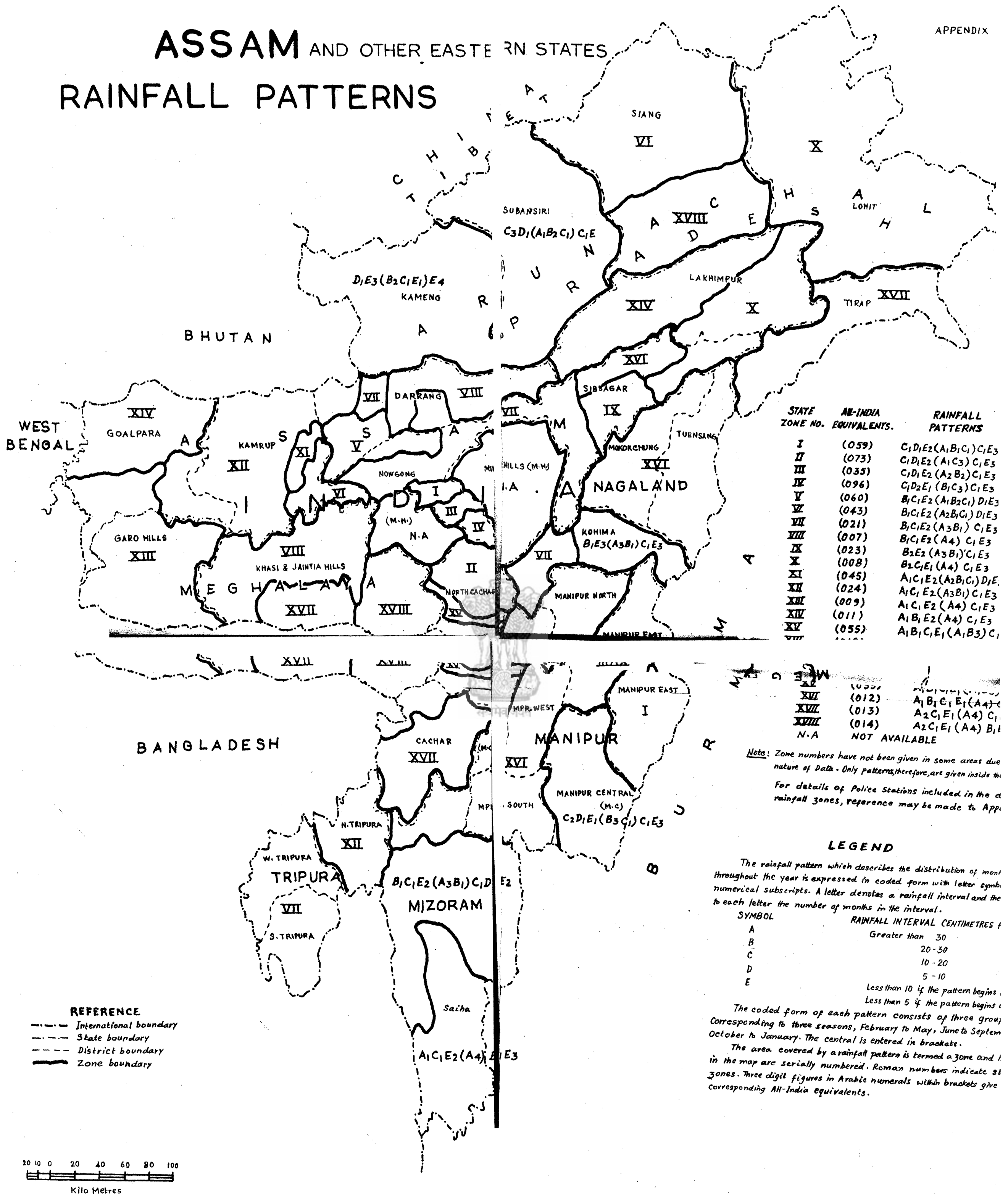
## CROPPING PATTERNS

APPENDIX 7

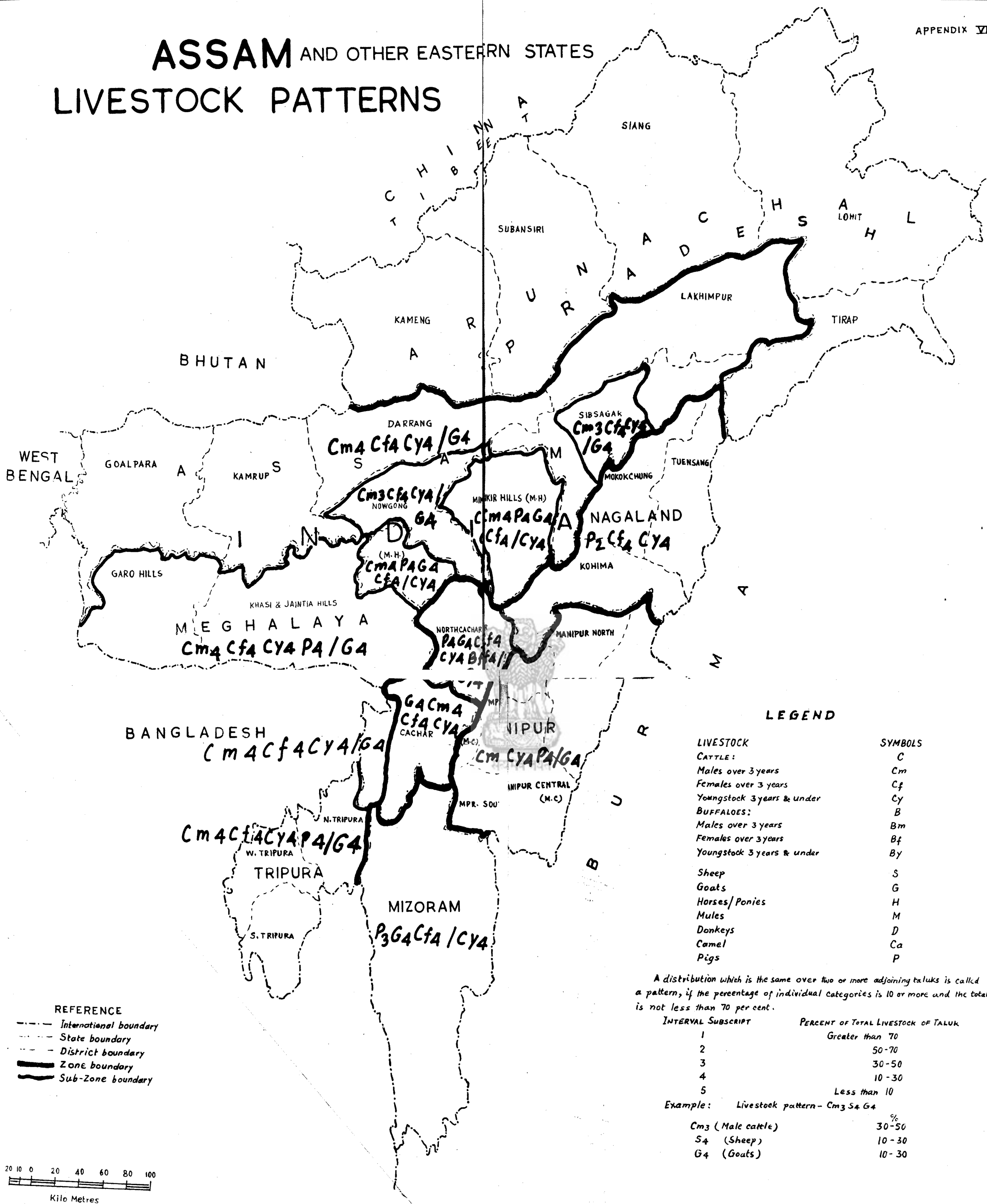


# ASSAM AND OTHER EASTERN STATES

## RAINFALL PATTERNS



# ASSAM AND OTHER EASTERN STATES LIVESTOCK PATTERNS



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The boundary of Meghalaya shown on this map is as interpreted from the North-Eastern Areas (Reorganisation) Act, 1971, but has yet to be verified.