Agricultural Transformation in West Bengal since Independance

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This is to certify that the dissertation entitled "AGRICULTURAL TRANSFORMATION IN WEST BENGAL SINCE INDEPENDENCE" submitted by Sucharita Sen in fulfilment of six credits out of the total requirement of twenty four credits for the degree of Master of Philosophy of the University, is, to the best of our knowledge, a bonafide work and may be placed before the examiners for evaluation.

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SUCHARITA SEN

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CHAPTER I

INTRODUCTION

Agriculture has a crucial role to play in the development of an underdeveloped economy. There are various important ways in which agriculture can contribute to the process of economic development. This sector not only has to provide food and raw materials to the other growing sectors but also resources for investment in the other sectors especially in the absence of sizeable foreign aid. On the demand side, the rural population has to provide an effective domestic market, from the incomes generated by agricultural growth, for the products of the industrial sector. High levels of agricultural production can result in earnings/ savings of foreign exchange to import crucial capital goods needed for overall development of the economy.

In India, there is dominance of the agricultural sector not only in terms of contribution to the National Income but also in terms of the proportion of population dependent upon it for their livelihood. This sector is likely to continue as the primary source of employment for sometime to come. It becomes imperative,

therefore, to analyse the factors operating within the agricultural sector and to determine whether this sector is in a position to contribute to the process of overall development. In the present study an attempt has been made to analyse the extent and nature of transformation, if any, in the agricultural sector of the state of West Bengal since the time of Independence to the present decade.

It is important to carefully distinguish between the somewhat similar but not synonymous terms of 'development' and 'transformation'. According to Meir "development is a process of cumulative change that results from positive forces that raise productivity."[1]. Hence, development is a positive change. The direction of change cannot, in the strictest sense of the term, be specified in transformation though a number of scholars have used it in a positive sense.[2]

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1. Meir G.M. (1976), "Leading Issues in Economic Development", New York, Oxford University Press, p. 1.

2. Nevaj K. and Rudra A (1975), "Agrarian Transformation in a district of West Bengal", Economic and Political Weekly, Review of Agriculture, March, 1975.

In any study of transformation a holistic analysis is desirable. However, something as complex as the economy or society has to be studied in parts for a deeper analysis. Hence, a partial analysis has to assume a total character at the end of the study.[3]

In a holistic study of agricultural transformation one cannot, strictly speaking, leave out the social factors affecting it. But in an empirical study one has to concretise the factors to enable quantitative interpretation. Two points have to be noted here in this connection. Firstly, it is difficult to visualise an all encompassing 'whole' social phenomenon affecting the society and economy. Secondly, upto-date data is not available for whatever social indicators are chosen to measure the social phenomenon. Hence, the present study has been restricted to economic transformation of agriculture in West Bengal.

STATEMENT OF THE PROBLEM:

In the traditional interpretations, the economy

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3. Kurien C.T. (1980), "Dynamics of Rural Transformation," Economic and Political Weekly, Annual Number, February, 1980, p. 365.

in the development process undergoes a structural transformation where the share of agriculture in the National Product is marked with a decline and is replaced by growing shares of both industrial and services sectors. But this transformation itself is dependent upon agricultural growth otherwise industrial development would be constrained. In the process of transformation of the economy there would be a flow of labour from the agricultural sector to the other growing sectors. If this happens, then the shifting workers have to "take" their food (in absence of large scale imports) from the agricultural sector. Thus, agricultural production has to feed not only a growing population but also a growing non-agricultural labour force.

This shift of labour force results in a lesser number of labour needing to produce a greater amount of agricultural output including foodgrains. This increase in output can come about either by bringing more land under plough or increasing productivity or a combination of both. Increase in area can be brought about either through physical expansion of land under cultivation or by increasing cropping intensity.

Taking into consideration the fact that the scope for area increase is limited in India and especially in a state like West Bengal,* increased output has to depend primarily upon increased productivity. A lesser number of labour producing a greater output can be achieved either by (a) increased effort in terms of man-hours (b) greater dependence on technology to increase productivity.

As there is a limit to which increased effort on the part of an undivided labourer results in increase in output, ceteris paribus, it signifies that in the ultimate analysis there has to be some extent of dependence on technological progress in agriculture. It must be noted that increasing cropping intensity is optimal only if accompanied by use of technological inputs.

In 1981, with a net cropped area of about 5.6 million hectares and a cropping intensity of 136 percent, the gross cropped area in West Bengal was around 7.6 million hectares. The state accounted for 4.7 per cent

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*. In 1981, the land-man ratio in West Bengal was 0.16 hectare as compared to 0·48 hecs. for India.

of the country's gross cropped area under foodgrains and 6.2 percent of total output of food-grains. The state ranked fourth with respect to production of food-grains, first in respect of rice and jute and second in potato.

However, optimistic the above ranking, the situation in West Bengal with respect to production of agriculture, especially foodgrains, is quite dismal. The state runs a deficit between production and consumption with respect to foodgrains and oilseeds.[4] Since agriculture provides nearly 50 per cent of state income and approximately 60 percent of employment, growth of agriculture is essential for the general development of the state.

West Bengal has been termed as a "low growth rate" state by Bhalla and Algah.[5] Green Revolution, which was in the initial stages primarily a wheat

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4. Sengupta A.K. (1985), "Agriculture in West Bengal, some technoeconomic aspects "Insed Paper 1, Institute for Studies in Social and Economic Development, Calcutta, July 1985, p. 1

5. Bhalla G.S. and Alagh Y.K. (1979), "Performance of Indian Agriculture", A Districtwise Study", JNU and PPD, Planning Commission, 1979.

revolution, has not contributed significantly to agricultural growth in West Bengal as wheat occupied only 383.6 thousand hectares in 1971-74 (at the time of Green Revolution) as against 5005.47 thousand hectares occupied by rice. The introduction of new technology in rice which had brought about a tremendous breakthrough in the yield rates of rice in Punjab has not been able to make any such impact in West Bengal. In 1981, the comparative yield rates of rice were 2733 kg/hect. for Punjab and 1193 kg/hect. for Bengal.

As the Green Revolution was primarily a revolution in the field of technology the reason for the wide variations in yield can be identified as failure to adopt new technolgies in West Bengal. The technology can be termed as being primarily a "package" technology, the elements of which were complementary to each other. Adoption of allthe elements was necessary for optimum results and this adoption primarily depended upon assured irrigation. The technology can be termed as being income biased and some of its elements were size biased. Infrastructural development with respect to distribution of inputs, marketing, storage and transportation facilities were necessary for the technology to make

its full impact on productivity.

It, thus, becomes necessary to study all the above aspects in determining the extent to which agriculture in West Bengal has undergone transformation.

OVERVIEW OF LITERATURE :

Numerous studies have been done on agriculture in India since Independence some of which have analysed transformation in agriculture. A large proportion of the studies, however, deal primarily with growth of agricultural output. Some of the major studies in this regard are those of Mitra (1968), Rudra (1970), Dey (1975) Vaidnathan (1977), Srinivasan (1979), Choudhri (1981) and Pillai (1982). Bhalla and Alagh[6] had divided India into high growth, medium growth and low growth areas. Continuing their analysis, S. Mahendra Dev had come to the conclusion that by the end of the decade of seventies, technological and demographic forces were operating against the low growth areas, while they were operating in favour of the high and very high growth regions.[7] He also came to the conclusion that rich

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6. Ibid.

7. Dev S.M. (1985), "Direction and Change in Performance of Indian Agriculture in Late 1970's," Economic and Political Weekly, Review of Agriculture, December, 1985, p. 236.

regions have become richer in terms of both output per capita and output per area. The low growth regions have become poorer in terms of output per capita in absolute terms and poorer in output per area in relative terms.

Productivity of agriculture is a very important variable to assess agricultural development. However, different concepts of productivity have been utilised by different authors for their work. The necessity of assigning some kind of weight to productivity of different crops to formulate a composite index of productivity was realised in the first half of the century. Huntington and S.V. Valtenberg tried an index method by taking the output of each crop as 100 and calculating the yield accordingly.[8] Kendall devised the rank co-efficient technique and measured productivity in terms of starch equivalent or energy.[9] Sapre and

8. Stamp L.D. (1960), "Our Developing World", pp. 105 to 107.

9. Kendall M.G. (1939), "The Geographical Distribution of Crop Productivity in England", Journal of Rural Statistical Society, Vol. 162, pp. 101-105.

Despande modified Kendall's procedure by taking a weighted average of the ranks.[10] Subsequently, Shafi attempted to co-relate production and agricultural efficiency in his study of agricultural development of Uttar Pradesh at a district level.[11] Maitra and Roy covered ten crops and assessed their yield per acre.[12] They fitted a linear trend in the index and finally compared the initial and final year computed values.

Bhatia tried to take into account the relative shares of each crop in the total cropped area to measure output per area.[13] Sinha discussed the problem of

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10. Sapre S.G. and Despande V.D. (1960), "Inter-district Variation of Agricultural Efficiency in Maharashtra", Indian Journal of Agricultural Economics, 1960, pp. 242-252.

11. Shafi M. (1962), "Agricultural Efficiency in in Relation to Land use Survey in U.P.", Geographical Outlook, 1962, vol. 3, No. 1.

12. Maitra T. and Roy B., (1964), "Regional Variations in Yield Per Acre of Major Crops in India (1950-51 to 1954-60).

13. Bhatia (1968), "A New Measure of Crop Efficiency in U.P.", Economic Geography, vol. 43, pp. 244-260.

agricultural efficiency and adopted a common standard deviation formula to determine agricultural efficiency in the country.[14] Tiwari studied the efficiency of agriculture and relationship of population growth with agricultural development in Uttar Pradesh.[15]

In one of the more recent works on the subject, agricultural productivity was defined as the "ratio of output to inputs in relation to land, labour, capital and overall resources used in agriculture".[16] In his work on agricultural efficiency in Uttar Pradesh, Shafi divided the state into different agricultural efficiency regions by using seven alternate methods of measuring productivity.[17] One of the seven methods was the

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14. Sinha B.N. (1968), "Agricultural Efficiency in India", The Geographer, vol. 15, pp. 101-105.

15. Tiwari R.N. (1970), "Agricultural Development and Population Growth, Analysis of Regional Trends in U.P."

16. Mohammed N. (ed.) (1980), "Perspective in Agricultural Geography", Concept Publications, New Delhi, p. 89.

17. Shafi M. (1984), "Agricultural Productivity and Regional Imbalances, A Study of U.P.", Concept Publishing Co., New Delhi.

Standard Nutrition Unit (SNU) output per hectare.

The concept of productivity that has been used in this study has been explained in the section on methodology.

Productivity, in itself, is a very important indicator of agricultural transformation. However, it cannot convey entirely, by itself, either the state of development of a region or the potential for development that exists in a region. Hence, other indicators of agricultural development, both technological and infranstructural have also to be studied to analyse fully the process of transformation of agriculture in an region.

Several studies in India have focussed on identifying levels of development of agriculture in a region. They vary, to a large degree, in the choice of indicators chosen for the analysis. Mitra was specific in his selection of indicators of agricultural development of a region.[18] These were intensity of cropping, gross irrigated area under various crops and

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18. Mitra A. (1967), "Levels of Regional Development in India", ISI, New Delhi, pp. 8-9.

yield of clean rice indicating efficiency of agricultural practices. Nath prepared a composite index of agricultural development based on three factors; rate of growth of output, use of modern inputs and yield per hectare.[19] He also attempted to identify the spatial pattern of agricultural development in India by comparing inter-state differences.

Sharma argued that levels of agricultural development should be assessed not only by levels of productivity or trends in agricultural production but also with reference to inputs like irrigation, fertiliser, improved seeds and extent of cultivated area.[20]. Raza has analysed the levels of regional development in India using 41 indicators grouped into 4 subsets -- productivity and production conditions, agrarian relations and change in agriculture.[21] In

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19. Nath V. (1969), "The Growth of Indian Agriculture; A Regional Analysis, Geographical Review, vol. 59, p. 364.

20. Sharma P.S. (1971), "Agricultural Regionalisation of India" in A. Chandresekar (ed.)" Economic and Socio-Cultural Dimension of Regionalisation", New delhi, pp. 253 to 273.

21. Raza M. (1978), "Levels of Regional Development of India", in Indo-Soviet Sympcsium on Regional Development and National Planning, Tilbisi Baku, Appendix II.

another study he had developed a regional model of modified development where he deduced that the green revolution had, in general, led to acute regional disparities in the hinterland of primary production.[22]

The non-availability of data in West Bengal regarding agriculture is the main constraint in any work on the state at the district level. The studies on the state are mostly at a micro level and are mainly based on primary data. Bandopadhyay[23] and Rudra [24] have done extensive work on agrarian relations in the state.

Among the works relevant to the present study is that of Das who has studied the crop output of Eastern India from 1950-51 to 1973-74.[25] He has concluded

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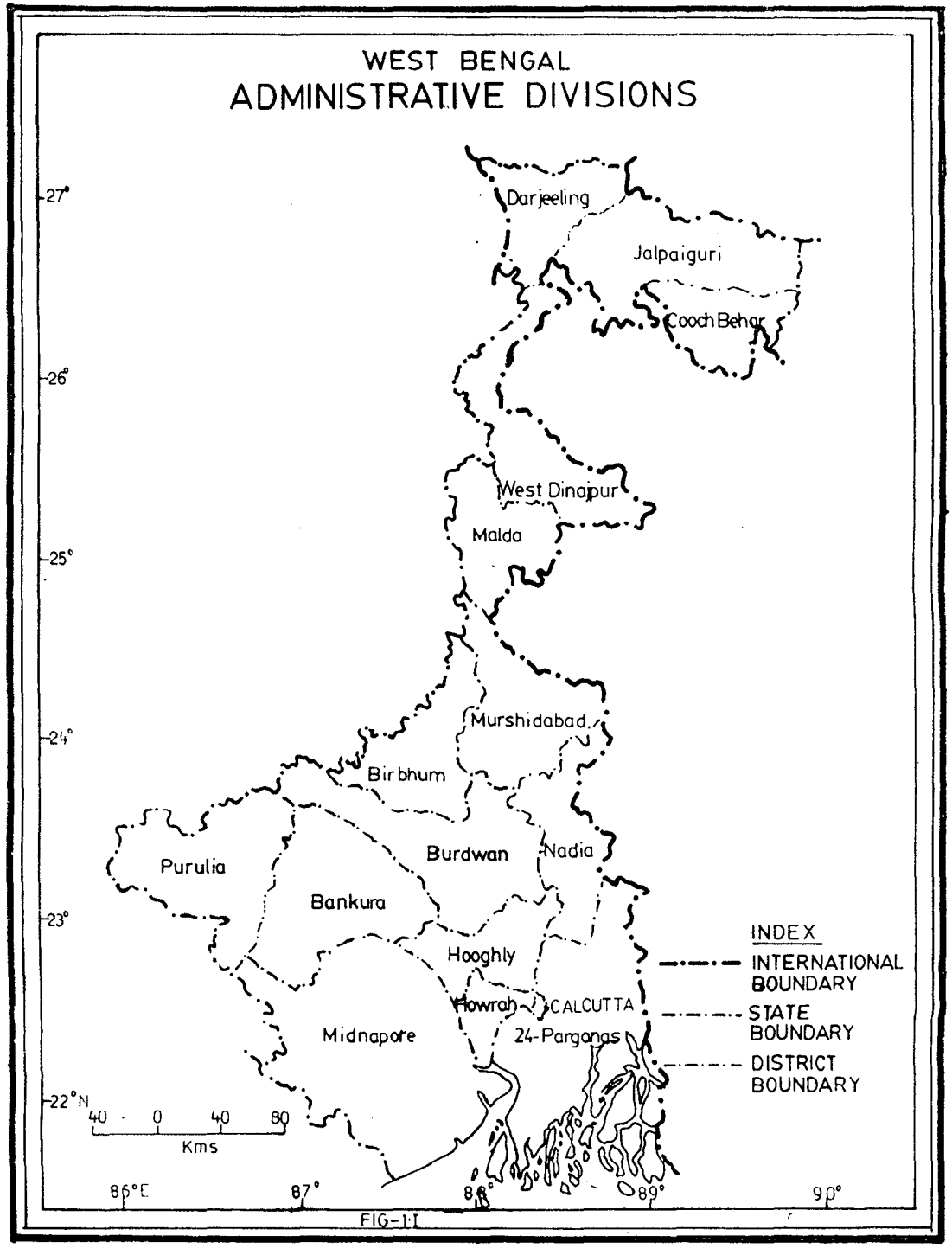
22. Raza M. (1981), "Regional Disparities in India -A Preliminary Exploration of Regional Perspective in Agricultural Development" in Noor Mohammad's "Perspective on Agricultural Geography," vol. IV. pp. 103-104.

23. Bandopadhyay A. (1976), "Agrarian Changes in India, A Comparative Study of Bengal and Punjab:1901-1940 and 1950-1974", New Delhi.

24. Rudra A. (1982), "Indian Agricultural Economics; Myths and Realities", Allied Publishers, Bombay.

25. Das P.S. (1978), "Growth and Instability in Crop Output in Eastern India", Economic and Political Weekly, October, 1978.


WEST BENGAL
ADMINISTRATIVE DIVISIONS
27°
26°
25°
24°
23°
22°N
Darjeeling
Jalpaiguri
Cooch Behar
West Dinajpur
Malda
Murshidabad
Birbhum
Burdwan
Nadia
Purulia
Bankura
Hooghly
Howrah
CALCUTTA
24-Parganas
Midnapore
INDEX
INTERNATIONAL BOUNDARY
STATE BOUNDARY
DISTRICT BOUNDARY
40 0 40 80
Kms
86°E
87°
88°
89°
90°
FIG-1.1

that the growth rate of total agricultural production of West Bengal had declined though the green revolution had beneficial effects on foodgrain production. James Boyce has done a time series analysis of area, production and yield of all crops in West Bengal from 1949-50 to 1980-81.[26] He has pointed out flaws in the data system of the state.

GEOGRAPHICAL PERSONALITY OF THE STUDY AREA:

The present study pertains to the state of West Bengal which extends between 21°N and 27°N latitudes and 86°E and 90°E longitudes. It is bounded from the North by Sikkim and Bhutan, from the east by Assam and Bangladesh, from the South by the Bay of Bengal and from the West by Orissa, Bihar and Nepal. The state covers 86048.5 sq km. and accomodates 545.81 lakhs of people (1981 census) and recorded a population density of 615 persons per sq km.

i) Relief : The relief of West Bengal can be broadly classified under two divisions - the Himalayas forming the extreme northern part and the lower Ganga plains encompassing the rest of the state. The former occupies

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26. Boyce J. (1984), "Agricultural Growth in West Bengal 1949-50 to 1980-81", Economic and Political Weekly, Review of Agriculture, March, 1984, pp. A-9 to A-16.

the northern most parts of the North Bengal districts of Darjeeling and Jalpaiguri. However, agriculture cannot be practised in this northern zone because of the constraints put by its relief.

The relief features of the lower Ganga plains are not marked with a well defined stage of evolution. The general relief feature is a monotonous plain surface, bisected by the channels of the tributaries or distributaries of the Ganga and Brahmaputra. From the areas where relative relief is somewhat noticeable, an attempt can be made to arrive at the following physiographic divisions:

1) The Northern Plains: This region comprises of two distinct landforms, the Duars and the Barind, both of which are the results of the deposits of mountainous streams at the foothills due to sudden changes in the gradient. The northern plains stretch in all five of the North Bengal districts - Darjeeling, Jalpaiguri, Cooch-Behar, West Dinajpur and Northern parts of Malda.

2. The Delta Proper Comprising of :

a) Land of dead and decaying rivers or the moriband delta in Murshidabad and Nadia.

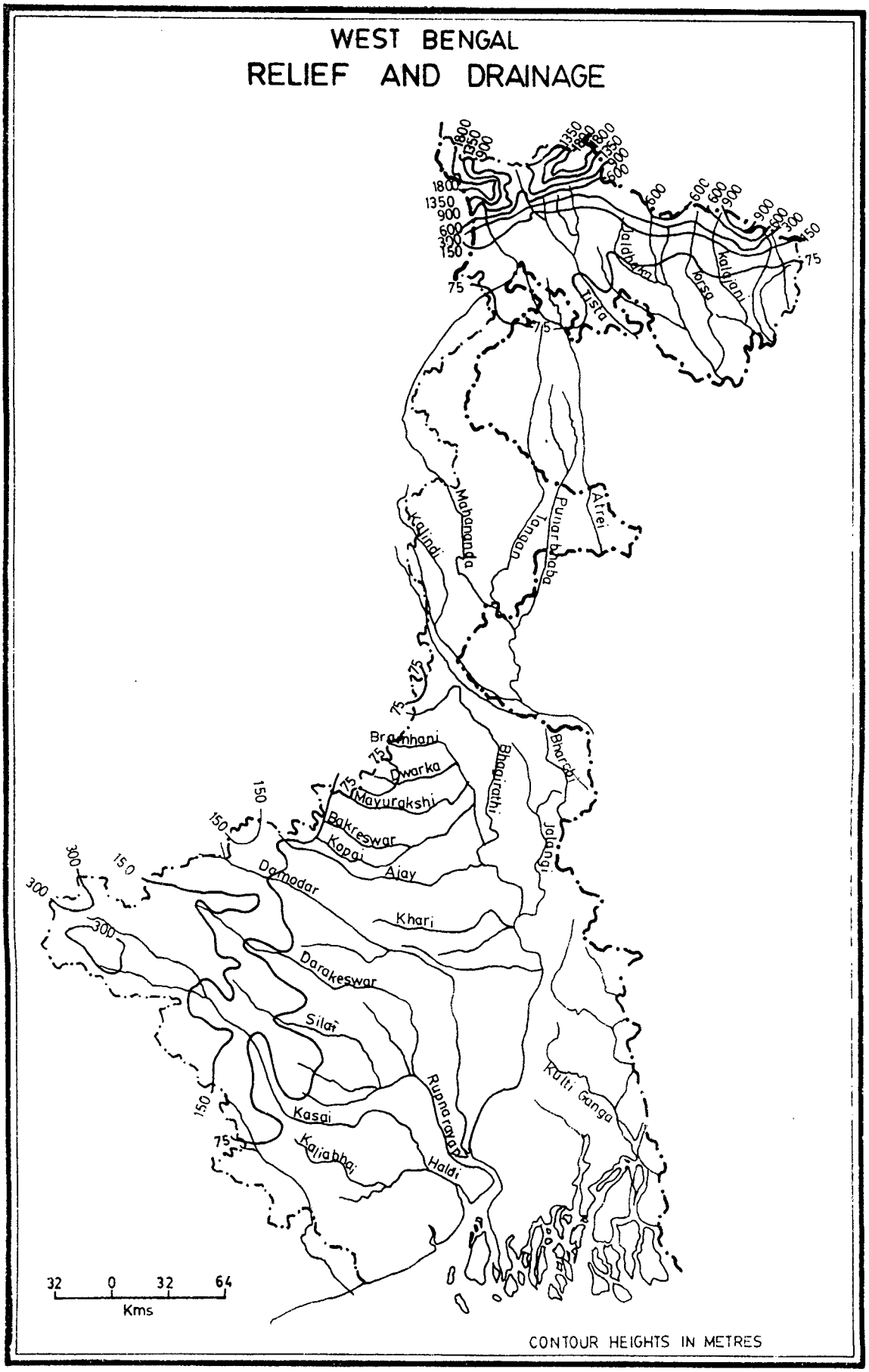
WEST BENGAL
RELIEF AND DRAINAGE
Jaldhaka
Kaljani
Torsa
Tista
Mahananda
Kalindi
Punarbhaba
Tangan
Atrei
Brahmhani
Dwarka
Mayurakshi
Bakreswar
Kopai
Ajay
Damodar
Khari
Darakeswar
Silai
Kasai
Kaliabhai
Rupnarayan
Haldi
Bhagirathi
Bharati
Jalangi
Rutti Ganga
32 0 32 64
Kms
CONTOUR HEIGHTS IN METRES

FIG. - 1·11

b) The active delta of Sunderban in 24-Parganas.

c) The mature delta in parts of Birbhum, Burdwan, Midnapore, Howrah and Hooghly.

3. The Wester Rarh region where lateretic alluvial landscape developed and is the land bordering the Chotanagpur highlands.

ii) Drainage :The Ganga is the only rainfed perennial river in the West Bengal delta. It runs as the Padma river from west to east across the state, dividing it into North Bengal which includes the districts of Malda, West Dinajpur, Darjeeling, Jalpaiguri and Cooch-Behar and South Bengal which comprises the rest of the districts of West Bengal. The Ganga river as Bhagirathi, again divides South Bengal into Western and Eastern parts.

Distributaries of the Padma river like Jalangi, Mathabhanga, Ichamati, Bhairab, Nabaganga and Gorai join the right hand channel of Bhagirathi. As Bhagirathi flows southwards from the main channel of Ganga it is joined by a number of tributaries from the west as Pagla, Bansloi, Brahmani, Dwarka,, Mayurakshi, Ajoy, Damodar, Rupnarayan and Kasai, of which Ajoy and Damodar are the more important tributaries.

One of the main rivers of North Bengal is the Mahananda, which is a rainfed river, joining Ganga at the point where it enters Bangladesh. The other important river of North Bengal is the Tista, which is a snow fed river, and which alongwith its numerous tributaries from the Himalayas drains a large part of the districts of Darjeeling and Jalpaiguri.

iii) Climate : West Bengal is situated at the head of the Bay of Bengal, with the Himalayas in the extreme northern part only about 300 miles from the sea. This mountain range bars the access of the polar air at the low levels. Since the influence of the sea is felt even in North Bengal, the state is marked with a conformity in climatic aspects.

Temperature :

The temperature conditions show limited variations, except for the Himalayan tract where the temperatures vary with altitude. The Himalayan tract exists in parts of Darjeeling, Jalpaiguri and very small portions of Cooch-Behar. These portions experience temperatures well below the normal for the latitudes, that is, mean normal temperatures of 30° centigrade

in summer and 9.3° centigrade in winter. Absolute temperatures below 0° centigrade and snowfall occur occasionally.

The rest of West Bengal, the plains, have a short winter of two and a half months and a long summer season. January is the coldest month while May is the hotest. However, April mean maxima are found to be higher in the northern parts. Diurnal ranges of temperature are 12° centigrade in Jalpaiguri and 12.1° centigrade in Midnapore. However, in the extreme south it decreases to 9.3° centigrade in Calcutta.

Percipitation :

This element of climate is most vital for the agriculture of the state. Precipitation is derived from four sources in West Bengal.

a) Winter rains associated with westerly winter depressions and convergences.

b) Pre-monsoon rainfall occurring between March and May associated with conventional over-turning of air.

c) Cyclonic disturbance of varying intensities during the monsoon and post-monsoon seasons.

d) Monsoon currents occurring along the convergence lines of the monsoon sea level trough.

TABLE 1.1

RAINFALL IN WEST BENGAL

S.No	Districts/ Rainfall Zones	Geographical Area (Sq. Km)	Rainfall Pattern	Annual Rainfall Total (cms)	Annual Rainfall Rainy Days
1	Rainfall Zone I				
	a) Bankura	6881	$D_1E_3(A_2B_1C_1)$ D_1E_3	132	68
	b) Purulia	6259		136	71
2	Rainfall Zone II				
	a) Nadia	3926		131	75
	b) Murshidabad	5341	$C_1E_3(B_3C_1)$ D_1E_3	135	71
	c) Burdwan	7028		135	70
	d) Birbhum	4550		129	68
3	Rainfall Zone III				
	a) Malda	3713	C_1E_3 (A_2B_2) C_1E_3	154	67
	b) W. Dinajpur	5206		163	69
4	Rainfall Zone IV				
	a) 24-Parganas	13,796		161	79
	b) Hooghly	3145	$C_1D_1E_2(A_2B_2)$ C_1E_3	152	75
	c) Howrah	1474		163	81
	d) Midnapore	13,725		154	74
5	Rainfall Zone V				
	a) Darjeeling	3075	$B_1C_1E_2(A_4)$ C_1E_3	299	116
6	Rainfall Zone VI				
	a) Cooch Behar	3386		320	102
	b) Jalpaiguri	6245	$A_1C_1E_2(A_4)$ C_1E_3	394	114

Source: "Rainfall and Cropping Pattern", National Commission on Agriculture

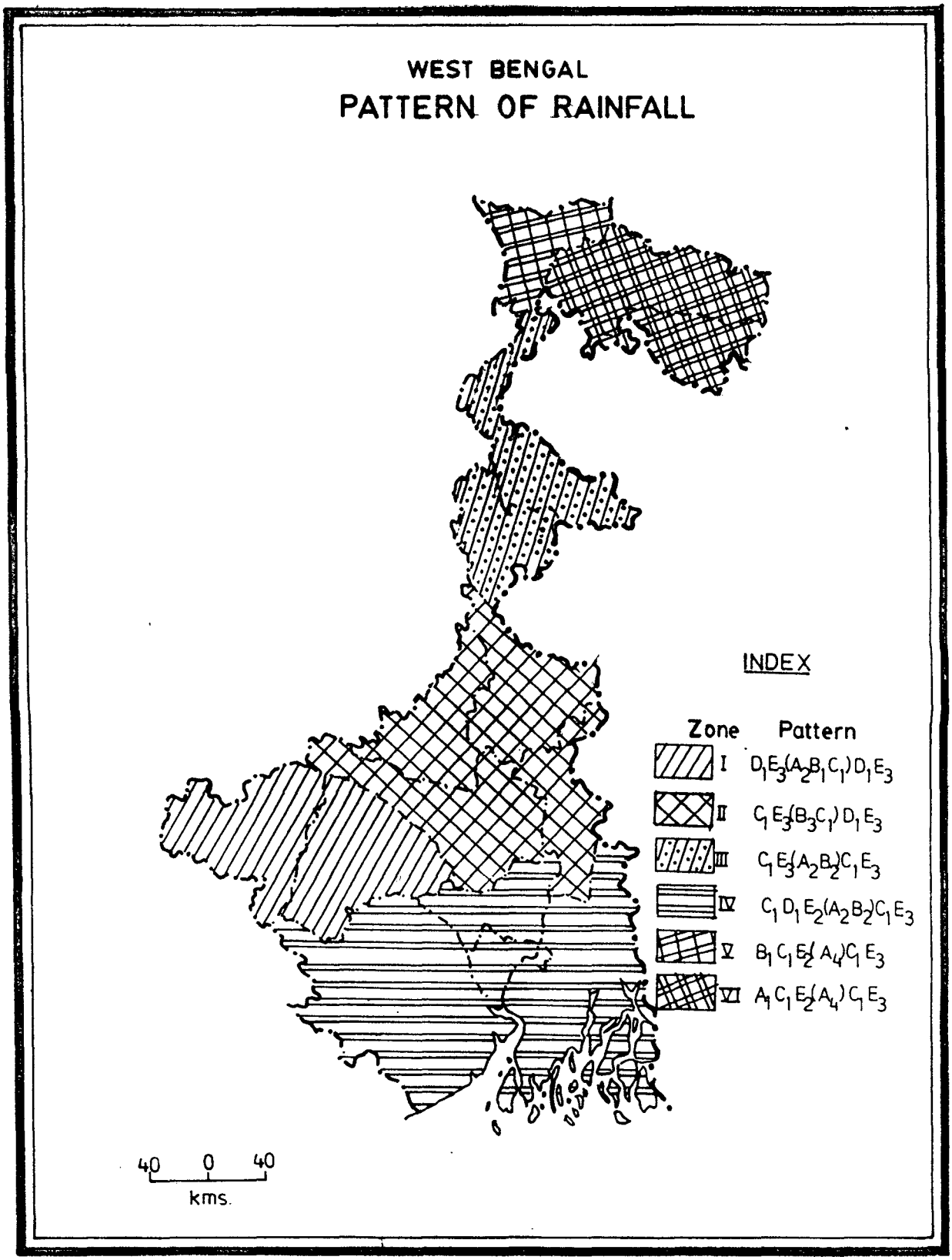
WEST BENGAL
PATTERN OF RAINFALL
INDEX
Zone Pattern
I $D_1E_3(A_2B_1C_1)D_1E_3$
II $C_1E_3(B_3C_1)D_1E_3$
III $C_1E_3(A_2B_2)C_1E_3$
IV $C_1D_1E_2(A_2B_2)C_1E_3$
V $B_1C_1E_2(A_4)C_1E_3$
VI $A_1C_1E_2(A_4)C_1E_3$
40 0 40
kms.

FIG. III

The rainfall during the monsoon season, which is between May to August, is most significant for the agriculture of West Bengal.

The mean annual rainfall of West Bengal reflects

a) incidence of orographic rainfall in sub-montane zone.

b) the decrease of precipitation north-west onwards in South Bengal.

A clear pattern of rainfall distribution emerges from table : 1.1. The National Commission on Agriculture has identified six rainfall zones in India according to the rainfall patterns. The rainfall pattern was described by five signs which are as follows:-

A - signifies monthly rainfall of more than 30 cms.

B - signifies monthly rainfall between 20 to 30 cms.

C - signifies monthly rainfall between 10 to 20 cms.

D - signifies monthly rainfall between 5 to 10 cms.

E - Signifies monthly rainfall less than 5 cms.

Elements in parenthesis in table 1.1 for rainfall patterns indicate the monsoon months (May to August) the elements before the parenthesis the premonsoon months and elements after it the post monsoon months. The figures in the subscripts indicate the number of months.

As is evident from table 1.1 except for the three

submontane districts of Darjeeling, Cooch-Behar and Jalpaiguri, which have higher total annual rainfall than the rest of the state, there is not much variability in rainfall in the state. However, rainfall zones III and IV receive marginally higher rainfall than zones I and II. There is no perceptible difference between rainfall zones I and II in terms of number of days having rainfall. Similar is the case between zones III & IV. The total annual rainfall is mainly determined by the monsoon and the post monsoon rainfalls as can be seen from the comparative rainfall patterns.

iv) Soils:

Broadly five kinds of soils are present in West Bengal

I. Laterites:

This kind of soil forms in an intermittently moist climate from loss of soil nutrients, by a process of leaching. This soil is poor in organic matter like nitrogen, phosphorus and calcium. The soil also has low water holding capability. This soil is to be found in parts of the districts of Birbhum, Burdwan, Bankura and Midnapore.

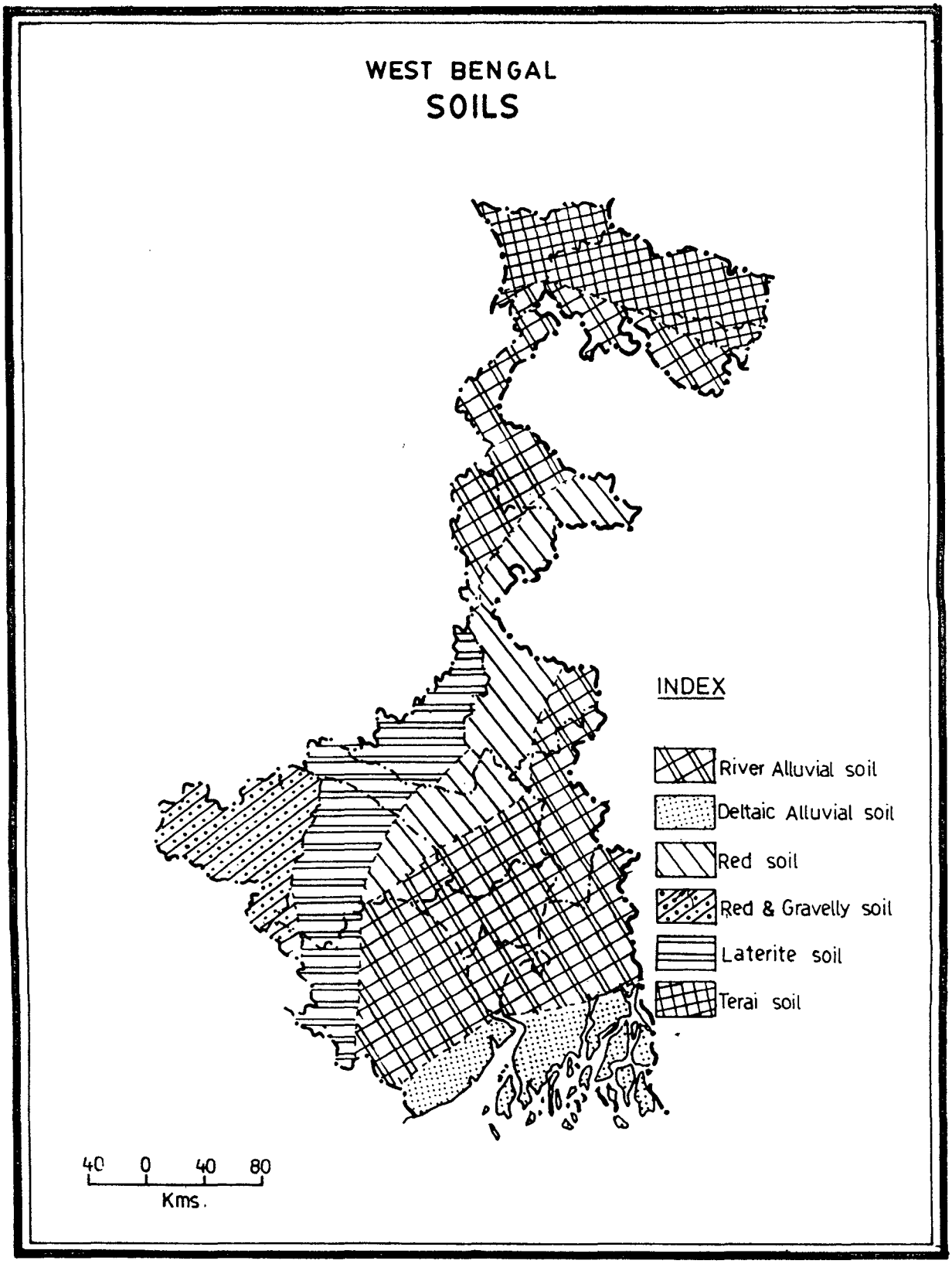
WEST BENGAL
SOILS
INDEX
River Alluvial soil
Deltaic Alluvial soil
Red soil
Red & Gravelly soil
Laterite soil
Terai soil
40 0 40 80
Kms.

FIG-1·IV

II. Alluvial Soils :

Depending on the parent material the soils of the alluvial tract can be divided into two families - the Ganga alluvium and the Vindhyan alluvium. This kind of soil is fertile and rich in nutrients and has good water holding capability which often, however, leads to waterlogging. The Ganga alluvium is found in the districts of Murshidabad, Nadia, 24-Parganas, Malda, Burdwan and Hooghly. Vindhyan alluvium is present in the districts of Murshidabad, Birbhum, Bankura, Purulia, Burdwan, Hooghly and Midnapore.

III. Coastal Soils :

These are the soils which have been formed from tidal deposits and can be classified as saline, nonsaline alkali, alkali and degraded alkali soil. They occur in 24-Parganas, Midnapore and Howrah.

IV. Terai Soils :

These soils are derived from the mountainous regions of Himalaya. The deposits are mostly of the sandy and raw humus kinds. This type of soil forms a major portion of Jalpaiguri and Cooch-Behar.

V Colluvial Soils :

This type of soil is skeletal soil containing large amounts of coarse sand and gravel. This type is to be found in Purulia and Western parts of Birbhum and Bankura.

The knowledge of the chemical composition of the different soil groups, particularly in respect to its plant nutrients, is important. The soils of West Bengal are generally poor in organic matter as well as in nitrogen. Regarding pH values, soil reaction does not appear to be a problem except in Darjeeling, Jalpaiguri and Cooch-Behar where the soil is acidic. In some portions of Midnapore, Howrah and 24-Parganas, the salt content is high. The available nitrogen content is particularly low in most districts except Darjeeling, Jalpaiguri and Cooch-Behar.

OBJECTIVES OF THE STUDY:

The main objectives of the study are as follows;

a) to evaluate the agricultural development of West Bengal since Independence both in terms of area and yield and examine the trend of growth of both.

b) to examine the decadal development of technological factors regionally; also to look into the development of some selected infrastructural factors.

c) to establish relationship between yield and its determinants at different points of time.

d) to determine the levels of agricultural development of the districts at different points of time.

DATA BASE:

The primary responsiblity for the collection of statistics regarding agriculture rests with the State Government. Statistics regarding landuse and area under crops are obtained in the various states following different systems existing in different states. The yield rates of principal crops are estimated through Crop Estimation Surveys (CES) conducted by state agencies. At the national level, the statistics of area, yield and production are obtained from the different states and are compiled and published by the Directorate of Economics and Statistics (DES) of the Ministry of Agriculture and Co-operation. The National Sample Survey Organisation (NSSO) has the overall responsibility of assisting the states by developing suitable survey techniques for obtaining reliable and timely estimates, providing training to the states' field personnel and exercising supervision over primary field work.

The data collected for our work has been published by the Directorate of Economics and Statistics which

in the case of West Bengal is "Bureau of Applied Economics and Statistics" under the supervision of the Ministry of Agriculture, Government of West Bengal.

The two main sources of data are :

a) The Statistical Abstract, West Bengal 1955, 1965, 1975, 1976 and 1977.

b) Economic Review (statistical Appendix).

Unpublished data by the Ministry of Agriculture, West Bengal 1987 and 1988.

The statistical Abstract of West Bengal has various sections of which the section on agriculture and related subjects gives data on land utilisation, area, production, yield rate of principal crops, index members of agricultural area, production and productivity and agricultural implements and machinery. The latest information in the last published issue relate to 1976-77.

In West Bengal, there is no agency like the Patwari to collect agricultural statistics. Except statistics of principal crops, all other statistics are collected by the staff of the Agricultural Department working at various levels. The Bureau of

Applied Economics and Statistics carries out crop surveys in different seasons of the year on behalf of the Agricultural Department and prepares estimates of area, yield and production of principal crops. These estimates form the basis of crop statistics issued by the Agricultural Department. The major and medium irrigation data is obtained from the Irrigation and Waterways Directorate while the responsiblity of data for minor irrigation lies with the Agriculture Directorate.

Until recently, the states of Kerala, Orissa and West Bengal, which account for about 9 percent of all India area had no system of village agency to maintain area records. The state surveys in this regard served only a limited objective of providing estimates of area and yield for some of the important crops at higher administrative levels or at the state level. In view of this, a scheme for Establishment of an Agency for Reporting Agricultural Statistics (EARAS) has been intorduced for these three states which envisages, among others, the estimation of areas by complete enumeration in a sufficiently large sample of villages. This scheme provides for setting up, in a phased manner, a whole-time agency to cover a sample of 20 percent of the

villages every year so that all the villages in the states whould be covered once in a period of five years. In the sample villages crop areas will be reported on the basis of complete enumeration.

As a NSSO report says, "it is enccuraging to note that during 1984-85, the coverage of EARAS in West Bengal was enhanced to about 14% of the villages, from 11.6% of the villages during 1983-84." However, this is still far belcw the targetted percentage i.e. 20 percent[27].

The statistical Abstract, West Bengal, 1987 and 1988, is still under the process of publication and the data from it has been obtained from the office of Bureau of Applied Economics and Statistics, Calcutta by special permission. This issue would cover up to 1985-86 which is five years after 1976-77, the year covered by the last published issue.[28] The

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27. "A Report on the Status of Estimation of Agricultural Production in India" 1984-85. NSS. p. 7.

28. Statistical Abstract, West Bengal, 1977 & 78 Published by Bureau of Applied Eccnomics and Statistics, Government of West Bengal.

data of 1980-81, 1981-82 and 1982-83 of the present study has been obtained from this unpublished issue.

The Economic Review is a report published by Government of West Bengal and it usually comes out before the budget session. The sources of the report are more less the same as the sources of Statistical Abstract and, thus, the data of the two reports are completely comparable. What is different is the form in which the data is presented. In the case of Economic Review, the data is mostly presented as a statewise aggregate, except in few cases, where the districtwise breakupis given. However, the publication of Statistical Abstract, which is the only report which gives district-wise break-up, is highly irregular and so the Economic Review becomes very relevant for any study of West Bengal.

Economic Review in its section on Agriculture and Allied Sectors has given information on index numbers of area, production and productivity of selected crops of West Bengal. Index numbers of net sown area, Cropping pattern, Cropping intensity, utilisation of land in West Bengal, rainfall, area, production and yield - statewise and districtwise, extension of area under

HYV, consumption of fertilizer, distribution of government deep tubewells, river-lift irrigation & shallow tubewells - districtwise, area irrigated by government canals - districtwise, regulated markets, storage capacity and other information regarding forestry & fishery.

Other data are based on reports or pamphlets as follows:

(a) "Outlines for Better Water Management of Crops of West Bengal", 1983, Paper Published by Department of Development Manager (Agriculture), State Bank of India, Calcutta.

(b) "Krishi Shahayika" A Publication on the Indo-German Fertilizer Training Scheme, West Bengal, 1981.

(c) "Agriculture in West Bengal; Some Techno-Economic Aspects" Anil Kr. Sengupta, July 1985, INSED Paper No. 1, Institute for Studies in Social and Economic Development, Calcutta.

(d) Statistical Abstract of Punjab, 1969 and 1986.

Limitations of Data: As mentioned above, all the data taken into account are published by the Bureau of Applied Economics and Statistics, under the supervision of Ministry of Agriculture, West Bengal.

The irregular publishing of the statistical Abstract poses a lot of problems for any research

work. There has been no issue published since the last issue of 1977 and 1978. The issue which is about to be published concerns the next ten years after the previous issue. Since there is a ten year gap it is natural that some of the formats would have changed and hence cannot be compared. For example, the format in which the data on agricultural implements and machinery is given in 1982 is not comparable with that of the previous decades. (Source: Livestock and Farm Equipments Census, Directorate cf Animal Husbandry.) Also, after the mid sixties, the data for "land sown more than once" is not given in the land utilization data.

The most important lacunae of the data is that after the mid sixties there is no data regarding the total area irrigated or net area irrigated. This proves to be a very crucial gap as any study on agriculture can never be complete without complete data on irrigation. In the present study figures for gross area irrigated and net area irrigated have been substituted by the data available, which is area irrigated by government canals and distribution of government deep tubewells, river lift irrigation and shallow

tubewells by districts.

The area covered by high yielding variety seeds in districts is not available. It is presented in the Economic Review at the aggregated state level. Thus, out of the technological determinants of productivity, the high yielding variety seeds and irrigation cannot be analysed properly. Out of the institutional indicators, districtwise data regarding storage capacity and credit structure is not published by the Government of West Bengal. There is, however, an account of both the variables at aggregate state level and while discussing the different determinants in the third chapter, an account will be given of their state level development. However, they cannot be included in the multiple regression analysis or the factor analysis.

Let us make a short comparison between the agricultural data available in the Statistical Abstract, West Bengal & Statistical Abstract, Punjab. Firstly, the data on punjab has been published very regularly-almost annually and the Statistical Abstracts till 1986 have been published. In this, besides the data on area, production and yield of Punjab (district-wise), the contributions of different states have been compared.

The cropwise and district-wise comparison of area under HYV is given and in this case also, aggregated data of all states have been given. Extremely detailed data on irrigation has been given in form of gross irrigated area and percentage of gross irrigated area to gross sown area. Similarly data on net irrigated area and percentage of net irrigated area to net sown area has been given. Besides this, source-wise and crop-wise irrigation data has also been included. A comparison of different states in irrigation also figures in the Statistical Abstract, Punjab. Besides all this, an item of information, which has not appeared in any of the issues of the Statistical Abstract, West Bengal is presented in the counterpart of Punjab, and this is data on the structure of operational holding which is given district-wise and also for all the states at an aggregate levle. An example of the state-wise comparison is as follows.

TABLE : 1.2

OPERATIONAL HOLDING (1980-81)

Country/State	Average Size in	%of Number to Total	% of Area to Total
India	1.82	100	100
Punjab	3.79	1.15	2.39
West Bengal	0.94	6.58	3.41

Source: Statistical Abstract, Punjab, 1986.

From the above table it can be clearly seen that West Bengal had a far greater share of number of operational holdings as compared to its share of the area of the operational holding. This reflected itself in the average size of holding, which was 0.94 hectare, far less than that of Punjab (3.79 hectare) and also less than the Indian average (1.82 hectare).

Such easy availability of data would have enabled our research work to reach a far greater depth than currently possible given the above stated limitations of the data concerning agriculture in West Bengal.

METHODOLOGY:

In the present study, a district-wise analysis of agricultural transformation of West Bengal since the time independence has been attempted. Four time periods have been taken for the major part of the analysis, i.e. 1951-52, 1961-62, 1971-72, and 1981-82. In case of area, output and productivity trianniel averages have been calculated for 1950-53, 1960-63, 1970-73 and 1980-83.

The basic variables discussed in our study are the following:

(1) Dependent Variables

(a)Area (both net sown area and area under individual crops)

(b)Output (both in physical and money terms)

c) Productivity (in money terms)[29]

d) Cropping pattern

ii)Independent Variables.

A) Technological Variables

1) Proportion of area irrigated by government canals to net sown area.

2) Number of pumps (total) per 1000 hectares of net sown area.

3) Number of tubewells per 1000 hectares of net sown area.

4) Kilograms of fertilizers used per hectare of net sown area.

B) Institutional Variables

1) Road density (in km/sq km)

2) Number of regulated markets per 10 square kilometers of total geographical area.

3) Proportion of electrified villages to total inhabited villages.

C) Other Variables.

1) Proportion of agricultural workers to total work force.

2) Proportion of cultivators and agricultural labourers to total agricultural workers.

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29. To convert output and productivity into money terms 1980-81 harvest prices (West Bengal) have been used for all the districts.

The following methods have been used for the analysis:

i) Indices of growth has been calculated for area, output and productivity for important crops for the aggregate state level from 1952-53 to 1984-85 (base year 1952-53 = 100).

ii) The cropping patterns of the four time periods has been worked out for the district level.

iii) Compound growth rates were calculated to examine decadal changes of various variables and also to see the total change in the overall period, with the help of the formula below.

$$\sqrt[n]{\frac{Q\ t}{Qo}} - 1 = r$$

where r = Compound rate of growth

n = Number of years in the time period.

Qt = Quantity in the terminal year

Qo = Quantity in the base year

iv) While calculating the ranges for the compound growth rates, the growth rates of districts above twice the state growth rate have been considered as very high, those between the state average and twice state average as high and those below state average as low categories. Negative growth rates constitute a separate range.

While working out the ranges for the yield levels and other distributions the state average has been taken as the middle point of the whole range and the highest and lowest districts as the highest and lowest limits of the range. From this framework, four categories- very high, high, low,very low were worked out.

v) For the irrigation technology and ploughing technology M.N. Pal s method of index of mechanisation was used. Among the ploughing machinery tractors and wooden plough are most commonly used. Based on the study done by ICAR, according to the comparative work done by the three implements the following ratios are used;

1 iron plough = 4 wooden ploughs

135 H.P. tractor = 50 wooden plough[30]

Based on the above ratio, the wooden plough equivalent per 1000 hectares of gross cropped area was worked out, Similarly, the pumps per 1000 hectares of gross cropped area was also worked out.

To make the irrigation and ploughing machinery comparable, a problem of giving weightage to the two variables arose. However, any attempt at giving weightage would have been highly arbitrary and subjective.

M.N. Pal has treated those two variables at par [31]. However, there still arises the question as to whether those two variables, which perform two

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30. M.H. Qureshi and Ashok Mathur (1985), A Geo-Economic Evaluation for Micro Level Planning, p. 116.

31. Ibid, p. 110-111.

different functions are additive or not. Secondly, a pump is used for functions other than irrigation, and this is not taken into account in this method. Thirdly, only irrigation and ploughing techniques cannot determine the "level of mechanisation". Other functions as sowing, weeding, harvesting are totally ignored. However, one does realise the problem of data availability regarding machinery of the above mentioned operations. One more problem, arising specially in case of West Bengal is that the Persian-Wheel Technique is used widely in all the districts. Since the equivalent of Persian Wheels to pumps cannot be calculated unless a field survey is conducted, it cannot be included in M.N. Pal's method of determining levle of mechanisation.

(vi) The relationships between the different dependent and independent variables have been studied, by correlation and multiple regression analysis. Stepwise regression is attempted because it indicates the change in the goodness of fit every time a new variable is entered. More importantly, it shows us the comparative importance of each of the variables in terms of its effect on the dependent variable.

vii) Principal component analysis has been used in order to arrive at a composite index of agricultural development for the state. An examination of the factor loadings have been done to judge which of the variables are significantly correlated with the various principal components.

ORGANISATION OF THE STUDY :

The second chapter has been devoted to analyse the changes in agriculture in terms of area under different crops and net sown area, and yield of different crops and aggregate yield in money terms. The resultant output for each crop also have been examined. This has been done at two level, one at the state level, which would be a time series analysis and another at the district level for four different time-periods.

In the third chapter, the technological and infrastructural determinants of agricultural development have been studied. Their changes in terms of rate of growth have also been examined till 1981-82.

The fourth chapter presents the analysis of the relationship between the agricultural yield and its technological and infrastructural determinants. An attempt would also be made to arrive at a composite

index of agricultural development taking into account both the actual development of agriculture or the yield levels, and the spatial distribution of the various determinants of yield.

CHAPTER - II

TRENDS IN AREA, OUTPUT AND YIELD IN WEST BENGAL

The changes in terms of area, output and productivity of different crops in West Bengal, both at the state level as well as the district level, have been discussed in this chapter. The change in area has been studied in case of net sown area and the gross cropped area. In addition, the changes of area under the individual crops have been examined.

'Productivity' has been studied here in terms of output per unit area. The yields of different crops have also been analysed. Since the yields of different crops can not be compared due to difference in units, the output of the individual crops have been converted to money terms by using the 1980-81 harvest prices of the respective crops of West Bengal. The aggregate yield (productivity) for the districts and for the state as a whole has been arrived at by aggregating the output of the individual crops in money terms and then taking its proportion to the gross cropped area of the districts.

This chapter has been divided into two sections. Section - I deals with the analysis of the agricultural scenario in West Bengal during the pre-independence period. This has been included primarily as a background for analysing the changes in the post-independence period, which have been dealt with in section II.

SECTION - I

TRENDS IN AGRICULTURE BEFORE INDEPENDENCE AND THE SITUATION DURING LATE 1940's

The studies done by George Blyn show that there had been a fall in the per capita ouput availability in the decade before independence for the country as a whole.[1] This was because the rate of increase in agricultural output was slower than the rate of increase in population.[2]

Considering the "ten reference decades"[3] of the study done by Blyn, Greater Bengal's foodgrain output showed a steep decline, while all the other regions of British India had higher rates of growth than those experienced by British India as a whole. The fall in the output of foodgrain was entirely due to the fall in the output of rice, which constituted 91 percent

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1. Blyn, George (1951), "The Agricultural Crops of India - 1893-1941, a Statistical Study of Output and Trends". Philadelphia, Pennsylvania.

2. Blyn, George (1966), "Agricultural Trends in India, 1891-1947, Output, Availability and Productivity". Philadelphia, Pennsylavania.

3. Ten reference decade refer to series of population census years, i.e., 1891-01, 1901-11 to 1931-41 and population mid census decade years, i.e, 1896-06, 1906-16 to 1936-46.

of the foodgrain output in the first half of the period of study by Blyn and 89 percent in the second half.

TABLE 2.1

YEARLY AVERAGE OF PERCENTAGE CHANGE OF OUTPUT (FOODGRAINS) AND POPULATION OF SELECTED REGIONS.[4]

1891 to 1947

S. No.	Regions	Foodgrains	Population
1	British India	0.11	0.67
2	Greater Bengal	(-) 0.73	0.65
3	Greater Punjab	1.10	0.93
4	United Provinces	0.35	0.40

It is evident from table 2.1, that in Greater Punjab, the percentage increase in foodgrains was more than the percentage increase in population over the same period. The United Provinces witnessed a percentage increase of foodgrains equal to percentage increase of population. Thus, it was the negative rate of growth of foodgrains in Greater Bengal which pulled down the average for British India as a whole.

The output of non-foodgrains in Greater Bengal did increase but the rate of increase was less than

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4; Blyn, George (1966), op cit, p. 99.

that of the other regions as well as that of British India as a whole (table 2.2).

TABLE 2.2

YEARLY AVERAGE OF PERCENTAGE CHANGE OF NON FOODGRAIN OUTPUT[5]

S. No	Region	Growth Rate
1	British India	1.31
2	Greater Bengal	0.23
3	Greater Punjab	2.40

It is important to examine the possible reasons for the relative low rate of growth of non-food grain crops in Greater Bengal. Jute, which occupied half of the area under the non-food-grains had a low growth rate of 0.27 percent.[6] Secondly, even though sugarcance had been grown in all the districts, the drainage conditions were not favourable for the crop.[7] Tea was the only crop which recorded high rates of growth, but proportion of area under tea to the total area under non-foodgrain was not large.

5. Ibid, p. 112

6. Ibid, pp. 112-113.

7. Ibid, p. 114.

In the period 1891 to 1947, output of all the crops taken together in Greater Bengal also experienced a negative growth rate (-0.45 percent), while British India as a whole had a low positive growth rate (0.37 percent).

An examination of table 2.3(a) indicates that Greater Bengal had a negative growth rate in terms of acreage. However, the rate of growth did not decline as steeply as the rate of growth of output and hence it explains only a part of the declining rate of growth of output.

TABLE 2.3(a)

AGGREGATE PERCENTAGE CHANGE IN CROP ACERAGE

1891 to 1947 (ANNUAL GROWTH RATES)[8]

S.No.	Items	British India	Greater Bengal	Greater Punjab
1	All Crop	0.40	(-) 0.06	0.96
2	Food Grains	0.31	0.00	0.87
3	Non Food Grains	0.42	(-)0.41	1.20

8. Ibid, p. 134.

TABLE 2.3 (b)

AGGREGATE CHANGE IN CROP ACERAGE (Average per Year)

1891 to 1947

S. No	Categories	Greater Bengal	Greater Punjab
1	Total area sown	(-)2.1	4.2
2	Area sown more than once	1.2	0.9
3	Net sown area	(-)3.3	3.3

It is evident from table 2.3(b) that there had been a considerable decline in the net sown area, which was more than the decline of gross cropped area. The area sown more than once had increased at a faster rate in Greater Bengal than even in Punjab. This implied that the cropping intensity in Bengal must also have increased during this period. It has been shown by Blyn's study that the area under rice, which was the main crop, had declined and so had the area under most other crops, with the exceptions of jute, tea, linseed and gram. Over 3 million acres of land went out of cultivation between 1907 and 1946. Most of this decrease apparently was as a result of increase in fallow land.

Several conjectures can be made to explain the decrease in the net sown area. One possible explanation is that certain marginal lands which had been clutivated before, had become less fertile and it was no longer profitable to cultivate them. Returns on better land could have been more when cultivated more intensively.

The decrease in productivity in some areas could have been related to the shift of the Ganga river towards the east.[9] Some districts like Murshidabad and Nadia were left with poorly drained, malaria infested channels and were deprived of the silt brought by floods every year which tended to maintain soil fertility. Development of salty "moriband" deltas could also have converted some land to submarginal status.

An examination of the figures of yield per area in Greater Bengal revealed that it had been declining at an average rate of -0.34 percent annually. This negative rate of growth experienced by the top ranking region (in terms of output) was sufficiently large to offset positive growth rates in the other regions, thus giving British India as a whole a meagre rate of growth of 0.01 percent over the period.

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9. Ibid, p. 136.

A downward trend in the yield of rice was very apparent from the study of Blyn.[10] Decline also occurred from the second half of the period for the other crops - gram, maize and barley. The non-foodgrain yield per acre showed a steady trend upward, but the rate of increase was not as rapid as in most other regions.

Blyn came to the conclusion that the decline in yield per acre of rice in Greater Bengal as a whole was attributable more to the Birhar-Orissa portion than to Bengal where the decline was marginal.[11] However, it was clear that even in the Bengal Province, progress in terms of output and yield was nowhere near that of Punjab.

The distribution of irrigation facilities in terms of irrigated land as percentage of cultivated land has been given below.

TABLE 2.3(c)

IRRIGATED LAND AS PERCENTAGE TO TOTAL CULTIVATED LAND[12]

Region	1st Period (percent)	2nd Period (percent)
British India	21.6	23.6
Greater Bengal	13.3	15.0
Greater Punjab	43.5	55.5

10. Ibid, p. 156
11. Ibid, p. 176
12. Ibid, p. 187.

From the above table it is clear that the extent of irrigation in Greater Bengal was less than the British India average and was far below that of Greater Punjab. The negative rate of growth of yield might be explained to a great extent by this phenomenon.

Soil fertility often depends upon the change in the rate of cropping of land. Leaving land fallow results in increase in soil fertility and consequently the yield per acre. Cropping intensity which was becoming increasingly high in Greater Bengal might probably have resulted in exhaustion of soil nutrients but this is an aspect which has to be looked into deeply before any conclusive statement can be made.

An important point of interest was the frequent shifts in the courses of rivers in Greater Bengal e.g. rivers like the Kosi, Upper Gandak and Tista. But the greatest of the shifts had been the shifting of the main Ganga flow from the Bhagirathi, Hooghly and Padma rivers, giving rise to the formation of "moriband deltas". This particular delta formation gave rise to increase in malaria which resulted in slight slowing in the rate of growth of population and also decline in soil fertility.[13]

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13. Ibid, p. 136.

SECTION II

ANALYSIS OF CHANGES IN AGRICULTURE OF WEST BENGAL IN TERMS OF AREA, YIELD AND PRODUCTION (1950-53 TO 1980-83)

In this section the changes of output, area and yield of different crops in the state of West Bengal over the thirty year period, 1950-53 to 1980-83*, have been analysed. As stated earlier in this chapter, the changes of area have been studied through net sown area at the aggregated level and the total area under the important crops at the individual district levels. The changes of yield have been analysed through physical yield levels of the individual crops and the composite productivity in money terms in the individual spatial units.

While analyzing the changes in output is important, it alone cannot indicate the state of development of agriculture. To elaborate, changes in output in agriculture can be brought about only through changes in area or changes in yield or a combination of both.

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* Triennial averages have been taken for four decades 1950-53, 1960-63, 1970-73 and 1980-83.

More emphasis has been laid in examining yield as an indicator of agricultural transformation, as it takes into account both changes in output and changes in area.

(A) (i) The pattern of net area sown:

Since net area sown is the physical extent to which land has been brought under cultivation, it is important to see how its proportion to total area in respective areal units has changed over time.

In 1951, the proportion of net area sown to total area for West Bengal was 58.7 per cent (appendix table 2.1). Ten districts had proportions higher than the state average, while four districts had proportions below it. Out of the former group, five districts had very high percentages, recording over 70 percent of total area, as compared to the state average. These districts were Howrah, Hooghly, Murshidabad, West Dinajpur and Malda. The other districts which were above the state average were Burdwan, Birbhum, Midnapore, Nadia and Cooch Behar. It can be seen from the distribution that except for Midnapore and Cooch Behar, all the districts having high percentages above the state average are concentrated above or below the Padma river

or by the side of Hooghly-Bhagirath rivers. Silt deposition leading to fertile soil formation is one of the likely explanations for such concentration. The districts having low proportions of net sown area (below the state average) are Bankura, 24-Parganas, Jalpaiguri and Darjeeling. A large portion of Jalpaiguri and Darjeeling is situated in the Eastern Himalayas and hence have large shares of forest area and area not available for cultivation. 24-Parganas, because of the existence of marshy sunderbans had a large proportion of area under forest and land not available for cultivation. In Bankura, however, the share of fallow land - both current and 'other' is high. Hence, the percentage of cultivated area to cultivable area in Bankura is very low for the period (table 2.4).

In 1961, (appendix table 2.2) the proportion of net area sown to total area in West Bengal increased to 61.9 percent. As in 1951, this time period also witnessed ten districts having percentages above the state average. Cooch Behar, Malda, West Dinajpur, Murshidabad, Nadia, Hooghly and Birbhum recorded very high proportion, above 75 percent. Thus, Cooch Behar,

Nadia and Birbhum districts had advanced to the very high range in 1961-62 from the high range in 1951-52. In case of Cooch Behar, there had been deforestation and hence more area had been brought under cultivation. In case of Nadia and Birbhum the fallow land had been brought under plough, and so, as is evident from table 2.4, the percentage of cultivated area to cultivable area[14] had increased significantly from 1951-52 to 1961-62. In 1961-62, the districts which were below the state average, were Purulia, Darjeeling, Jalpaiguri, 24-Parganas and Bankura. Thus, these districts had not witnessed change during the decade and remained in the same category as in 1951-52.

In 1971-72, there were nine districts above the state average of 61.7 percent. Out of these nine districts, Birbhum, Nadia, West Dinajpur, Malda and Cooch-Behar had very high percentages (over 75 percent) and hence remained in the same category as in 1961-62. The districts having lower percentages than the state average were Bankura, Howrah, 24-Parganas, Jalpaiguri, Darjeeling and Purulia. Howrah, which had

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14. Cultivable area is the sum total of net sown area, current fallows and fallows other than current fallows.

a proportion above the state average in the previous period, had a relative decline in the proportion of net sown area. This was due to a steep increase in the percentage in current fallow in 1971-72, resulting in a significant decline in the percentage of cultivated area to cultivable area in 1971-72 (74 percent) over 1961-62 (94.4 percent).

In 1981-82, there were ten districts above the state average. The positions of the districts regarding the proportion of net sown area to total area relative to the state average remained almost unchanged in 1981-82 as compared to 1971-72 with two exceptions--Birbhum, which was in the very high category, both in 1961-62 and 1971-72, had gone down to the high range. This was because the percentage of area not avaialble for cultivation to total area had gone up in this district. A possible explanation for this could be the growth of urban areas claiming more land. The other exception is that of Howrah whose proportion of net sown area to total area was below the state average in 1971-72, had proportion of net sown area above the state average in 1981-82. This was primarily because there had been a decrease in the percentage of fallow

lands to total area.

A) (ii) Proportion of Cultivated Area to Cultivable Area :

It is useful to know the potential for extension of area under cultivation. This can be derived from the proportion of cultivated area, which is a proportion of net sown area to cultivable area.

From the figures for the state of West Bengal (table 2.4) it can be noted that over the three decades, this percentage had gone up from 77.6 percent to 97.3 percent. This implied that the potential for extension of cultivated area had been utilised well in the state. From 1961-62 to 1971-72, this proportion, however, remained more or less stable at 84.9 and 85.8 percent respectively.

For the same period, some of the districts had recorded a fall in the percentage of cultivated area to cultivable area. These are the districts of Howrah, Hooghly, 24-Parganas, Nadia and Burdwan. Geographically, these districts lie in a contiguous space, which is the detaic area of the river Hooghly. Thus, the increase of the land lying fallow could be because of

TABLE 2.4

PROPORTION OF NET CULTIVATED AREA TO TOTAL CULTIVABLE AREA* IN WEST BENGAL

(in Percent)

S.No	Districts	1951-52	1961-62	1971-72	1981-82
1.	Burdwan	80.5	91.5	86.8	97.2
2.	Birbhum	82.9	90.7	93.9	98.5
3.	Bankura	59.5	68.5	75.1	94.8
4.	Midnapore	81.1	85.9	86.4	96.1
5.	Howrah	92.8	94.4	74.0	98.3
6.	Hooghly	94.9	95.6	86.2	99.3
7.	24-Parganas	61.1	85.5	82.8	98.9
8.	Nadia	66.6	94.2	90.5	99.4
9.	Murshidabad	88.3	89.9	90.8	98.4
10.	W. Dinajpur	87.9	92.4	96.6	99.4
11.	Malda	84.0	85.7	88.3	99.6
12.	Jalpaiguri	58.5	84.5	94.6	99.4
13.	Darjeeling	75.0	85.6	88.3	97.8
14.	Cooch Behar	87.7	87.7	95.2	99.6
15.	Purulia	--	57.9	62.7	86.8
16.	WEST BENGAL	77.6	84.9	85.8	97.3

Source : Calculated from Statistical Abstract 1955, 1965, 1975 and 1977-78 and unpublished data, Bureau of Applied Economics and Statistics, Government of West Bengal

* Cultivable Area = Net area sown + Current fallows + fallows other than current fallows.

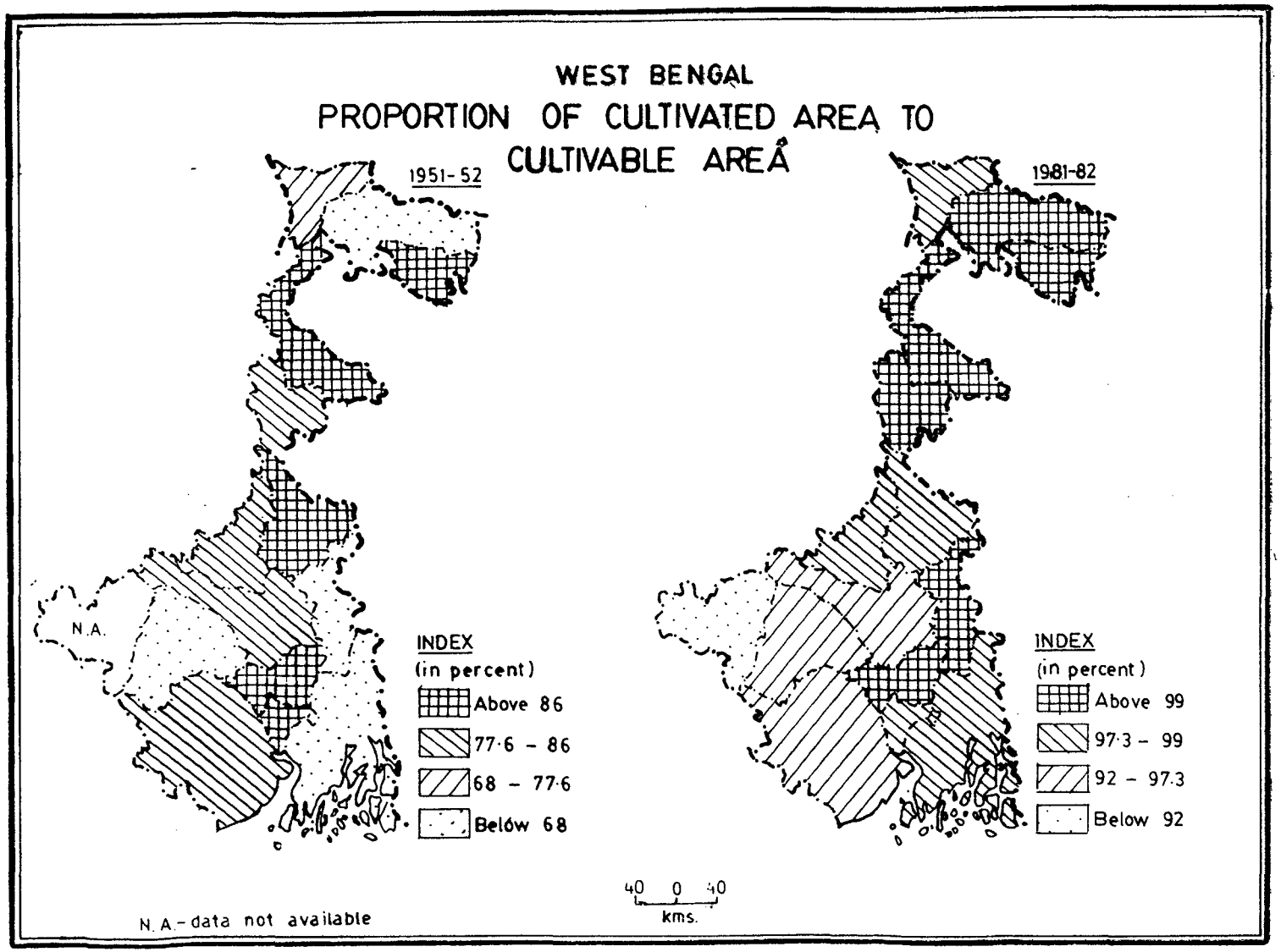
WEST BENGAL
PROPORTION OF CULTIVATED AREA TO CULTIVABLE AREA
1951-52
1981-82
N.A.
INDEX
(in percent)
Above 86
77·6 - 86
68 - 77·6
Below 68
INDEX
(in percent)
Above 99
97·3 - 99
92 - 97.3
Below 92
40 0 40
kms.
N.A.- data not available

FIG- 2·I

the choking of the river channel and inundations of the cultivable areas.

(B) Trends of Growth of Area, Yield and Production of Crops at the Aggregated Level.

The trends of growth of the area under various crops at the state level have been interpreted taking the indices of growth till 1984-85, with 1952-53 as the base year.

The area under rice had witnessed an increase with the growth index of 126 while its yield had increased to 160 and the production to 202 in 1984-85. This shows that the increase in production can be explained more by the increase of yield than the increase in area. The indices had recorded a slow but steady growth in area from 1961-62 to 1977-78, and after this period, a slow fluctuating fall till 1984-85. The production indices have been fluctuating indicating the possibility of climatic factors having a large degree of influence over production. The years between the period of 1974-75 to 1977 to 1978 have recorded very high growth (appendix tables 2.5, 2.6 and 2.7).

The indices of area, production and yield of

T.D.S. OF AREA UNDER SELECTED CROPS

IN WESTBENGAL(1952/53—1984/85)

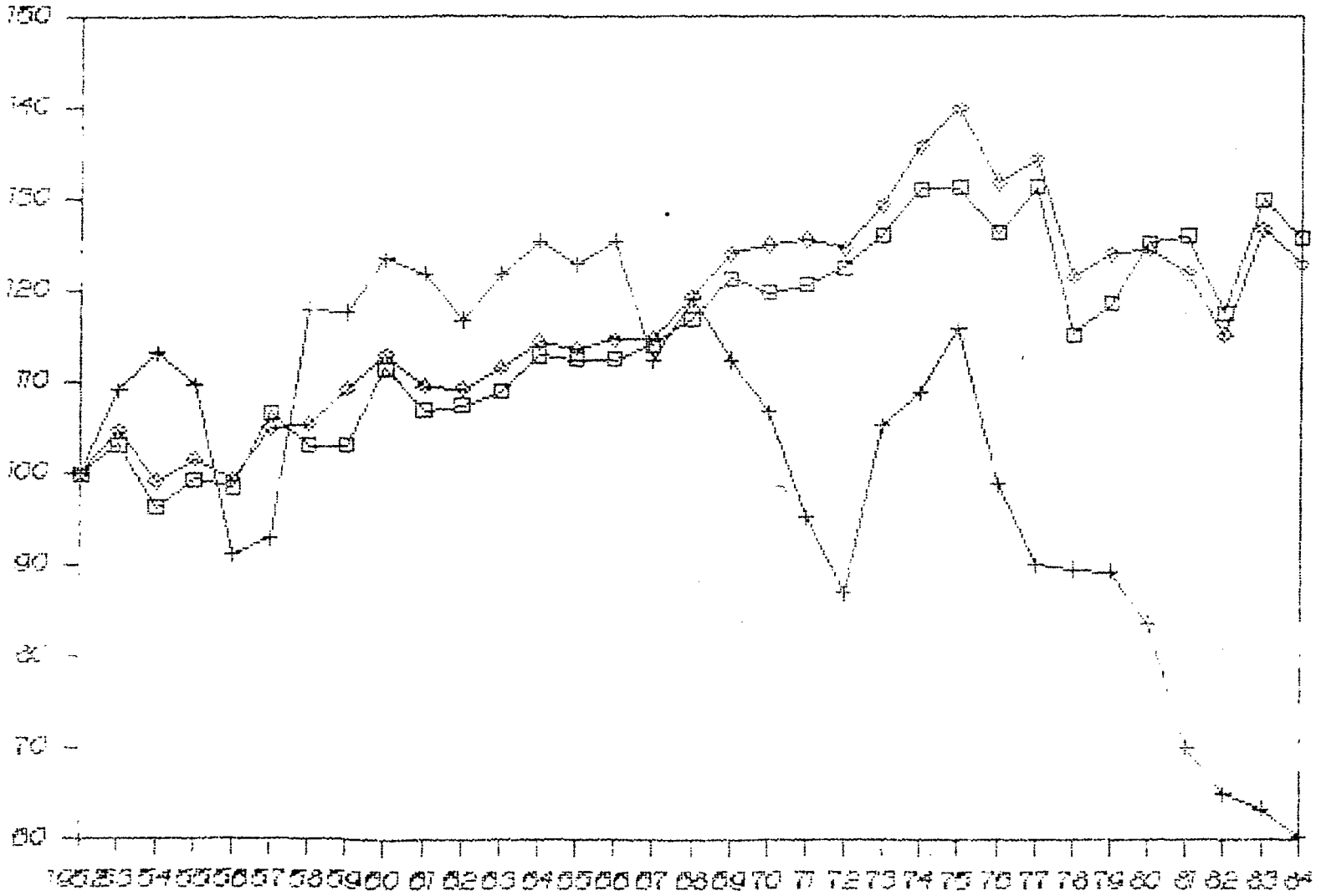

FIG.-2.11

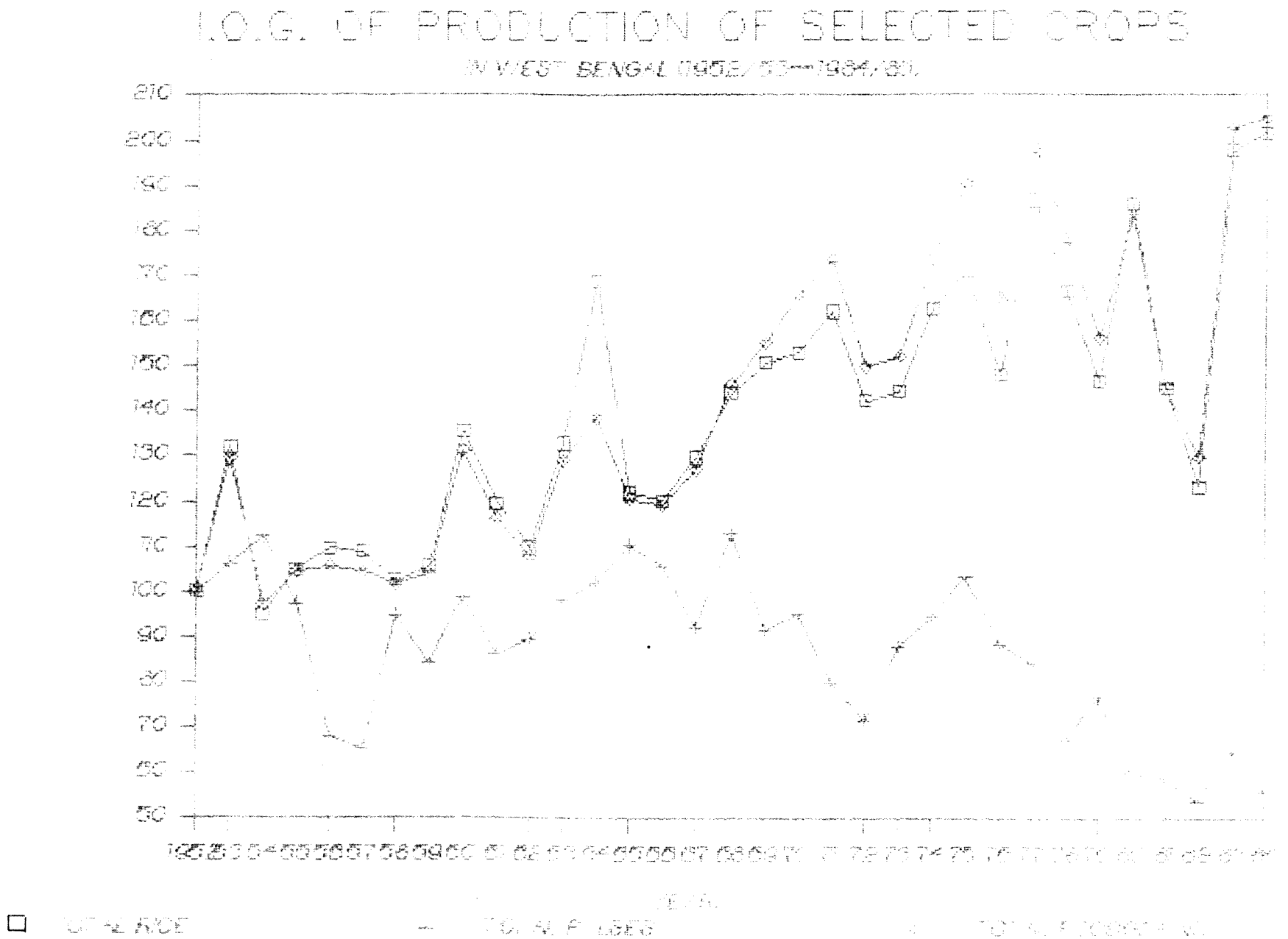
I.O.G. OF PRODUCTION OF SELECTED CROPS
IN WEST BENGAL (1952/53—1980/81)
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50

FIG.-2·III

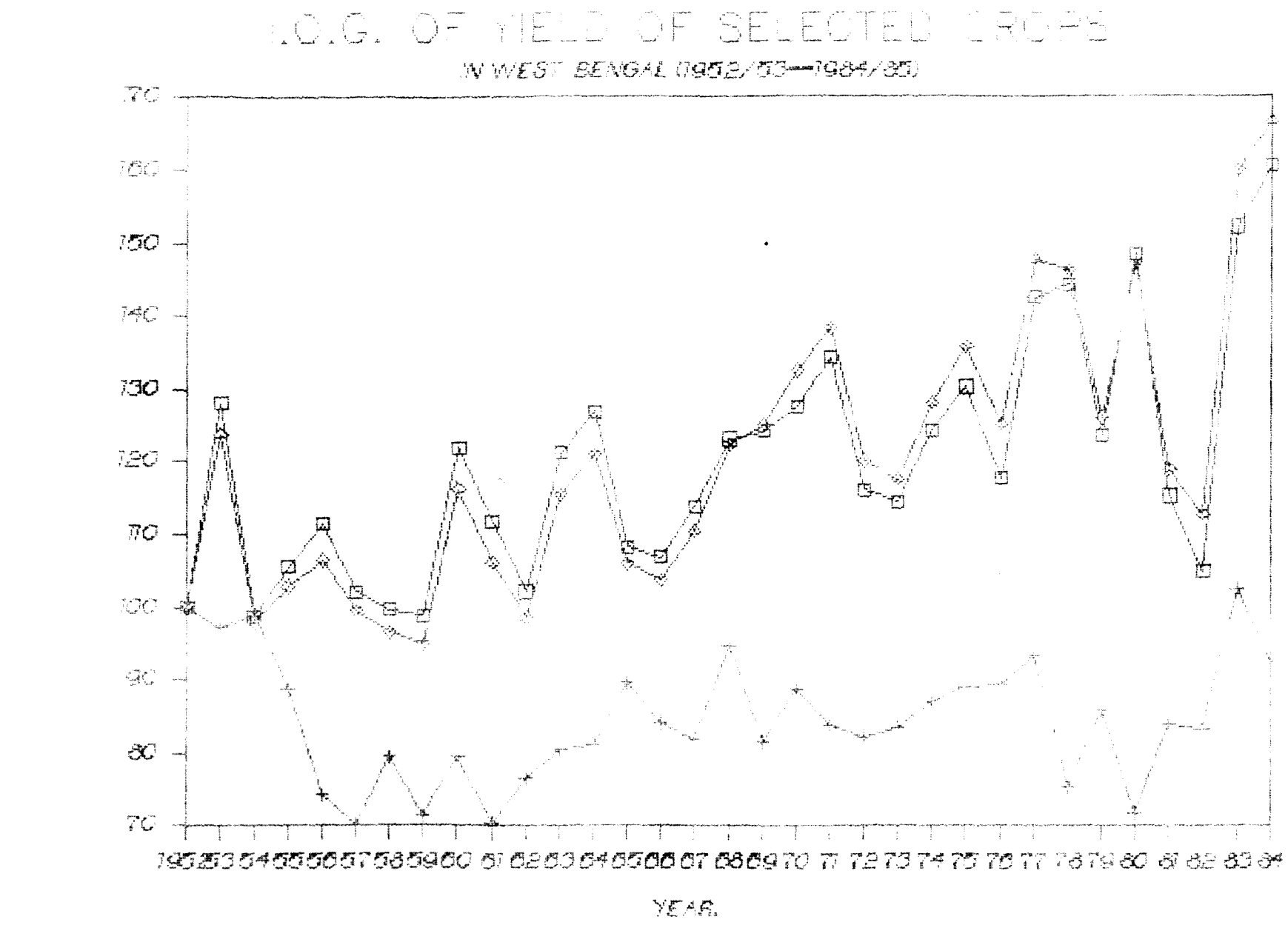
I.C.G. OF YIELD OF SELECTED CROPS
IN WEST BENGAL (1952/53—1984/85)
YEAR
TOTAL RICE
TOTAL PULSES
TOTAL FOODGRAINS

FIG-2·IV

all cereals and all foodgrains show similarities in behaviour with the indices of growth of total rice*. This was because rice was the major cereal constituting above 90 per cent of total cereals and above 80 percent of total foodgrains, both in area and production. The index of area of all foodgrains in the terminal year was marginally lower than that of rice, while in case of yield and production, it was marginally higher than rice (appendix tables 2.5, 2.6, 2.7).

The indices of area under total pulses declined drastically to 60 over the period of study, while the decline in its yield was not as sharp. The decline in the yield was marginal with index value of 92 at the end of the period. Its production index was 56 in 1984-85. These figures show that the decline in production in case of pulses was more because of the decrease in area rather than decrease in yield. The pehnomenal decline of the area under total pulses within the study period could have been a result of stagnation of its yield as compared to yield behaviour of other crops.

The indices of area, yield and production of

---

* Total rice is the aggregate of Aman, Aus and Boro.

total oilseeds in the terminal year were 29 7, 132 and 391 respectively. In this case, increase in area seems to have contributed more to the increase of production than the increase in yield. This observation is further corraborated by the fact that area and production had increased rapidly from 1973-74 and 1974-75, whereas the yield increase is noticed only from 1980-81.

(C) Cropping Pattern of West Bengal:

The cropping pattern in a region gives a very clear idea as to whether the trend of agriculture is heading towards specialisation or diversification. In West Bengal, as can be seen from appendix table no. 2.16, the cropping pattern had not changed except for very minor variations over the period 1951-52 to 1981-82.

In working out the cropping pattern, Aus, Aman and Boro, the three varieties of rice, have been considered separately because their yield rates were different. Boro has the highest yield while yield of Aus is the lowest. Secondly, Boro can be cultivated only in irrigated areas, while Aman is mainly a rainfed crop. It should be noted that had rice been taken as being one crop, most of the districts with few

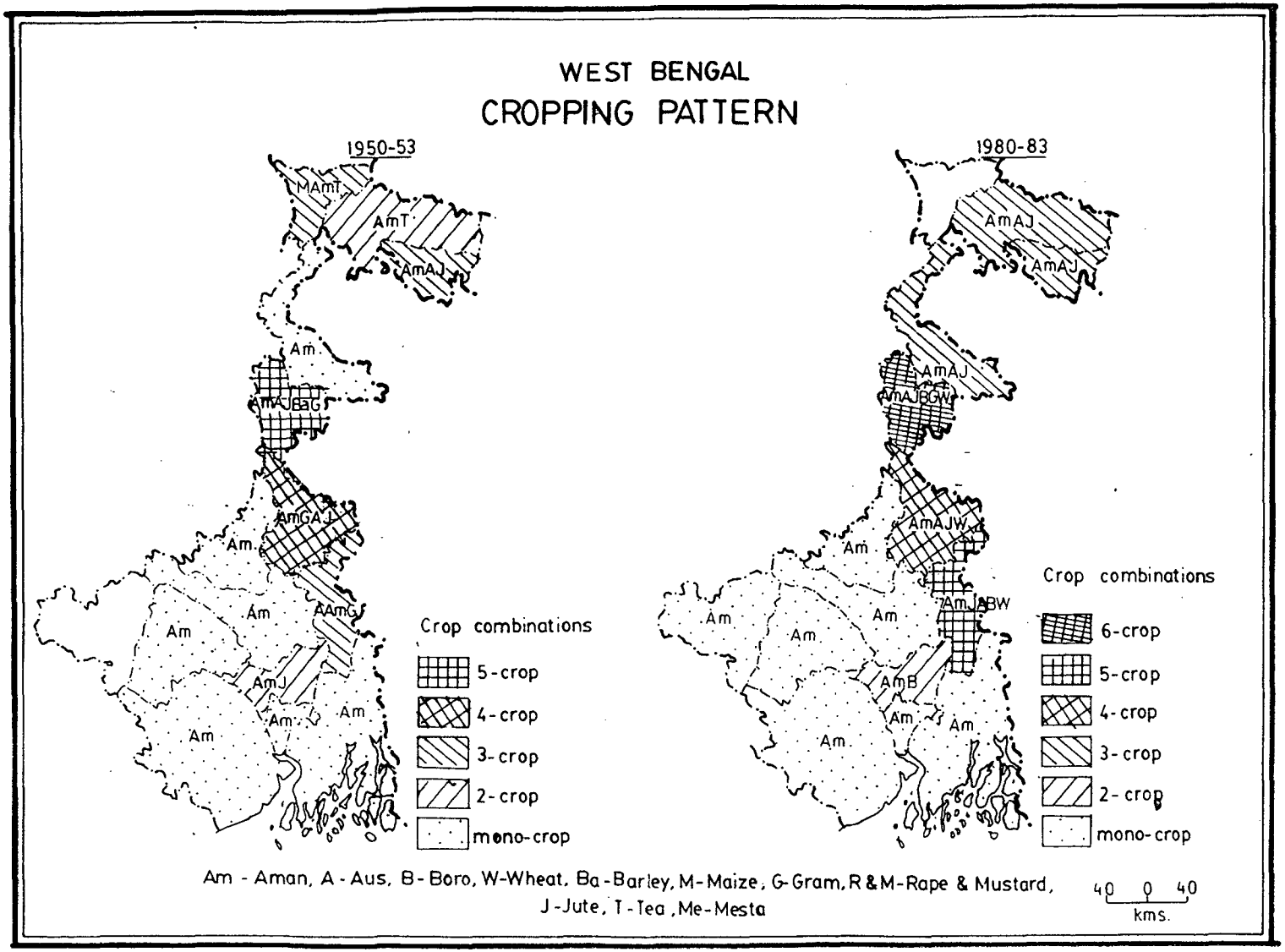
WEST BENGAL
CROPPING PATTERN
1950-53
1980-83
MAmT
AmT
AmAJ
Am
AmAJBaG
AmGAJ
AAmG
AmJ
AmAJ
AmAJW
AmAJBW
AmB
Crop combinations
5-crop
4-crop
3-crop
2-crop
mono-crop
6-crop
Am - Aman, A - Aus, B - Boro, W-Wheat, Ba - Barley, M - Maize, G - Gram, R & M - Rape & Mustard, J - Jute, T - Tea, Me - Mesta
40 0 40
kms.

FIG-2.V

exceptions like Nadia and Malda, would have emerged as monocrop areas.

Aman, as can be seen from the appendix table 2.16, figured as the dominant crop in all the districts, without any exception, over the whole of the thirty year period.

South Bengal, except for Nadia, Hooghly and Murshidabad, remained a monocrop region over the period. Birbhum in 1971-72, was a two-crop combination district with Aman-Wheat but in 1981-82 it again became a monocrop district. Howrah, which followed a similar pattern, with two crop combination of Aman - Boro in 1971-72 became a monocrop district in 1981-82. Hooghly remained a twocrop combination district throughout the thirty year period, with Aman - Jute combination for 1951-52 and 1961-62 and Aman - Boro combination for 1971-72 and 1981-82. Nadia, which was a four crop combination district in 1951-52 became a five crop district from 1961-62 onwards. The combination of Aus, Aman, Jute, Gram was there throughout the thirty year period, in differing order of importance, at all the four points of time. In 1971-72 and 1981-82, wheat also figured in the cropping pattern of Nadia. Murshidabad became

a six crop region only in 1971-72, while it was a four crop combination district at the other three points of time.

All the five districts in North Bengal experienced change in their cropping patterns over the period as a whole except for Darjeeling, which remained a three crop district consistently. However, data for 1981-82 was not available for the district. This district's crop combination was that of Aman, Tea and Maize in varying orders of importance at different points of time. Maize, which is a cereal grown in the poorly developed areas, was the primary crop in 1951-52 but had declined to the third position in 1971-72. Cooch Behar, which was otherwise a three crop district of Aman, Aus and Jute, became a two crop combination district of Aman and Aus in 1971-72. West Dinajpur, which was a monocrop district of Aman in 1951-52, had become a three crop district of Aman, Aus and Jute in 1981-82. Malda, which had the most diversified cropping pattern in West Bengal, was a five crop combination district in 1951-52. It became a six crop district in 1961-62, a eight crop district in 1971-72 and then again a six crop district of Aman-Aus-Jute-Boro-Gram-

-Wheat in 1981-82. Except for Aus, all the other crops had high yield as compared to the state averages in the district. Hence, such a combination does seem to support a strategy of diversified development.

In general, there has been no significant change in the cropping pattern in the state - other than very few minor variations. It emerged later in the analysis done on the yield levels, that most of the highly developed districts in terms of aggregate monetary yield were monocrop regions with Aman as the dominant crop. However, keeping in view the low rates of growth of production and yield of Aman, it can be postulated that there is a need for diversification to higher yielding crops like Boro, Wheat and Jute. It must be noted that Boro and Wheat need assured irrigation for full exploitation of their yield potential. The other alternative is to improve the techniques of Aman cultivation so as to improve its yield.

Thus, there is need to institute measures aimed at greater diversification and also to improve techniques of cultivation of the major crops, if the state is to witness a higher degree of agricultural growth.

(D) Cropwise Analysis of Changes from 1950-53 to 1980-83.

The behaviour of individual crops has been studied in terms of the indices of growth, the percentage shares of different districts in terms of area and output to total area and total output of the state, their physical yield levels, the growth rates of their area, production and yield. The analysis of growth rates are both decadal and for the period as a whole.

i) Rice:

Burdwan, Midnapore and 24-Parganas were among the largest countributors, both in terms of area and output. Midnapore had been the single largest contributor till 1970-73. However, its position declined to that of the third largest contributor in 1980-83.

An examination of table 2.5 reveals that with very few exceptions, none of the districts had very large differences between their contributions in terms of percentage shares of output and area, in any of the time periods. This implies that there were no large variations in the comparative yield levels of the districts.

TABLE : 2.5

SHARE IN AREA AND OUTPUT OF TOTAL RICE OF THE DISTRICTS IN WEST BENGAL

(in Percent)

S.No.	Districts	1950-53		1960-63		1970-73		1980-83	
		Area	Output	Area	Output	Area	Output	Area	Output
1.	Burdwan	10.7	12.5	10.1	12.9	9.8	9.5	9.7	13.3
2.	Birbhum	7.7	9.6	6.9	8.3	6.5	8.1	6.5	7.5
3.	Bankura	8.3	9.7	7.3	8.2	7.5	8.1	6.9	7.0
4.	Midnapore	21.4	22.2	18.7	17.8	18.3	17.9	17.7	11.7
5.	Howrah	2.3	2.5	1.9	2.2	1.7	1.8	1.8	2.0
6.	Hooghly	4.6	5.0	4.2	4.8	4.5	6.1	4.6	6.6
7.	24-Parganas	14.2	12.3	13.3	12.7	12.3	10.8	12.7	12.0
8.	Nadia	3.9	2.9	4.5	3.4	3.9	2.1	4.2	4.6
9.	Murshidabad	6.9	6.3	6.3	5.9	5.5	5.0	6.1	6.2
10.	W. Dinajpur	5.7	4.7	8.4	7.3	9.1	7.8	9.1	7.2
11.	Malda	4.3	3.8	3.9	3.0	4.0	3.6	4.2	3.1
12.	Jalpaiguri	4.4	4.1	4.3	4.3	5.1	4.9	5.2	4.0
13.	Darjeeling	0.7	0.9	0.7	0.7	0.8	0.7	0.8	0.8
14.	CoochBehar	4.0	3.5	4.3	3.4	5.3	4.5	5.6	4.7
15.	Purulia	-	-	5.0	4.6	5.3	4.9	4.6	3.9
16.	WEST BENGAL	100	100	100	100	100	100	100	100

Source: Same as for table : 2.4

However, there were districts in which the output contributions have been marginally higher than the area contributions - which implied that these would be the districts with relatively higher yield levels as compared to the state average. These districts were Burdwan, Birbhum, Bankura, Midnapore, Howrah and Hooghly. These districts maintained the same position throughout the three decades with the exception of Midnapore. For Midnapore, the share of output in 1980-83, was not only less than the share in area, but there was large difference between these percentage shares - the area contribution was 17.7 per cent while the output contribution was 11.7 percent. This implied a drastic fall in the yield level in Midnapore over the previous periods.

On the other hand, Nadia and Murshidabad had higher output contributions in 1980-83 as compared to the area contribution. Thus, for these two districts, there had been a rise in yield over the last decade of the period of study.

It will be worthwile to look at the behaviour of the three varieties of rice popular in West Bengal.

Aus:

Aus is the pre-Kharif rice which is sown in April

TABLE : 2.6

SHARE IN AREA AND OUTPUT OF AUS RICE OF THE DISTRICTS IN WEST BENGAL

(in Percent)

S.No	Districts	1950-53		1960-63		1970-73		1980-83	
		Area	Output	Area	Output	Area	Output	Area	Output
1.	Burdwan	3.6	4.5	4.1	4.8	4.0	7.2	3.4	6.6
2.	Birbhum	5.7	8.9	5.6	8.2	6.6	9.4	0.9	1.5
3.	Bankura	12.9	13.6	7.4	6.8	6.1	5.9	3.5	4.1
4.	Midnapore	10.7	10.3	9.5	7.5	9.2	10.0	7.4	7.6
5.	Howrah	0.1	0.2	0.2	0.2	0.4	0.4	0.3	0.5
6.	Hooghly	1.7	2.1	1.4	1.8	2.0	1.8	1.7	3.1
7.	24-Parganas	5.1	5.8	5.1	5.7	3.7	3.4	3.4	5.9
8.	Nadia	15.4	14.7	18.8	20.6	13.2	11.0	13.3	14.9
9.	Murshidabad	16.8	15.5	13.5	13.1	10.7	8.1	14.9	14.9
10.	W. Dinajpur	5.8	5.2	11.3	11.1	14.9	15.5	16.8	9.4
11.	Malda	10.4	10.8	9.0	7.7	8.7	7.4	7.9	6.3
12.	Jalpaiguri	2.9	2.6	3.3	3.4	8.1	8.1	10.5	7.6
13.	Darjeeling	0.08	0.04	0.2	0.2	0.7	0.8	1.1	0.6
14.	CoochBehar	7.6	5.7	8.9	7.7	10.6	8.1	14.9	10.4
15.	Purulia	-	-	0.3	0.4	0.5	0.4	0.2	0.2
16.	WEST BENGAL	100	100	100	100	100	100	100	100

Source : Same as for table 2.4

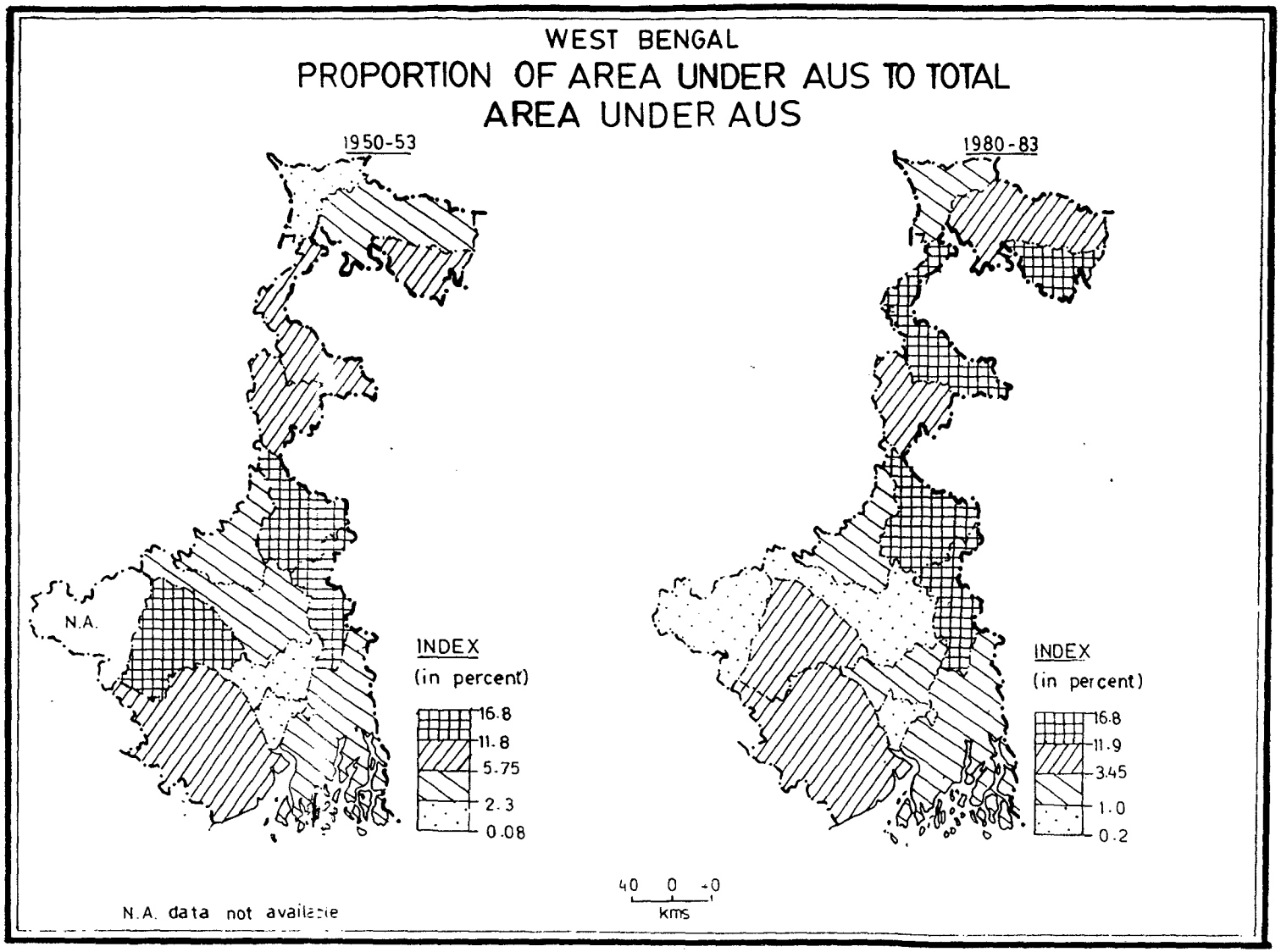
WEST BENGAL
PROPORTION OF AREA UNDER AUS TO TOTAL AREA UNDER AUS
1950-53
1980-83
N.A.
INDEX
(in percent)
16.8
11.8
5.75
2.3
0.08
INDEX
(in percent)
16.8
11.9
3.45
1.0
0.2
40 0 40
kms
N.A. data not available

FIG-2.1

and harvested in September. Aus contributed around 9 percent of total rice production, except in 1970-73, when it contributed more than 14 percent.

Nadia and Murshidabad contributed significantly both in terms of area under and output of Aus throughout the period of study. Bankura which contributed significantly in 1950-53 with area and output contributions of 12.9 and 13.6 percent respectively, had declined by the end of the period of study with 3.5 and 4.1 per cent shares respectively. The contribution to area as well as output in 1980-82 had also declined in case of Midnapore and Malda in comparison to their contributions during 1950-53. Burdwan, West Dinajpur, Jalpaiguri and Cooch-Behar had advanced in terms of shares of both area and output through the period of study. For three districts there were significant differences between contributions of area and output in each decade. Burdwan had almost double the share of output as compared to area. On the other hand, West Dinajpur, Jalpaiguri and Cooch Behar had low output contributions as compared to their area contribution (table 2.6).

TABLE : 2.7

YIELD LEVELS OF AUS RICE IN WEST BENGAL

Year	Yield Levels ((Kg/hect)	Category	Names of Districts	Number of Districts	Percentage of Total Area Under the Crop
1950-53	1007-1230	Very High	Birbhum, Hooghly	2	7.4
	783-1007	High	Burdwan, Bankura, 24-Parganas, Malda	5	32.0
	635-783	Low	Midnapore, Murshidabad, W. Dinajpur, Nadia, Jalpaiguri	5	51.7
	486-635	Very Low	Darjeeling,Cooch Behar	2	7.6
1960-63	943-1112	Very High	Birbhum, Hooghly	2	7.0
	774-943	High	Burdwan, Howrah, 24-Parganas, Nadia, Jalpaiguri	5	31.5
	690-774	Low	Darjeeling, W. Dinajpur, Murshidabad, Bankura	4	32.4
	606-690	Very Low	Purulia, Cooch Behar, Malda, Midnapore	3	27.7
1970-73	1545-1986	Very High	Burdwan, Birbhum	2	10.6
	1104-1545	High	W. Dinajpur, Jalpaiguri, Darjeeling, Hooghly	4	25.7
	962-1104	Low	Bankura, Howrah, 24-Parganas	3	10.2
	819-962	Very	Cooch Behar, Purulia Midnapore, Nadia, Murshidabad, Malda	6	52.9
1980-83	1336-1742	Very High	Burdwan, Birbhum, Howrah, Hooghly, 24-Parganas	5	9.7
	929-1336	High	Murshidabad, Midnapore, Bankura, Nadia	4	38.5
	797-929	Low	W. Dinajpur	1	16.8
	662-797	Very Low	Malda, Jalpaiguri, Darjeeling, Cooch-Behar, Purulia	5	34.6

Source: Same as for table 2.4

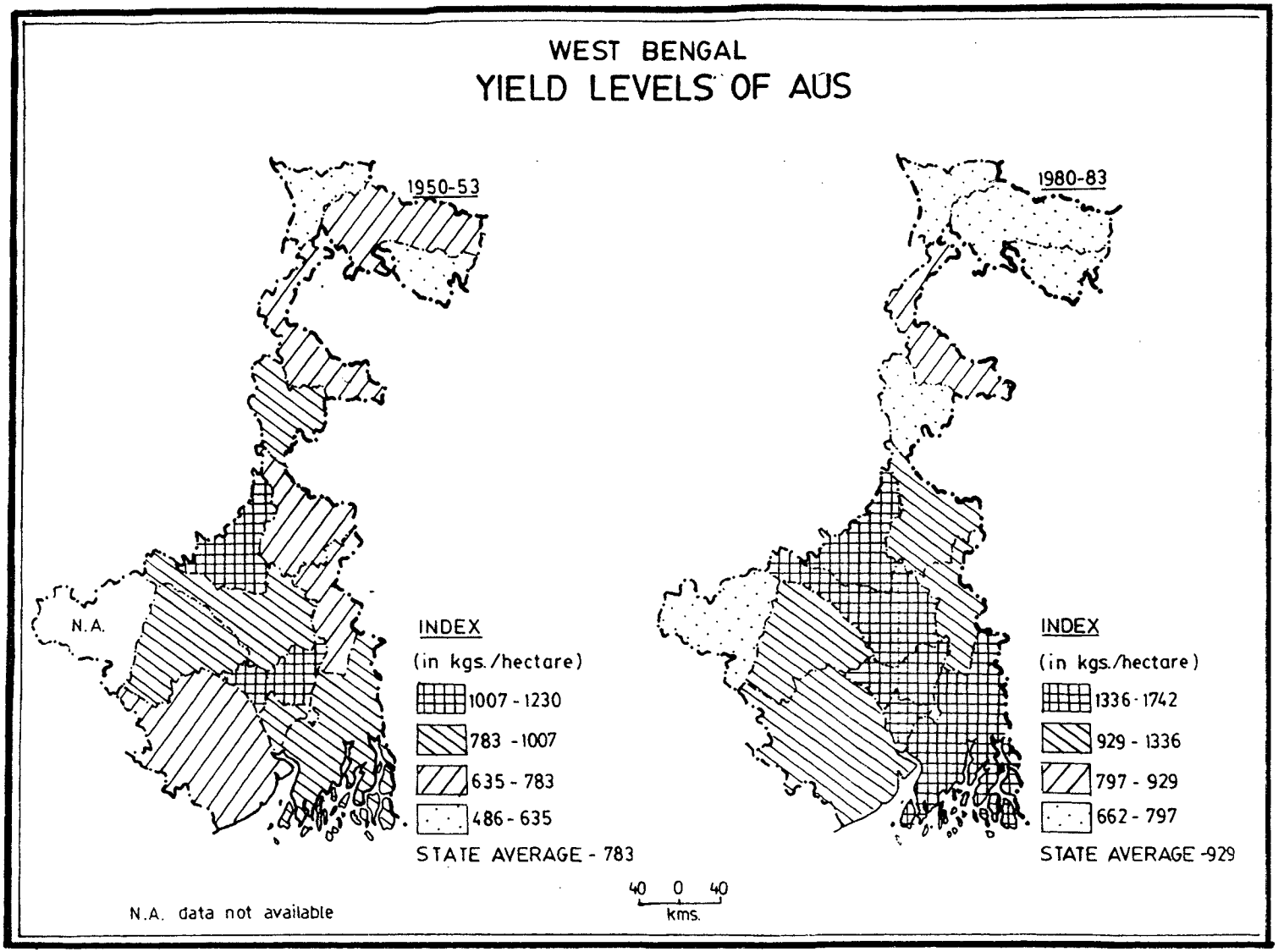
WEST BENGAL
YIELD LEVELS OF AUS
1950-53
1980-83
N.A.
INDEX
(in kgs./hectare)
1007 - 1230
783 - 1007
635 - 783
486 - 635
STATE AVERAGE - 783
INDEX
(in kgs./hectare)
1336 - 1742
929 - 1336
797 - 929
662 - 797
STATE AVERAGE -929
40 0 40
kms.
N.A. data not available

FIG-2-VII

The table 2.7 shows that both in 1950-53 and 1960-63, the high and the low categories occupied most of the area under Aus. However, in 1970-73, the maximum area is occupied by the very low ranges (62.9 percent). In 1980-83, the pattern changed again and the area under Aus was concentrated in the high and very low ranges.

It can be seen from the table that most of the southern districts were above the state average, while most of the northern districts were below it. Birbhum and Hooghly consistently occupied the very high range, while Cooch Behar, Purulia and Malda consistently occupied the lowest range.

The decadal growth rates as well as the growth rates for the thirty year period of Aus rice show that between 1960-63 and 1970-73, for the state as a whole, the rate of growth of production of Aus was very high (7.3 per cent), and the growth rates of area and yield had also been significantly high i.e. 3.5 per cent in both the cases (table 2.8). From 1970-73 to 1980-83, the growth rates for area, production and yield had been negative. Specially, the negative growth rate for production had been quite high at 3.8 percent. This high negative growth rate can be attributed

TABLE : 2.8

GROWTH RATES OF AREA, PRODUCTION AND YIELD OF AUS RICE IN WEST BENGAL

(in Percent)

S.no	Districts	1950 to 1960-63			1960-63 to 1970-73			1970-73 to 1980-83			1950-53 to 1980-83		
		Area	Pro-duction	Yield	Area	Pro-duction	Yield	Area	Pro-duction	Yield	Area	Pro-duction	Yield
1.	Burdwan	2.6	0.5	-0.8	3.5	11.6	8.1	-3.5	-4.6	1.3	0.8	2.8	1.9
2.	Birbhum	1.5	0.5	-1.0	5.0	8.8	3.7	-19.6	-20.0	-0.6	-5.1	-4.4	0.7
3.	Bankura	-4.0	-5.5	-1.5	1.5	6.0	4.2	- 7.1	- 7.2	-0.0	-3.3	-2.4	0.9
4.	Midnapore	0.4	-1.8	-2.2	3.1	1.0	4.5	- 4.2	- 6.4	0.06	-0.3	0.5	0.7
5.	Howrah	2.8	1.5	-1.5	12.1	13.8	1.7	- 5.4	-2.8	3.0	2.9	3.9	1.0
6.	Hooghly	-0.01	-0.03	0.0	7.2	10.2	2.8	- 3.7	-0.8	3.4	0.9	3.0	2.0
7.	24-Parganas	1.6	1.2	-0.7	0.1	4.7	2.0	- 2.8	-1.5	3.8	-0.4	1.6	1.7
8.	Nadia	3.6	4.8	1.3	0.01	0.8	0.7	- 2.2	0.8	1.5	0.4	1.6	1.1
9.	Murshidabad	-7.5	-0.2	0.3	1.1	2.2	0.9	0.6	1.3	1.7	0.3	1.4	1.0
10.	W. Dinajpur	8.4	9.4	0.6	6.4	10.9	4.2	-1.5	-8.4	-3.5	4.3	3.6	0.4
11.	Malda	-0.01	-2.0	-1.8	3.2	6.9	3.4	- 3.2	-5.3	-2.6	-0.02	-0.3	-0.2
12.	Jalpaiguri	3.0	4.5	1.8	12.7	16.6	3.5	0.4	-4.5	-4.8	5.2	5.2	0.1
13.	Darjeeling	8.6	14.7	4.7	20.7	26.3	4.8	2.2	-4.0	-5.9	10.2	11.8	1.1
14.	CoochBehar	1.4	4.6	2.4	5.3	7.7	2.3	0.9	-1.1	-1.9	3.1	3.7	0.9
15.	Purulia	-	-	-	6.2	10.0	3.5	- 9.0	-13.1	-3.6	-	-	-
16.	WEST BENGAL	1.5	1.3	-0.1	3.6	7.3	3.6	-2.2	- 3.8	-1.7	0.9	1.5	0.6

Source : Same as for table 2.4

primarily to decline of area under Aus rather than decline in yield, as eleven districts out of fifteen had witnessed negative growth in area, while eight districts had experienced negative growth in yield, most of which were the districts of North Bengal.

As far as growth of production over the thirty year period was concerned, high growth rate (3.0 per cent and above) had been recorded by six districts out of which five districts experienced high growth rates in area (Howrah, West Dinajpur, Darjeeling and Cooch Behar). Thus, a large part of the increase in production can be attributed to increase in area for these five districts. Hooghly, was the only other district experiencing very high growth rate in output. Hence, in this case, the rise in production can be attributed more to increase in yield rather than area.

Negative growth rates for production had been experienced by three districts out of which two districts, Birbhum and Bankura, had negative growth in area too. The other district, which was Malda, had both negative area and yield growth rates.

Among the rest of the districts, Hooghly was above the state average in growth of area while Burdwan,

Nadiaand Murshidabad were below it. Yield wise, Birbhum, Bankura, Midnapore, Howrah, Nadia, Murshidabad, Darjeeling and Cooch Behar were above the state average, while West Dinajpur and Jalpaiguri were below the state average.

Aman

Aman is a Kharif rice which is sown in June, and is harvested in December. It is also known as the Winter rice due to its time of harvesting. Aman is the main variety of rice cultivated in West Bengal and occupies more than 70 per cent of both area and output of rice of the state. Aman rice is mostly dependent on the monsoon rains.

The indices of growth of Aman rice recorded 174 in case of production, 151 in case of yield and 115 in case of area in 1984-85 (1952-53 = 100). Thus, there had been a considerable increase in yield, which accounted primarily for the increase in production (appendix table 2.8).

As far as the shares of the districts in area and output of Aman rice are concerned, in all the four decades, Midnapore, 24-Parganas and Burdwan contributed

I.O.G. OF AREA, PRODUCTION & YIELD

OF AMAN IN WEST BENGAL(1952/53-1984/85)

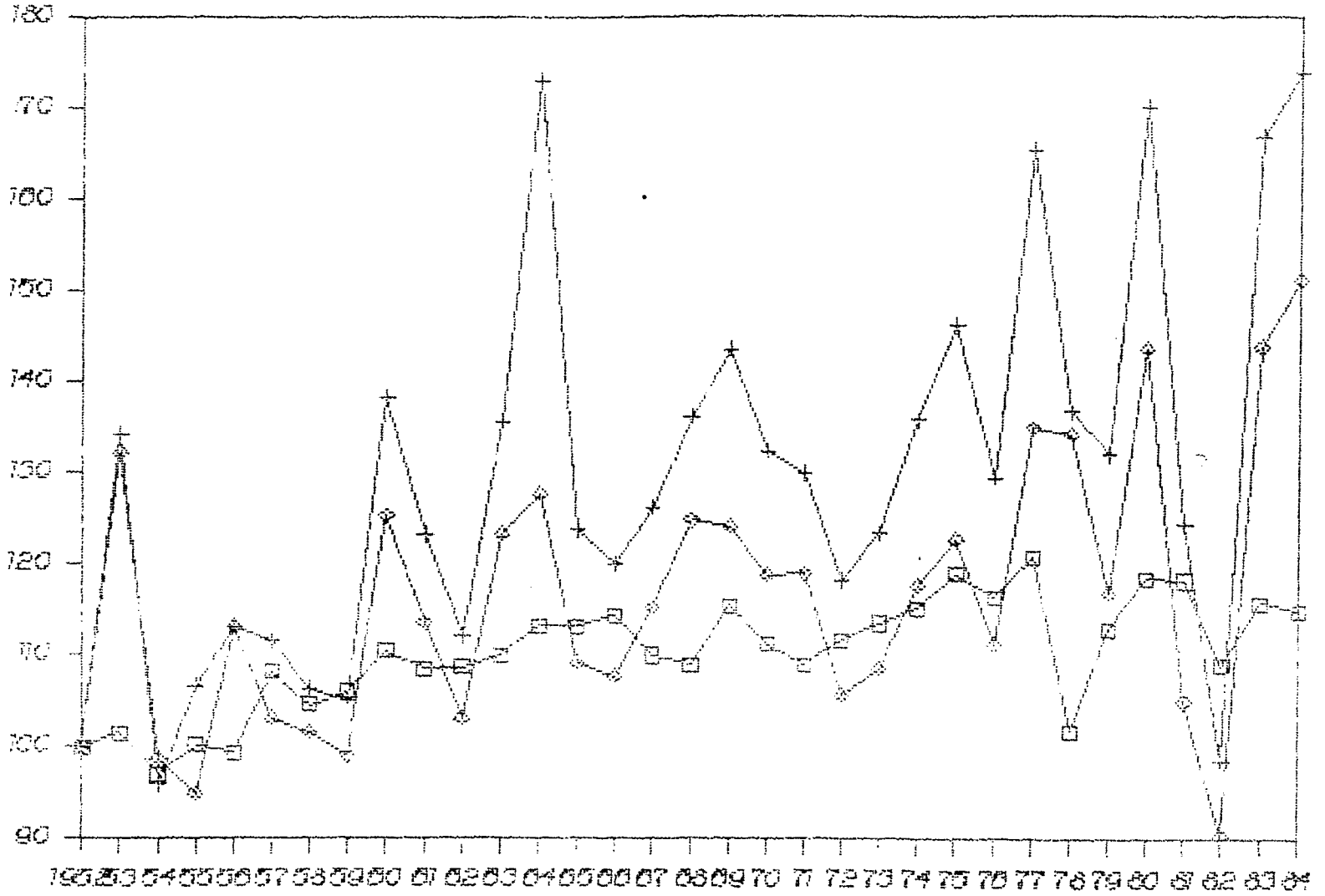

FIG-2.VIII

TABLE : 2.9

SHARE IN AREA AND OUTPUT OF AMAN RICE OF THE DISTRICTS IN WEST BENGAL

(in Percent)

S.No	Districts	1950-53		1960-63		1970-73		1980-83	
		Area	Output	Area	Output	Area	Output	Area	Output
1.	Burdwan	11.8	13.4	11.0	13.7	10.5	12.2	10.2	13.8
2.	Birbhum	8.0	9.7	7.1	8.4	6.8	8.8	7.6	9.0
3.	Bankura	7.9	9.3	7.3	8.4	8.2	9.9	7.9	8.4
4.	Midnapore	23.0	23.6	20.0	18.8	19.6	18.6	19.1	16.2
5.	Howrah	2.6	2.8	2.2	2.4	1.8	1.7	1.9	2.0
6.	Hooghly	4.9	5.3	4.6	5.0	4.1	4.8	4.3	5.8
7.	24-Parganas	15.5	13.1	14.6	13.4	14.2	12.4	14.0	12.1
8.	Nadia	2,4	1.6	2.4	1.7	2.0	1.5	2.4	2.3
9.	Murshidabad	5.4	5.3	5.2	5.2	4.5	4.6	4.7	4.9
10.	W. Dinajpur	5.8	4.7	8.0	7.0	8.4	7.5	8.4	7.2
11.	Malda	3.2	2.8	2.9	2.3	2.8	2.3	3.4	3.6
12.	Jalpaiguri	4.6	4.3	4.4	4.5	4.9	3.6	4.8	4.2
13.	Darjeeling	0.7	0.9	0.8	0.8	0.9	0.8	0.8	0.8
14.	CoochBehar	3.9	3.3	3.6	3.0	4.4	4.6	4.6	4.3
15.	Purulia	-	-	5.5	5.0	6.5	6.6	5.7	5.1
16.	WEST BENGAL	100	100	100	1000	100	100	100	100

Source : Same as for table : 2.4

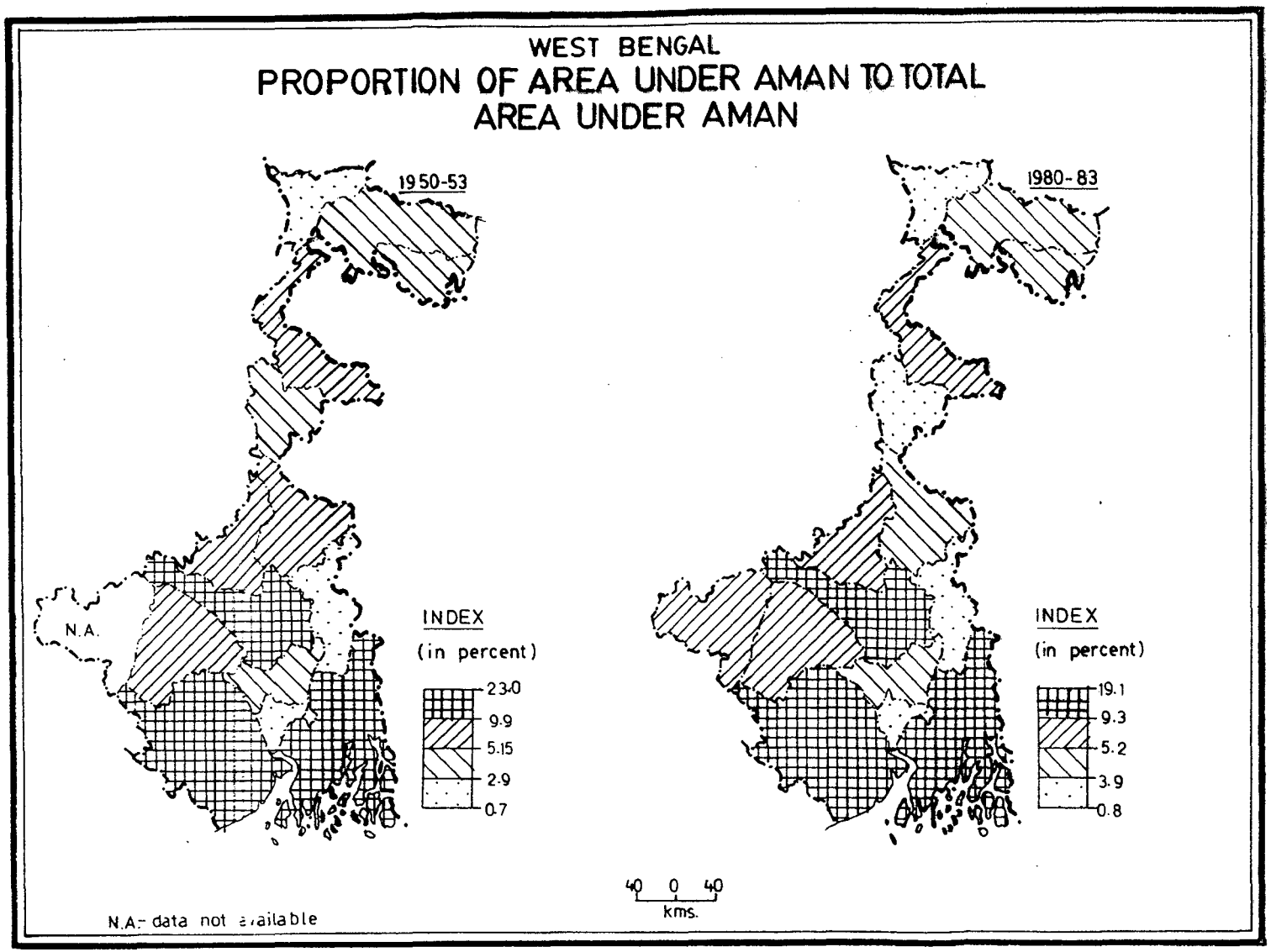
WEST BENGAL
PROPORTION OF AREA UNDER AMAN TO TOTAL AREA UNDER AMAN
1950-53
1980-83
N.A.
INDEX
(in percent)
23.0
9.9
5.15
2.9
0.7
INDEX
(in percent)
19.1
9.3
5.2
3.9
0.8
40 0 40
kms.
N.A.- data not available

FIG.-2.1X

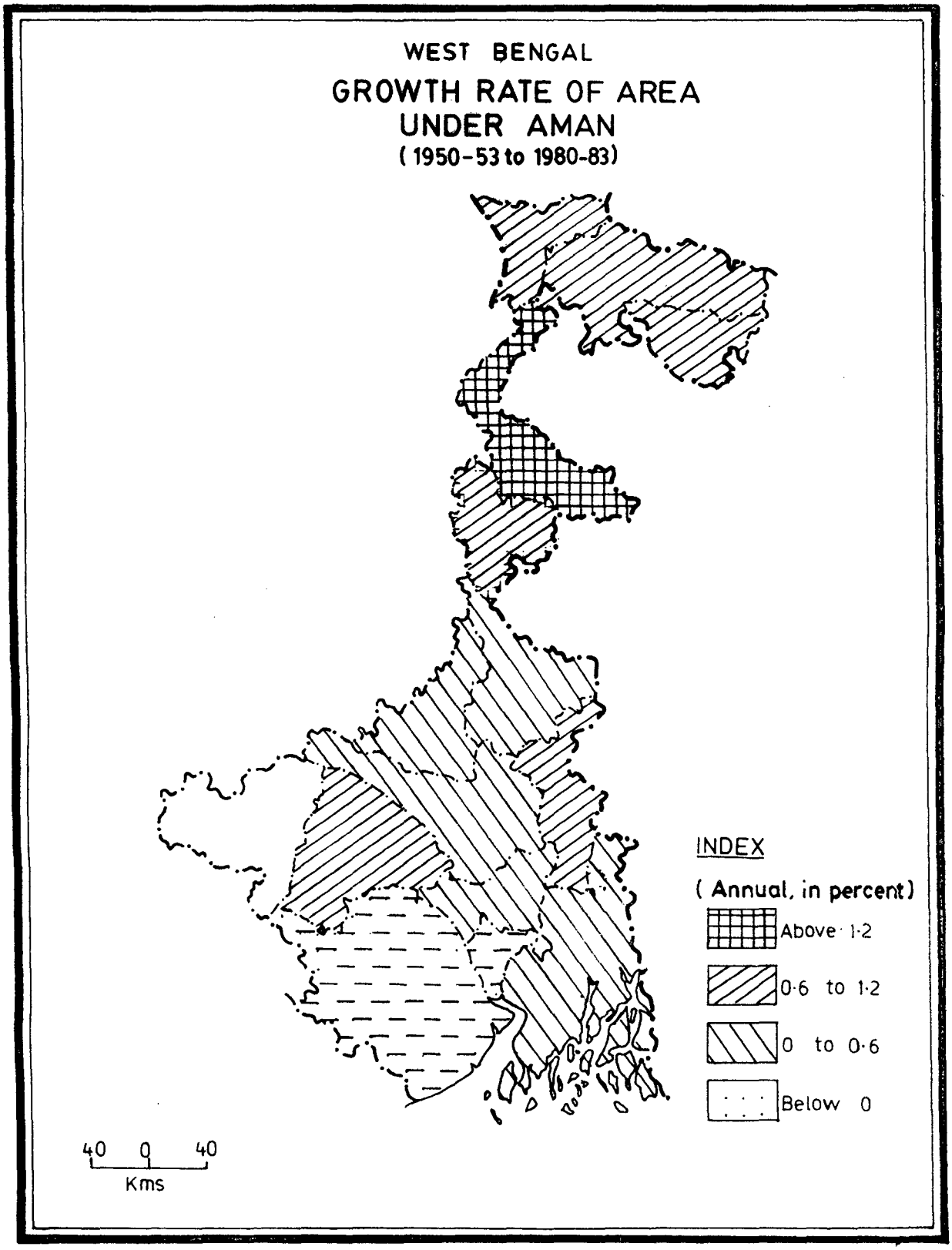
WEST BENGAL
GROWTH RATE OF AREA
UNDER AMAN
(1950-53 to 1980-83)
INDEX
(Annual, in percent)
Above 1·2
0·6 to 1·2
0 to 0·6
Below 0
40 0 40
Kms

FIG.-2·X

above 10 percent individually. Midnapore occupied the first position in all the four time periods in both area and output. However, it should be noted that in the last three decades the shares of output for the above districts were less than the shares in area.

The patterns of share of area and output in case of Aman rice remained almost the same over the three decades with very minor variations. The share of area and output were above 10 per cent in three districts, between 5 and 10 percent in four districts and below 5 per cent in seven districts (table 2.9).

In 1950-53, most of the area under Aman was distributed almost equally within the first three categories of yield levels - very high, high and low. In 1960-63, area under Aman rice was concentrated in the category of low yield districts. In the next decade, the area was equally distributed among all the four categories. In 1980-83, a greater share of the area under Aman rice was in the very low yield category districts. From this it can be noted that with the passage of time, a greater share of the area under Aman rice was accounted for by districts which had lower yield as compared to the state average. The figures

TABLE : 2.10

YIELD LEVELS OF AMAN RICE IN WEST BENGAL

Year	Yield Levels (Kg/hect)	Category	Names of Districts	Number of Districts	Percentage of Total area Under the Crop
1950-53	1107-1222	Very High	Burdwan, Birbhum, Bankura, Darjeeling	4	28.4
	911-1107	High	Midnapore, Howrah, Hooghly	3	30.5
	820-911	Low	24-Parganas, Murshidabad, Malda, Jalpaiguri, Cooch Behar	5	32.6
	648-820	Very Low	Nadia, W. Dinajpur	2	8.2
1960-63	1279-1425	Very High	Burdwan, Birbhum, Bankura	3	25.4
	1133-1279	High	Howrah, Hooghly, Jalpaiguri, Darjeeling	4	12.0
	977-1133	Low	Midnapore, 24-Parganas, W. Dinajpur, Murshidabad, Purulia	5	53.3
	821-977	Very Low	Nadia, Malda, Cooch Behar	3	8.9
1970-73	1299-1458	Very High	Burdwan, Birbhum, Bankura	3	25.5
	1140-1299	High	Hooghly, Murshidabad, Jalpaiguri, Cooch Behar	4	17.9
	1002-1140	Low	Purulia, Darjeeling, Midnapore, Howrah	4	28.8
	864-1002	Very Low	Malda, W. Dinajpur, Ndia, 24-Parganas	4	27.6
1980-83	1390-1540	Very High	Burdwan, Hooghly	2	12.5
	1245-1390	High	Birbhum	1	7.6
	1023-1245	Low	Bankura, Howrah, Nadia, Darjeeling, Cooch Behar	6	21.0
	801-1023	Very Low	Purulia, Jalpaiguri, W. Dinajpur, Murshidabad, 24-Parganas, Midnapore.	6	56.7

Source : Same as for table 2.4

WEST BENGAL

GROWTH RATE OF YIELD OF AMAN

(1950-53 to 1980-83)

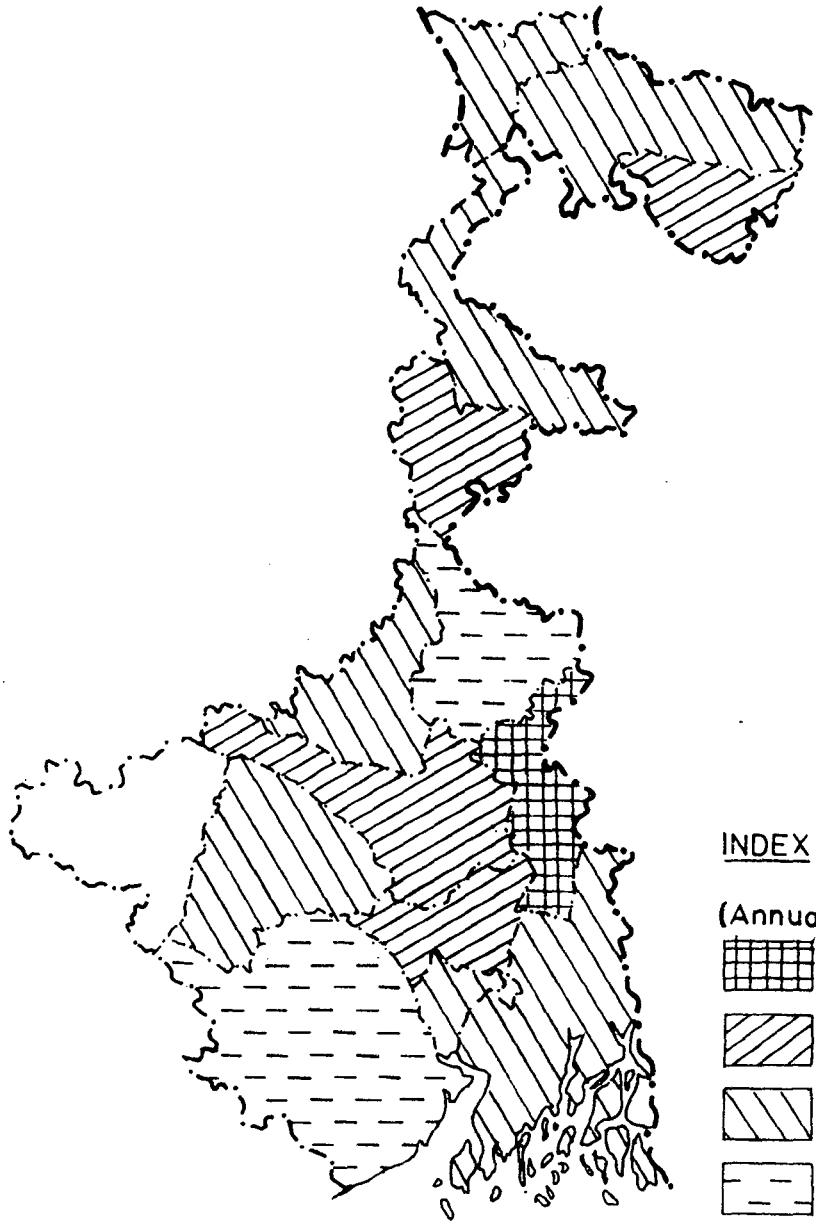

FIG.-2.XII

in table 2.13 also indicate that a very few districts having very high yield rates were pulling up the state average - like Burdwan, Birbhum, Bankura, Hooghly in the later years. Districts like Nadia and West Dinajpur have had consistently low yield levels throughout the period of study. A number of districts of South Bengal like Purulia, Murshidabad, Midnapore, 24-Parganas had come to the lowest category of yield in 1980-83.

Over the thirty year period, there had been significant similarities in the pattern of growth rates of production and yield of Aman rice among districts (table 2.11). There were eleven districts below the state average in both production and yield with 1.0 per cent growth rate case of production and 0.8 per cent in case of yield. Out of these, six districts were below the state average in both production and yield (Birbhum, Bankura, Howrah, 24-Parganas, Jalpaiguri and Darjeeling). On the other hand, five districts - (Burdwan, Hooghly, Malda, Cooch Behar and Nadia) had registered growth rates above the state average in both production and yield.

TABLE : 2.11

GROWTH RATES OF AREA, PRODUCTION AND YIELD OF AMAN RICE IN WEST BENGAL

(in Percent)

S.No	Districts	1950-53 to 1960-63			1960-63 to 1970-73			1970-73 to 1980-83			1950-53 to 1980-83		
		Area	Production	Yield	Area	Production	Yield	Area	Production	Yield	Area	Production	Yield
1.	Burdwan	0.5	2.8	2.4	0.03	-1.2	-0.9	0.02	1.7	1.7	0.1	1.1	1.1
2.	Birbhum	-0.08	1.1	1.2	-0.3	0.6	0.8	1.6	0.6	-1.0	0.4	0.8	0.3
3.	Bankura	0.3	1.5	1.1	1.4	1.8	0.4	0.02	-1.2	-1.4	0.6	0.7	0.03
4.	Midnapore	-0.22	0.2	-0.5	-0.0	-0.0	0.01	0.1	-0.9	-1.1	-0.1	-0.25	-0.2
5.	Howrah	-0.6	1.1	1.7	-1.9	-3.4	-1.3	1.2	2.2	0.8	-0.4	0.05	0.4
6.	Hooghly	0.4	2.1	1.8	-0.8	-0.6	0.3	0.8	2.4	1.5	0.1	1.3	1.2
7.	24-Parganas	0.5	2.8	2.2	-0.2	-0.8	-0.7	0.3	0.2	0.01	0.2	0.7	0.5
8.	Nadia	1.2	3.6	2.4	-1.4	-1.3	0.5	1.9	4.7	2.3	0.6	2.3	1.7
9.	Murshidabad	0.7	2.4	1.7	-1.3	-1.1	0.1	0.8	1.1	-3.5	0.1	0.8	-0.6
10.	W. Dinajpur	4.5	6.8	2.2	0.6	0.5	-0.2	0.4	0.3	0.01	1.8	2.5	0.7
11.	Malda	0.3	0.4	0.1	-0.1	0.2	0.3	2.3	5.1	2.8	0.8	1.9	1.1
12.	Jalpaiguri	0.8	2.7	2.0	1.01	1.9	0.5	0.3	-1.5	1.8	0.7	0.9	0.2
13.	Darjeeling	1.9	1.4	-0.6	1.0	0.2	-0.7	-0.2	0.8	1.0	0.9	0.8	0.1
14.	CoochBehar	0.4	1.7	1.3	2.2	4.3	2.1	0.7	-0.1	-0.8	1.1	1.9	0.8
15.	Purulia	-	-	-	1.9	2.8	1.0	-1.0	-2.1	-1.3	-	-	-
16.	WEST BENGAL	1.2	2.5	1.4	0.1	0.3	0.1	0.4	0.5	0.9	0.6	1.0	0.8

Source : Same as for table : 2.4

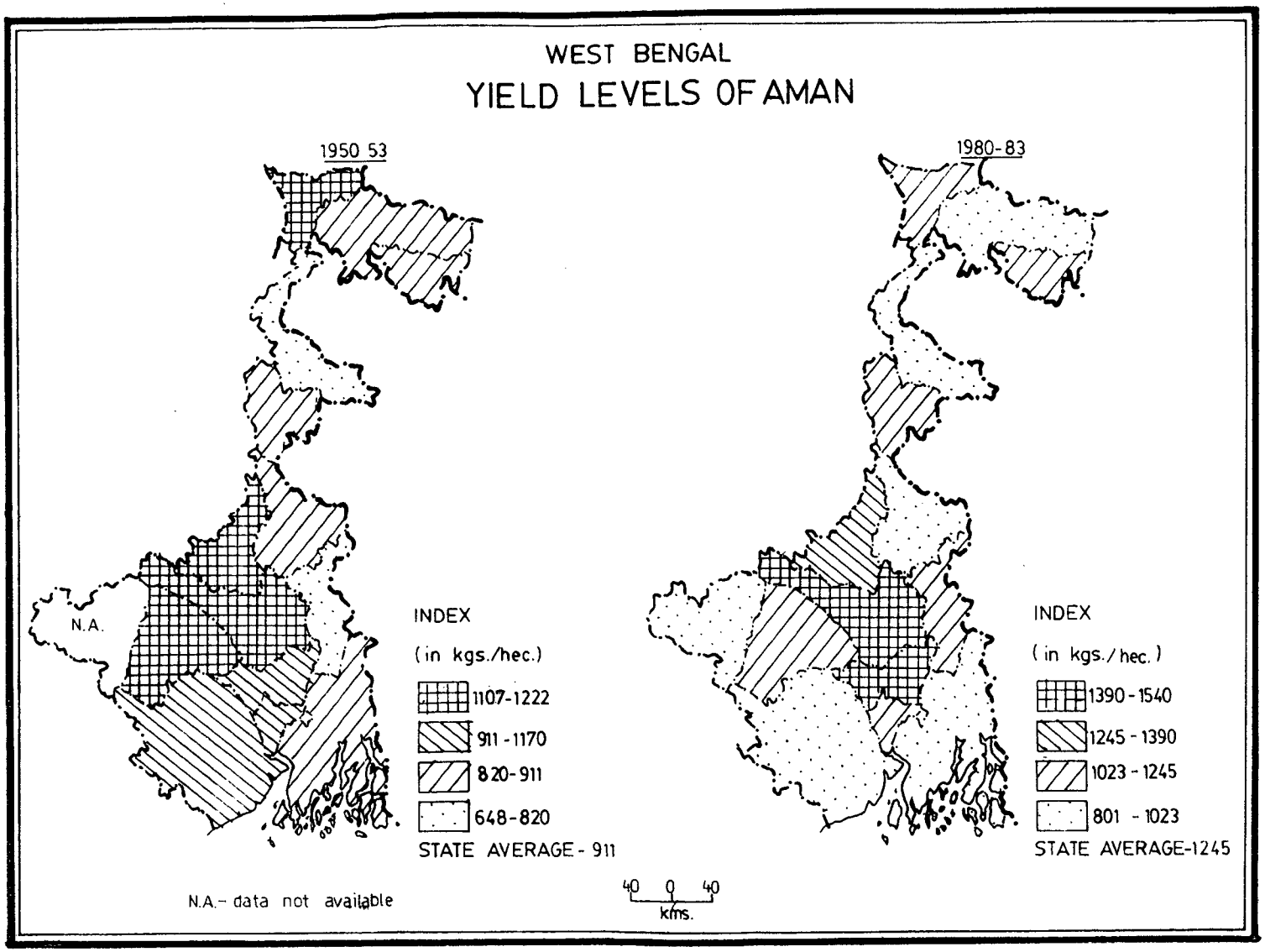
WEST BENGAL
YIELD LEVELS OF AMAN
1950 53
1980-83
N.A.
INDEX
(in kgs./hec.)
1107-1222
911 - 1170
820-911
648-820
STATE AVERAGE - 911
INDEX
(in kgs./hec.)
1390 - 1540
1245 - 1390
1023 - 1245
801 - 1023
STATE AVERAGE-1245
N.A.- data not available
40 0 40
kms.

FIG-2·XI

Midnapore and Murshidabad recorded negative growth rates of yield over the thirty year period. As far as growth rates of area were concerned, seven districts were above the state average, while seven were below it.

It will be worthwhile to examine as to how the decadal growths have affected the overall growth rates. The growth rate of 1 percent in production for the thirty year period had resulted primarily due to the growth in the first decade (1950-53 to 1960-63) which witnessed a growth rate of 2.5 per cent. In the second decade growth was almost stagnant and in the third decade, it was marginal at 0.4 per cent. The growth of area and yield also followed a similar pattern, that is the highest in the first decade, very marginal in the second and marginal in the third (table 2.11).

Boro:

Boro is sown at the end of November and harvested in the mid-June. It necessarily has to grow in an area with irrigation facilities, as none of the districts experience winter rain. Hence, the cultivation of Boro started extensively in the state only after the late sixties.

TABLE : 2.12

YIELD LEVELS OF BORO RICE IN WEST BENGAL

Year	Yield Levels (Kg/hect)	Category	Name of Districts	Number of Districts	Percentage of Total Area Under the Crop
1950-53	1150-1352	Very High	Burdwan	1	6.84
	948-1150	High	Bankura, Howrah, Hooghly, 24-Parganas	5	17.21
	797-948	Low	Midnapore, Murshidabad, Malda	3	74.68
	646-797	Very Low	Birbhum, W. Dinajpur	2	3.45
1960-63	1254-1384	Very High	Birbhum, 24-Parganas, Malda	3	39.24
	1124-1254	High	Burdwan	1	7.90
	923-1124	Low	Howrah, Hooghly, Ndia, Murshidabad, Cooch Behar	5	22.53
	722-923	Very Low	Bankura, Midnapore, W. Dinajpur	3	30.04
1970-73	3297-3689	Very High	Howrah	1	4.76
	2905-3297	High	Burdwan, Birbhum, Hooghly, 24-Parganas, Nadia	5	52.19
	2317-2905	Low	Midnapore, Murshidabad, W. Dinajpur, Purulia, Malda	5	41.22
	1728-2317	Very Low	Bankura, Jalpaiguri, Darjeeling, Cooch Behar	4	1.3
1980-83	3021-3500	Very High	Jalpaiguri	1	0.03
	2541-3021	High	Midnapore, 24-Parganas, Nadia, Malda, Cooch Behar	5	51.31
	2087-2541	Low	Burdwan, Birbhum, Howrah, Hooghly, Murshidabad	5	45.28
	1632-2087	Very Low	Bankura, W. Dinajpur, Purulia	3	3.97

Source : Same as for table 2.4

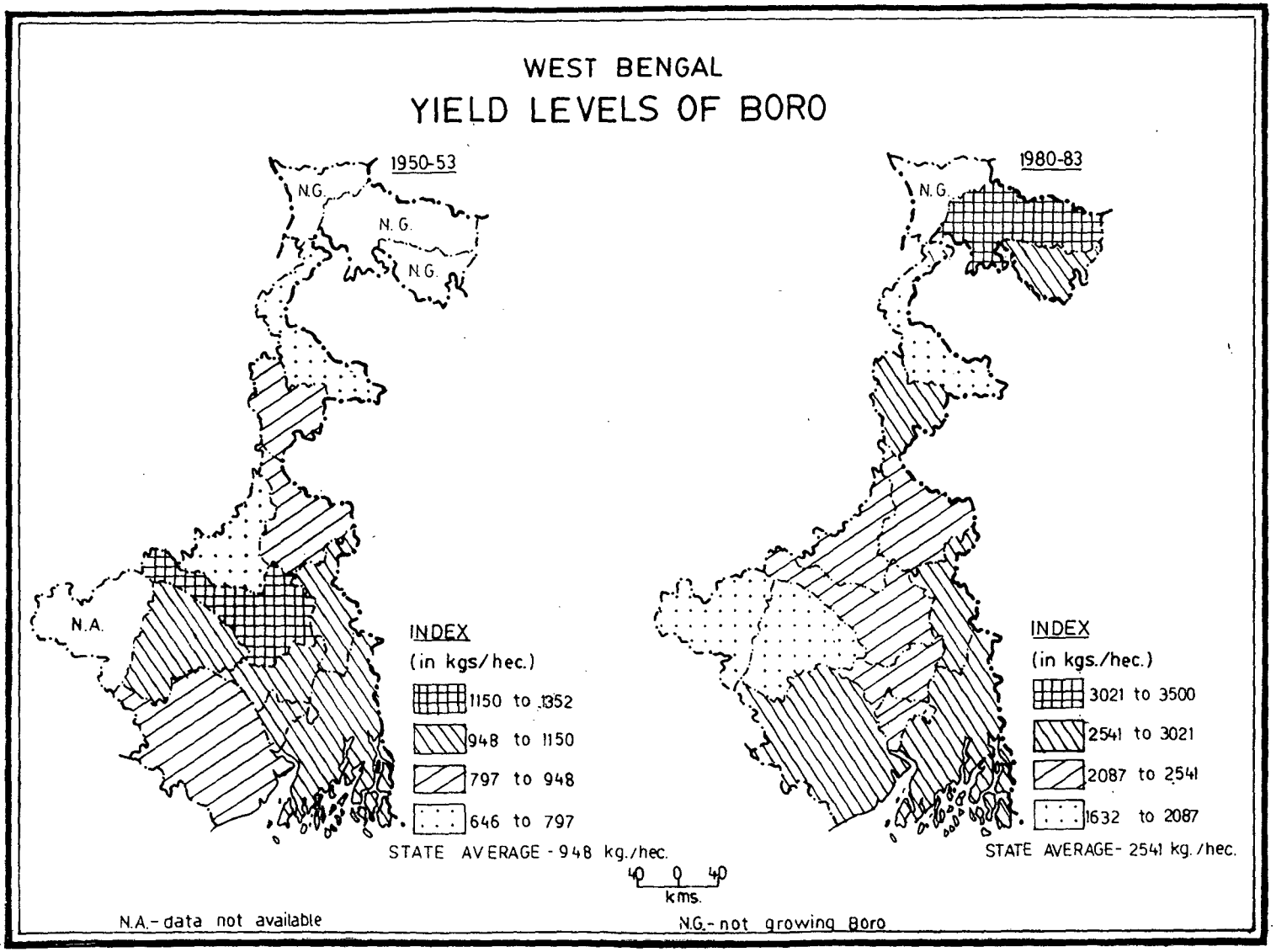
WEST BENGAL
YIELD LEVELS OF BORO
1950-53
N.G.
N.G.
N.G.
N.A.
INDEX
(in kgs/hec.)
1150 to 1352
948 to 1150
797 to 948
646 to 797
STATE AVERAGE - 948 kg./hec.
1980-83
N.G.
INDEX
(in kgs./hec.)
3021 to 3500
2541 to 3021
2087 to 2541
1632 to 2087
STATE AVERAGE- 2541 kg./hec.
40 0 40
kms.
N.A.- data not available
N.G.- not growing Boro

FIG.-2·XIII

As far as yield levels of Boro are concerned, in 1950-53, six districts were above the state average while five districts were below it (table 2.12). However, area-wise a high level of concentration could be seen in the low yield category (74.68 per cent). In 1960-63 four districts were above the state average and eight districts were below it. In 1970-73, six districts were above and nine districts were below the state average. The proportion of area cultivated under Boro was concentrated in the districts of the high and low yield categories. In 1980-83, there was a similar concentration in the proportion of cultivated area and the distribution of districts in the various yield categories. Here, it has to be mentioned that the absolute yield levels of the state increased significantly over the 30 year period, though there had been a slight decline in the yield for the state as a whole from 2905 kg./hec in 1970-73 to 2541 kg/hect. in 1980-83.

The growth rates in 1980-83 over 1950-53 in case of area, production and yield of Boro had been positive among the districts and no district had recorded negative growth rates in any of the elements (table 2.13) The patterns of growth of area and production were almost

TABLE : 2.13

GROWTH RATES OF AREA, PRODUCTION AND YIELD OF BORO RICE IN WEST BENGAL

(in Percent)

S.NO	Districts	1950-53 to 1960-63			1960-63 to 1970-73			1970-73 to 1980-83			1950-53 to 1980-83		
		Area	Production	Yield	Area	Production	Yield	Area	Production	Yield	Area	Production	Yield
1.	Burdwan	6.6	5.4	-1.8	34.8	49.6	10.9	2.1	-1.1	-2.7	13.6	16.0	2.0
2.	Birbhum	7.1	10.2	7.4	19.4	30.9	9.1	6.8	3.3	-3.3	11.1	14.4	4.3
3.	Bankura	25.9	24.7	-1.3	11.9	21.1	8.6	7.9	5.8	-2.4	15.0	16.9	1.5
4.	Midnapore	12.7	12.3	-0.4	24.6	39.6	12.1	-0.3	-0.4	0.9	11.9	16.0	4.1
5.	Howrah	-20.7	-21.5	-1.0	61.4	78.7	13.9	2.1	-3.2	-4.1	7.8	10.7	2.7
6.	Hooghly	3.6	3.1	-1.2	35.6	50.5	8.1	0.1	-2.2	-2.0	12.0	14.9	2.6
7.	24-Parganas	9.8	10.4	2.5	59.5	75.2	8.5	7.4	6.2	-0.8	23.4	27.1	3.3
8.	Nadia	9.9	10.2	0.3	26.1	42.0	11.7	14.5	11.2	-2.0	16.6	20.3	3.2
9.	Murshidabad	8.2	8.7	0.6	13.9	25.9	10.7	7.0	6.6	-0.4	9.6	13.4	3.5
10.	W. Dinajpur	24.9	24.6	-0.2	29.3	48.1	14.5	4.0	0.5	-3.9	19.1	22.9	3.2
11.	Malda	0.6	5.3	4.7	6.3	13.7	6.4	1.8	1.9	0.6	2.9	6.8	3.9
12.	Jalpaiguri	*	*	*	*	*	*	-0.3	4.3	6.7	*	*	*
13.	Darjeeling	*	*	*	*	*	*	*	*	*	*	*	*
14.	CoochBehar	*	*	*	17.5	14.2	5.6	-8.8	-5.4	4.8	*	*	*
15.	Purulia	-	-	-	16.7	39.	10.3	-4.4	-14.3	-3.2	-	-	-
16.	WEST BENGAL	5.0	6.9	1.7	24.2	36.6	10.0	2.7	1.3	-1.3	10.2	13.9	3.3

Source : Same as for table 2.4

* Indicates that there was no production and area under the crop in the base or terminal year or both.

the same, which meant that the growth of area had determined to a large extent the growth of production. However, as Boro rice registered high yield levels as compared to other seasonsal rice, it can be hypothesised that the extension of area can again be primarily attributed to the high yields. There was no district which had experienced high growth rates of yield. Five districts were in the medium range and five in the low range of growth of yield.

The decadal growth rate figures indicate that maximum growth took place during the decade 1960-63 and 1970-73, for all the three elements - area, production and yield. The growth rate of yield of Boro for the state as a whole was negative between the period 1970-73 to 1980-83 and in ten out of the fourteen Boro-producing districts, - the growth rate of yield was also negative. Boro, being a rice variety with high yield potentials this negative growth rate of its yield during this time period calls for investigation to identify the responsible factors.

Since it had a very small base in early 1950s, the indices for area, production and yield in 1984-85 were phenomenal-2402, 6828 and 285 respectively

(appendix table 2.8).

The yield levels of Boro rice were the highest among the varieties of rice and cultivation of this rice has tremendous potential provided irrigation facilities can be developed in the state.

ii) Wheat:

With rice contributing about 90 per cent to the total cereals, wheat is not a very important crop in West Bengal. However, its importance lies in the fact that both in terms of area and production it has been growing in the recent years.

The indices of growth of wheat indicate that in 1984-85 area, production and yield had increased respectively to 779, 2262 and 291 from its base of 1952-53=100. There was a sudden increase in case of area, production and yield from 1971-72, after which all the three elements exhibited steady growth.

Murshidabad was the single largest contributor to the area under wheat for all the three time periods, occupying more the 35 per cent in 1950-53 and above 31 percent in 1980-83. Murshidabad was followed by Nadia which contributed 14.3 per cent and 15.2 per cent

TABLE : 2.14

AREA UNDER WHEAT IN DISTRICTS AS PROPORTION TO TOTAL AREA UNDER WHEAT IN WEST BENGAL

(in Percent)

S.NO	Districts	1951-52	1961-62	1971-72	1981-82
1.	Burdwan	4.30	6.43	7.32	3.66
2.	Birbhum	11.45	14.92	16.80	6.84
3.	Bankura	9.52	8.35	3.39	3.66
4.	Midnapore	1.93	0.77	3.85	3.07
5.	Howrah	-	-	1.37	0.25
6.	Hooghly	1.09	0.77	5.68	2.55
7.	24-Parganas	0.57	0.46	4.48	3.50
8.	Nadia	14.30	10.83	13.87	15.21
9.	Murshidabad	36.34	37.36	25.96	31.29
10.	W. Dinajpur	2.46	2.62	6.95	13.64
11.	Malda	11.04	9.52	7.50	7.62
12.	Jalpaiguri	0.92	1.39	0.30	3.11
13.	Darjeeling	1.00	1.16	0.11	0.79
14.	CoochBehar	5.70	4.25	1.75	4.40
15.	Purulia	-	0.46	0.77	0.43
16.	WEST BENGAL	100.00	100.00	100.00	100.00

Source: Same as for table 2.4

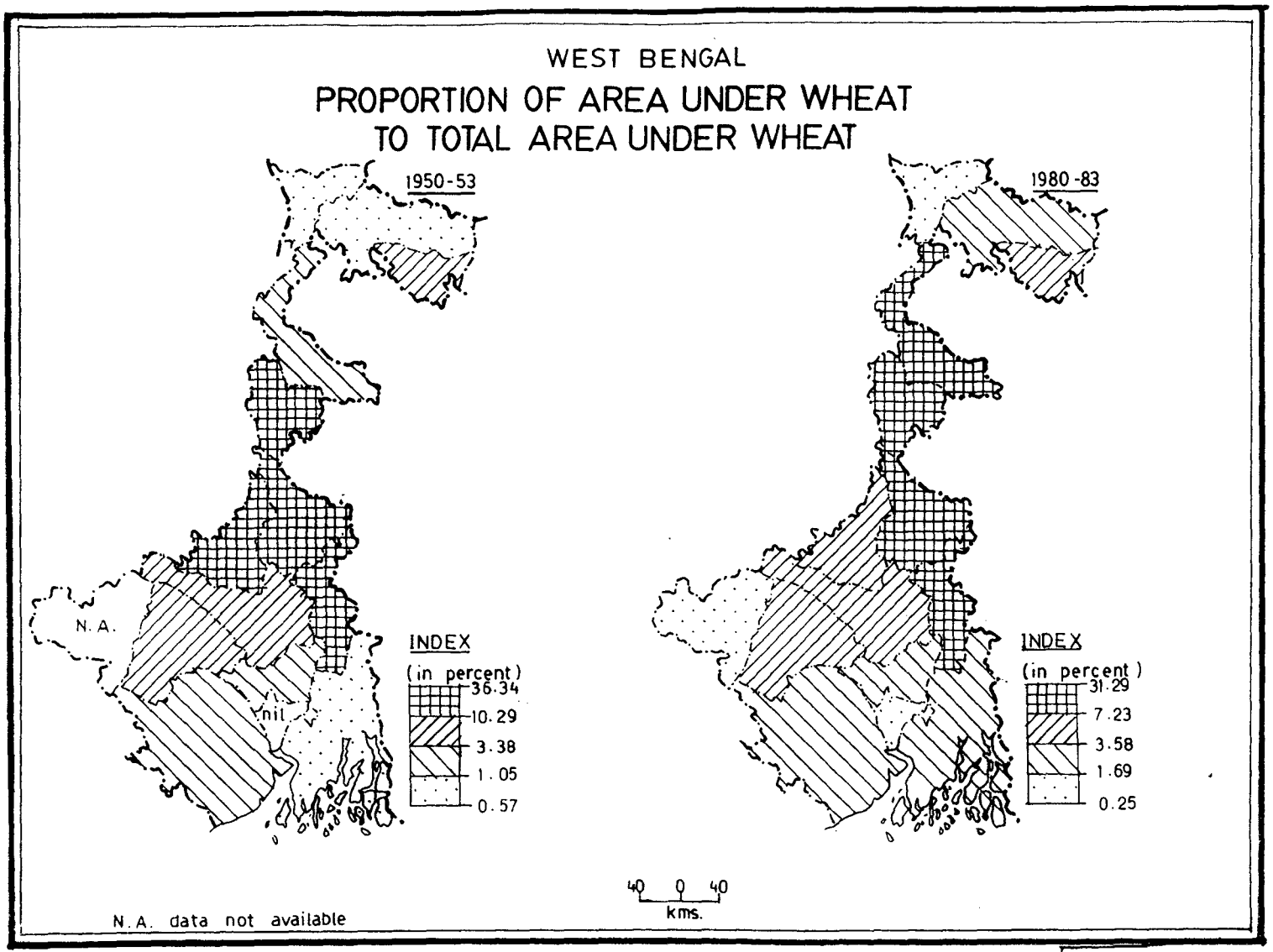
WEST BENGAL
PROPORTION OF AREA UNDER WHEAT
TO TOTAL AREA UNDER WHEAT
1950-53
1980-83
N.A.
nil
INDEX
(in percent)
36.34
10.29
3.38
1.05
0.57
INDEX
(in percent)
31.29
7.23
3.58
1.69
0.25
40 0 40
kms.
N.A. data not available

FIG-2·XIV

in 1950-53 and 1980-83 respectively of the area under wheat. Birbhum contributed above 10 per cent till 1970-73, but this declined to about 7 percent in 1980-83. All the other districts showed individual contributions of less than 10 per cent. The districts which contributed between 5 per cent to 10 per cent in 1950-53 were Bankura, Malda and Cooch-Behar. In 1960-63, Burdwan, Bankura, Malda were in the same category. Again in 1970-73, Burdwan, Hooghly, West Dinajpur and Malda and in 1980-83 only Birbhum and Malda contributed between 5 to 10 per cent of area under wheat. The area contributed by West Dinajpur grew phenomenally from 5.95 per cent in 1970-73 to 13.6 per cent in 1980-83. Thus, it can be seen that with the exceptions of Murshidabad, Nadia and Burdwan, all the other districts exhibited wide variations in terms of their contribution of area in the different time periods (table. 2.14).

An examination of the levels of yield reveals that in 1950-53, four districts were above the state average, while nine districts were below the state average, which was 816 kgs/hectare (table 2.15). The percentage contribution of area under wheat was concentrated in the very high yield category (51.68

TABLE : 2.15

YIELD LEVELS OF WHEAT IN WEST BENGAL

Year	Yield Levels (Kg/hect)	Category	Names of Districts	Number of Districts	Percentage Total Area Under the Crop
1950-53	863-909	Very High	Burdwan, Murshidabad, Malda	3	51.68
	816-863	High	Nadia	1	14-30
	621-816	Low	Birbhum, Bankura, Midnapore, Hooghly, Cooch Behar	5	26.69
	426-621	Very Low	24-Parganas, West Dinajpur, Jalpaiguri, Darjeeling	4	4.95
1960-63	826-945	Very High	24-Parganas, Malda, Darjeeling, Cooch Behar, Purulia	5	15.85
	707-826	High	Burdwan, Midnapore, Hooghly	3	7.97
	651-707	Low	Bankura, Murshidabad, Jalpaiguri	3	47.10
	595-651	Very Low	Birbhum, Nadia, West Dinajpur	3	28.37
1970-73	2290-2426	Very High	Burdwan, Midnapore, Nadia.	3	25.04
	2154-2290	High	Hooghly, Murshidabad, West Dinajpur	3	38.59
	1544-2154	Low	Bankura, 24-Parganas, Malda, Cooch-Behar, Purulia.	6	34.7
	933-1544	Very Low	Howrah, Jalpaiguri, Darjeeling	3	1.78
1980-83	2049-2176	Very High	Nadia, West Dinajpur	2	28.55
	1922-2049	High	Burdwan, Hooghly, Malda, Darjeeling	4	14.67
	1550-1922	Low	Birbhum, Bankura, Midnapore, Howrah, Murshidabad, Jalpaiguri, Cooch Behar, Purulia.	8	53.05
	1177-1550	Very Low	24-Parganas.	1	3.5

Source : Same as for table 2.4

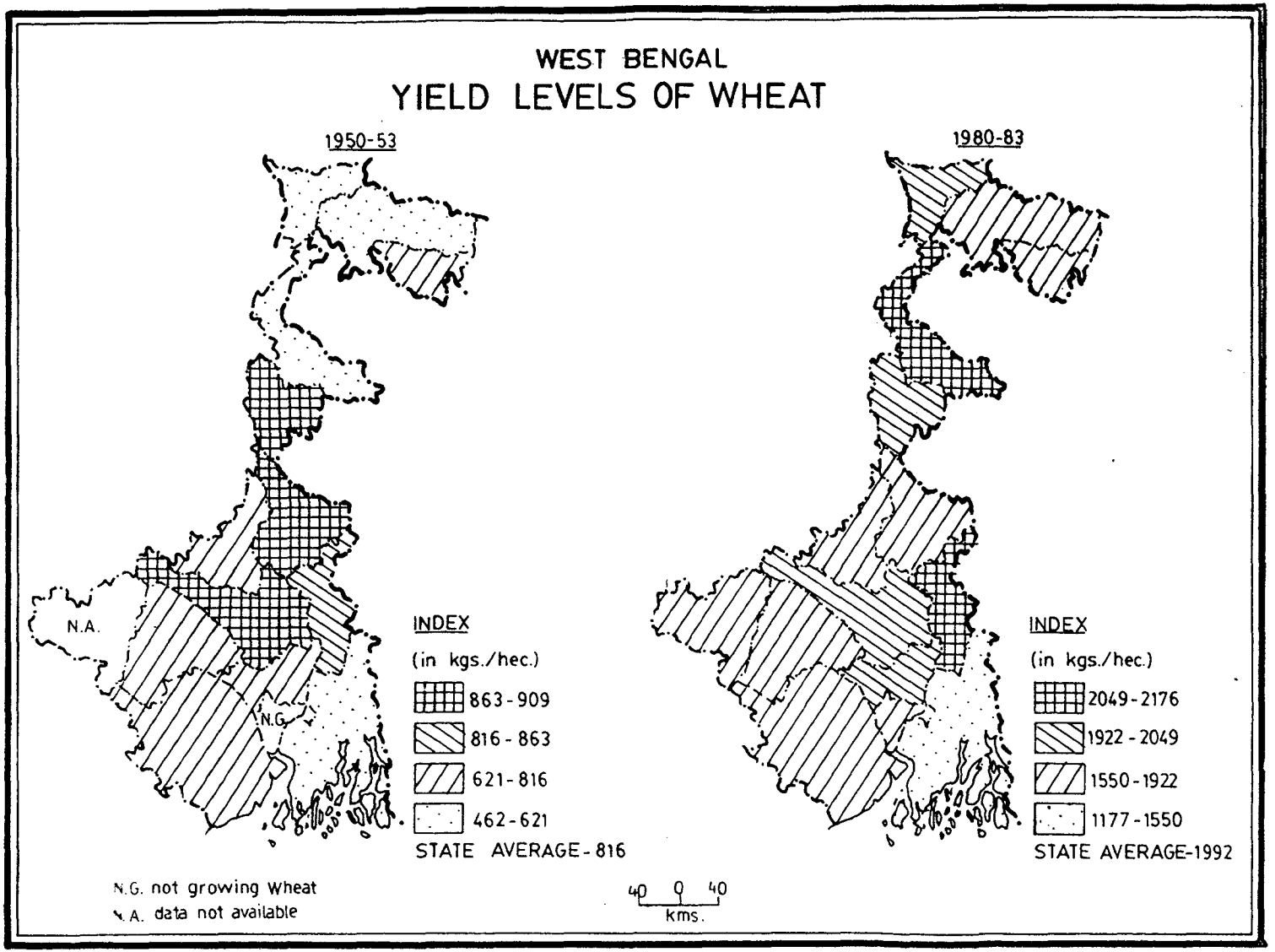
WEST BENGAL
YIELD LEVELS OF WHEAT
1950-53
1980-83
N.A.
N.G.
INDEX
(in kgs./hec.)
863 - 909
816 - 863
621 - 816
462 - 621
STATE AVERAGE - 816
INDEX
(in kgs./hec.)
2049 - 2176
1922 - 2049
1550 - 1922
1177 - 1550
STATE AVERAGE-1992
N.G. not growing Wheat
N.A. data not available
40 0 40
kms.

FIG.-2·XV

per cent). In 1960-63, eight districts were above the state average of 707 kgs/hectare, while six districts were below it. Here, the percentage of area contributed was concentrated in the low and very low yield categories. In 1970-73, six districts were above the state average of 2154 kgs/hectares while nine districts were below the average. However, area was evenly distributed distributed between the very high, high and low yield categories.

In 1980-83, six districts were above the yield level of state average of 1922 kg/hec and nine districts were below it. The low yield category (53.05 percent) districts contributed the highest proportion of area under wheat.

None of the districts of the state witnessed a negative growth rate in area, yield and output of wheat (table 2.16). An interesting feature of the decadal growth rates was that West Bengal as a whole, both in the first and the third decades, experienced negative growth rates for all the three elements-area, production and yield. From 1950-53 to 1960-63 area, production and yield experienced growth rates of -1.2, -2.7 and -1.4 respectively. From 1970-73 to 1980-83

TABLE 2.16

GROWTH RATES OF AREA, PRODUCTION AND YIELD OF WHEAT IN WEST BENGAL

(in Percent)

S.No	Districts	1950-53 to 1960-63			1960-63 to 1970-73			1970-73 to 1980-83			1950-53 to 1980-83		
		Area	Production	Yield	Area	Production	Yield	Area	Production	Yield	Area	Production	Yield
1.	Burdwan	2.8	0.1	-2.3	26.1	42.4	12.9	-10.5	-11.9	-1.7	5.1	7.9	2.7
2.	Birbhum	1.9	0.9	-1.1	25.4	41.1	12.4	-12.3	-14.3	-1.9	3.9	6.9	2.9
3.	Bankura	-12.5	-16.0	-1.4	13.7	25.3	10.7	- 3.3	- 5.1	-1.9	2.3	0.05	2.3
4.	Midnapore	-9.9	-10.0	1.2	46.3	64.8	11.9	-6.2	-8.1	-2.3	7.3	10.1	3.4
5.	Howrah	*	*	*	*	*	*	-19.1	-17.1	1.6	*	*	*
6.	Hooghly	-4.6	-5.1	-0.9	52.1	71.1	12.1	-11.4	-12.7	-1.4	8.7	12.3	3.1
7.	24-Parganas	-3.3	0.0	7.6	56.1	70.8	8.3	- 6.4	-6.5	-5.0	12.2	16.9	3.5
8.	Nadia	-3,9	-6.6	-2.8	27.5	46.6	14.8	- 3.1	-4.3	-1.3	5.9	9.3	3.3
9.	Murshidabad	-0.9	-3.8	-2.8	20.0	35.6	12.9	-2.2	-4.2	-1.9	5.1	7.7	2.5
10.	W. Dinajpur	-0.6	0.0	0.8	37.2	50.9	14.0	2.7	6.6	-0.2	11.9	17.2	4.7
11.	Malda	-2.7	-1.9	0.5	21.5	29.2	7.1	- 3.9	- 2.9	0.5	4.4	7.2	2.7
12.	Jalpaiguri	3.2	5.7	1.3	6.9	13.9	6.2	21.0	25.8	3.8	10.1	14.8	3.8
13.	Darjeeling	0.2	4.3	4.4	- 1.5	- 1.6	0.0	16.6	25.9	7.5	4.8	8.9	3.9
14.	CoochBehar	-4.1	-5.2	2.7	13.9	24.7	5.3	5.2	6.6	1.4	4.8	8.0	3.1
15.	Purulia	-	-	-	31.0	38.9	6.9	-9.5	-8.8	-0.4	-	-	-
16.	WEST BENGAL	-1.2	-2.7	-1.4	24.4	39.0	11.8	-4.0	-5.1	-1.1	5.7	8.7	2.9

Source : Same as for table : 2.4

* Indicates that there was no production and are under the crop in the base or terminal year or both

the rates of growth of area, production and yield were -4.0, -5.1 and -1.1 respectively. However, the positive growth rates of all the three elements in the second sub-period were so high as to offset the negative growth rates of the other two sub-periods with the result that the thirty year period as a whole witnessed positive growth rates for all the three elements.

(iii) Gram:

Gram, in spite of being the most important pulse in West Bengal experienced negative growth rates in area, production and yield over the thirty year period of study.

The districts of Nadia and Murshidabad had been two significant contributors both in terms of area and output of gram over the entire period. Till 1970-73, they occupied the first and second positions respectively for both area and output of gram. In both cases, the shares of output were lower than the shares of area in all the sub periods. Hence, it can be noticed that their yield levels were lower than the state average. Birbhum and Malda were the other two districts which had emerged as significant contributors both in terms of area and output over the period of study.

TABLE : 2.17

SHARE IN AREA AND OUTPUT OF GRAM OF THE DISTRICTS IN WEST BENGAL

(in Percent)

Sl.No.	Districts	1950-53		1960-63		1970-73		1980-83	
		Area	Output	Area	Output	Area	Output	Area	Output
1.	Burdwan	5.4	5.3	4.4	5.2	3.7	2.6	1.8	1.9
2.	Birbhum	6.7	7.7	7.5	6.5	6.5	4.9	11.5	12.7
3.	Bankura	1.5	1.7	1.2	2.0	0.1	0.7	0.5	0.5
4.	Midnapore	1.7	1.5	0.6	0.7	0.4	0.3	-	-
5.	Howrah	0.2	0.2	0.2	0.2	0.1	0.1	-	-
6.	Hooghly	2.0	1.7	1.3	1.2	0.4	0.3	0.4	0.5
7.	24-Parganas	4.9	4.8	6.1	7.0	5.9	8.2	2.1	1.6
8.	Nadia	29.4	33.0	30.8	32.7	36.3	36.4	25.7	17.5
9.	Murshidabad	36.9	35.7	30.2	30.3	27.2	28.8	27.6	22.9
10.	W. Dinajpur	2.7	1.9	2.5	2.8	4.1	4.0	8.5	9.2
11.	Malda	7.7	6.1	13.2	10.5	13.3	14.4	21.3	32.6
12.	Jalpaiguri	0.2	0.1	-	-	-	-	-	-
13.	Darjeeling	0.0	0.0	-	-	-	-	-	-
14.	CoochBehar	0.02	0.1	-	-	-	-	-	-
15.	Purulia	-	-	0.8	0.7	1.0	0.8	0.4	0.5
16.	WEST BENGAL	100	100	100	100	100	100	100	100

Source: Same as for table : 2.4

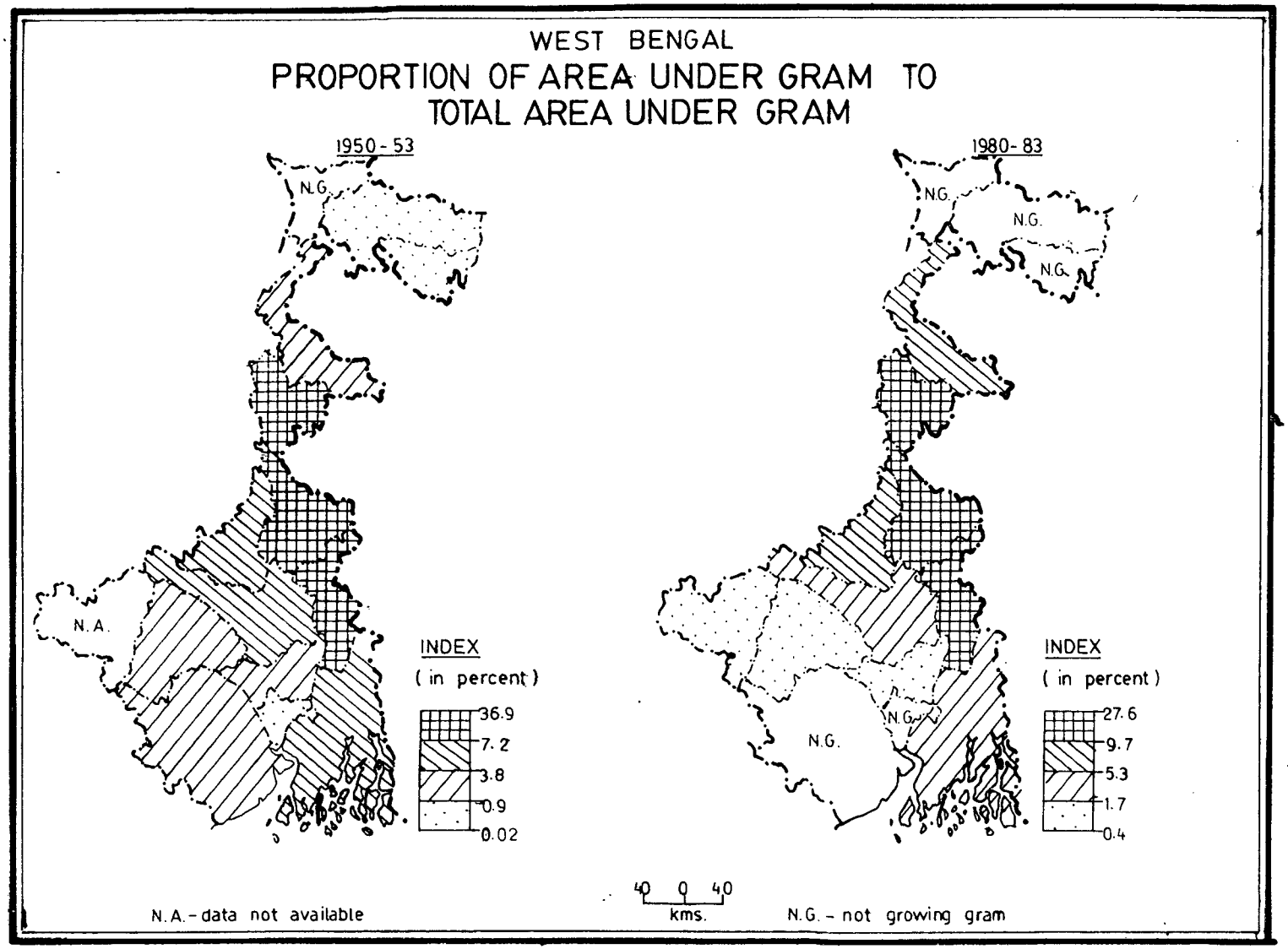
WEST BENGAL
PROPORTION OF AREA UNDER GRAM TO TOTAL AREA UNDER GRAM
1950-53
1980-83
N.G.
N.A.
INDEX
(in percent)
36.9
7.2
3.8
0.9
0.02
27.6
9.7
5.3
1.7
0.4
40 0 40
kms.
N.A. - data not available
N.G. - not growing gram

FIG-2-XVI

Malda occupied the first position in 1980-83, in terms of its contribution both in area and output. The contribution of output was far greater than the contribution of area in Malda, which implies that its yield was far higher than the state average in 1980-83.

In 1950-53, five districts were above the state average of yield levels of gram (833 kgs/hectare), while seven districts were below it. The percentage contribution of area was the maximum (51.6 percent), in the low yield range districts (table 2.18). In 1960-63, seven districts were above the state average of yield of gram (539 kgs/hectare), while five districts were below it. The contributions in terms of area were more or less evenly distributed within the high, low and very low yield categories. In 1970-73, only two districts occupying 40.5 percent of area under gram were above state average while 10 districts were below the average accounting for more than 50 percent of the area under gram. In 1980-83, seven districts were above the state average of yield of gram (645 kgs/hectare), while three were below it.

An examination of the growth rates reveal that most of the districts experienced negative growth over

TABLE : 2.18

YIELD LEVELS OF GRAM IN WEST BENGAL

Year	Yield Levels (Kg/hect)	Category	Names of Districts	Number of Districts	Percentage of Total Area Under the Crop
1950-53	940-1046	Very High	Birbhum, Bankura, Nadia	3	37.6
	833-940	High	Jalpaiguri, Cooch Behar	2	0.22
	737-833	Low	Burdwan, Midnapore, 24-Parganas, Murshidabad, West Dinajpur	5	51.6
	640-737	Very Low	Hooghly, Malda	2	9.7
1960-63	652-764	Very High	Bankura, Midnapore, West Dinajpur	3	4.3
	539-652	High	Burdwan, Howrah, 24-Parganas, Nadia	4	41.5
	487-539	Low	Murshidabad, Purulia	2	31.0
	435-487	Very Low	Birbhum, Hooghly, Malda	3	21.95
1970-73	666-694	Very High	Murshidabad, Malda	2	40.5
	637-666	High		0	0
	556-637	Low	24-Parganas, Nadia, West Dinajpur	3	46.3
	474-556	Burdwan, Birbhum, Bankura, Midnapore, Howrah, Hooghly, Purulia.		7	13.2
1980-83	812-978	Very High	Malda	1	21.3
	645-812	High	Burdwan, Birbhum, Bankura, Hooghly, West Dinajpur, Purulia	6	23.3
	549-645	Low	24-Parganas.	1	2.1
	453-549	Very Low	Nadia, Murshidabad.	2	53.3

Source ; Same as for table : 2.4

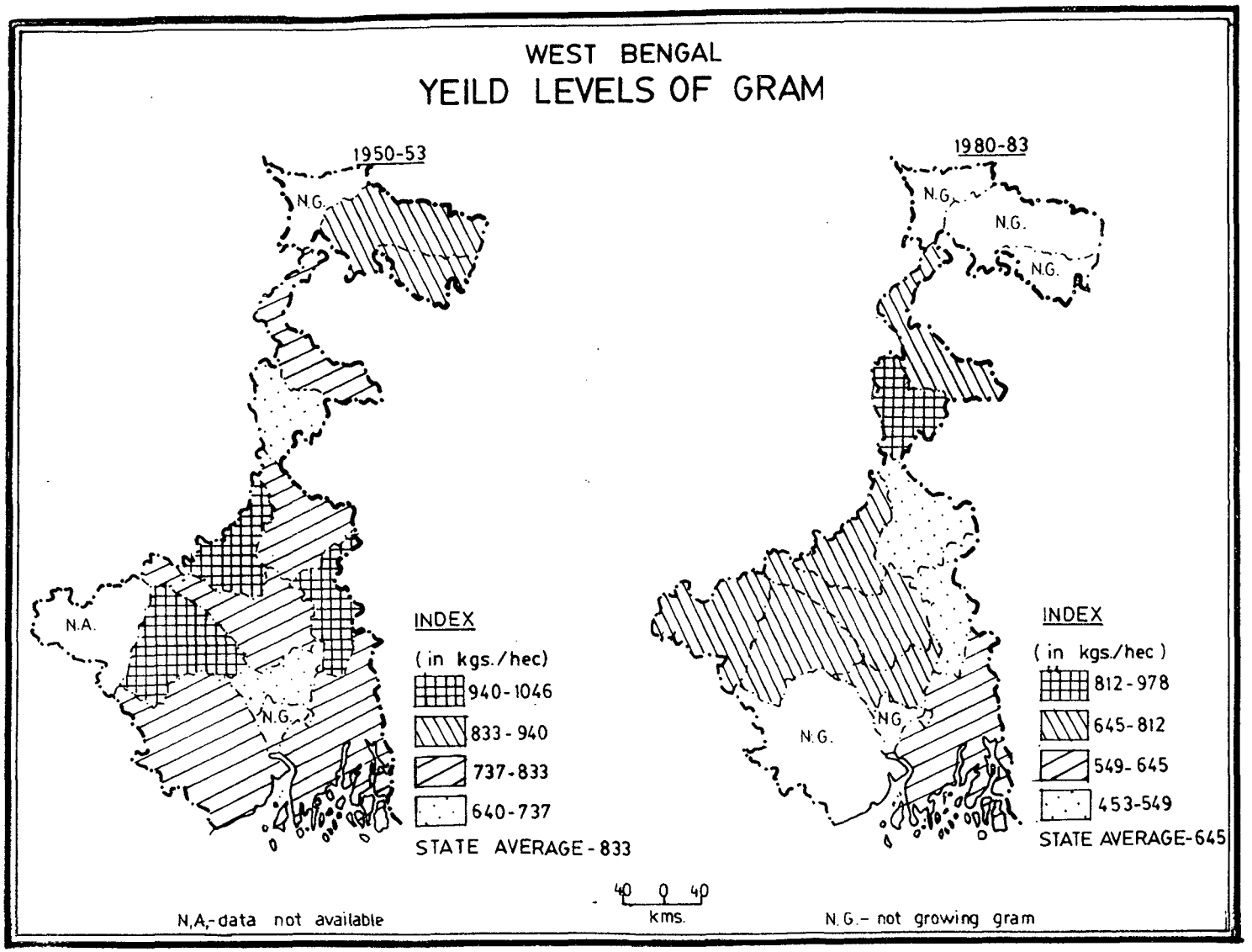
WEST BENGAL
YEILD LEVELS OF GRAM
1950-53
N.G.
N.A.
N.G.
INDEX
(in kgs./hec)
940-1046
833-940
737-833
640-737
STATE AVERAGE-833
1980-83
N.G.
N.G.
N.G.
N.G.
N.G.
INDEX
(in kgs./hec)
812-978
645-812
549-645
453-549
STATE AVERAGE-645
40 0 40
kms.
N.A.-data not available
N.G.- not growing gram

FIG-2 XVII

the period of thirty years. Hence, the growth rate ranges of yield were the following - positive growth, low negative growth, medium negative growth and high negative growth. Only West Dinajpur and Malda in respect to growth of area and output registered positive growth, while in respect of growth of yield, the districts of Hooghly and Malda occupied this positive range. In case of ouput, all the districts other than Birbuhum experienced high negative growth rates as compared to the growth rate for the state as a whole. All the decadal growth rates are negative for the state except the growth rates for production and yield for the second period.

iv) Rape and Mustard:

Rape and Mustard are the most important oilseeds in West Bengal. The indices of growth of Rape and Mustard for area, output and yield for the state as a whole were 267, 368 and 137 respectively in 1984-85 with 1952-53 as the base year.

The trends of percentage shares of the districts for area and output are very interesting. Upto 1970-73, the districts of North Bengal, viz; Cooch-Behar, Malda, West Dinajpur and Jalpaiguri were the most

TABLE : 2.19

SHARE IN AREA AND OUTPUT OF RAPE AND MUSTARD OF THE DISTRICTS IN WEST BENGAL

(in Percent)

S.No	Districts	1950-53		1960-63		1970-73		1980-83	
		Area	Output	Area	Output	Area	Output	Area	Output
1.	Burdwan	1.4	1.0	3.1	2.8	3.1	3.0	15.0	22.6
2.	Birbhum	0.1	0.7	0.6	0.6	1.9	1.7	9.5	9.1
3.	Bankura	1.4	1.4	1.8	2.0	1.9	1.8	2.8	3.8
4.	Midnapore	4.4	2.7	3.4	3.2	3.0	2.9	1.9	0.9
5.	Howrah	0.03	0.2	0.1	0.3	0.2	0.3	0.1	0.1
6.	Hooghly	0.1	0.8	1.2	0.9	2.4	2.2	3.0	3.4
7.	24-Parganas	3.4	2.4	4.5	3.5	8.4	8.8	8.4	7.0
8.	Nadia	4.4	4.3	9.8	9.3	13.3	12.0	14.0	16.0
9.	Murshidabad	9.6	16.8	11.9	12.3	12.2	14.5	14.0	15.5
10.	W. Dinajpur	25.6	20.8	28.0	34.3	21.1	24.1	14.5	9.5
11.	Malda	15.8	19.0	16.7	18.7	14.2	14.3	5.3	5.3
12.	Jalpaiguri	14.6	13.9	6.8	4.4	8.1	4.4	5.2	3.4
13.	Darjeeling	1.8	2.0	1.0	1.1	0.6	0.5	0.3	0.2
14.	CoochBehar	15.6	13.9	9.6	5.8	7.8	7.4	4.7	2.7
15.	Purulia	-	-	1.2	0.8	1.7	1.7	0.2	0.3
16.	WEST BENGAL	100	100	100	100	100	100	100	100

Source : Same as for table : 2.4

TABLE : 2.20

YIELD LEVELS OF RAPE & MUSTARD IN WEST BENGAL

Year	Yield Levels (Kg/hect)	Category	Names of Districts	Number of Districts	Percentage of Total Area Under the Crop
1950-53	651-834	Very High	Murshidabad	1	9.6
	468-651	High	Birbhum, Malda, Darjeeling	3	17.7
	367-468	Low	Bankura, Howrah, Hooghly, Nadia, W. Dinajpur, Jalpaiguri, Cooch-Behar	7	61.7
	265-367	Very Low	Burdwan, Midnapore, 24-Parganas	3	9.2
1960-63	431-500	Very High	Howrah, West Dinajpur	2	28.1
	361-431	High	Birbhum, Bankura, Murshidabad, Malda, Darjeeling	5	32.0
	296-361	Low	Burdwan, Midnapore, Nadia.	3	16.3
	231-296	Very Low	Hooghly, 24-Parganas, Jalpaiguri, Cooch-Behar, Purulia	5	23.3
1970-73	434-500	Very High	Howrah, Murshidabad	2	12.4
	367-434	High	24-Parganas, West Dinajpur	2	29.5
	281-367	Low	Burdwan, Birbhum, Midnapore, Hooghly, Nadia, Malda, Darjeeling Purulia, Cooch-Behar	9	48.0
	194-281	Very Low	Bankura, Jalpaiguri	2	10.0
1980-83	720-867	Very High	Burdwan, Bankura, Howrah, 24-Parganas.	4	26.3
	572-720	High	Hooghly, Nadia, Murshidabad, Purulia	4	32.0
	428-572	Low	Birbhum, Malda	2	14.8
	283-428	Very Low	Midnapore, West Dinajpur, Jalpaiguri, Darjeeling, Cooch-Behar.	5	26.6

Source: Same as for table 2.4

important contributors both in case of area and production. However, by 1980-83, their position had declined and the major contributing districts in 1980-83 were the districts of South Bengal, viz; Burdwan, Birbhum, Nadia and Murshidabad.

An examination of the yield levels reveals that in 1950-53, four districts were above the state average (468 kgs/hectares), while ten districts were below it. There were seven districts which, together, accounted for 61.71 per cent of the area under Rape and Mustard. In 1960-63, seven districts were above the state average, while eight were below it. In 1970-73, four districts were above the state average, while eleven were below it. These eleven districts accounted for almost 60 per cent of the total area under Rape and Mustard. In 1980-83 eight districts were above the state average of 572 kg/hectare, while seven were below it.

An interesting fact which emerged was that the districts of North Bengal have recorded growth rates below that of the state average and most of these districts experienced negative growth in area, production and yield. On the other hand, most of the districts of South Bengal have experienced high or very high

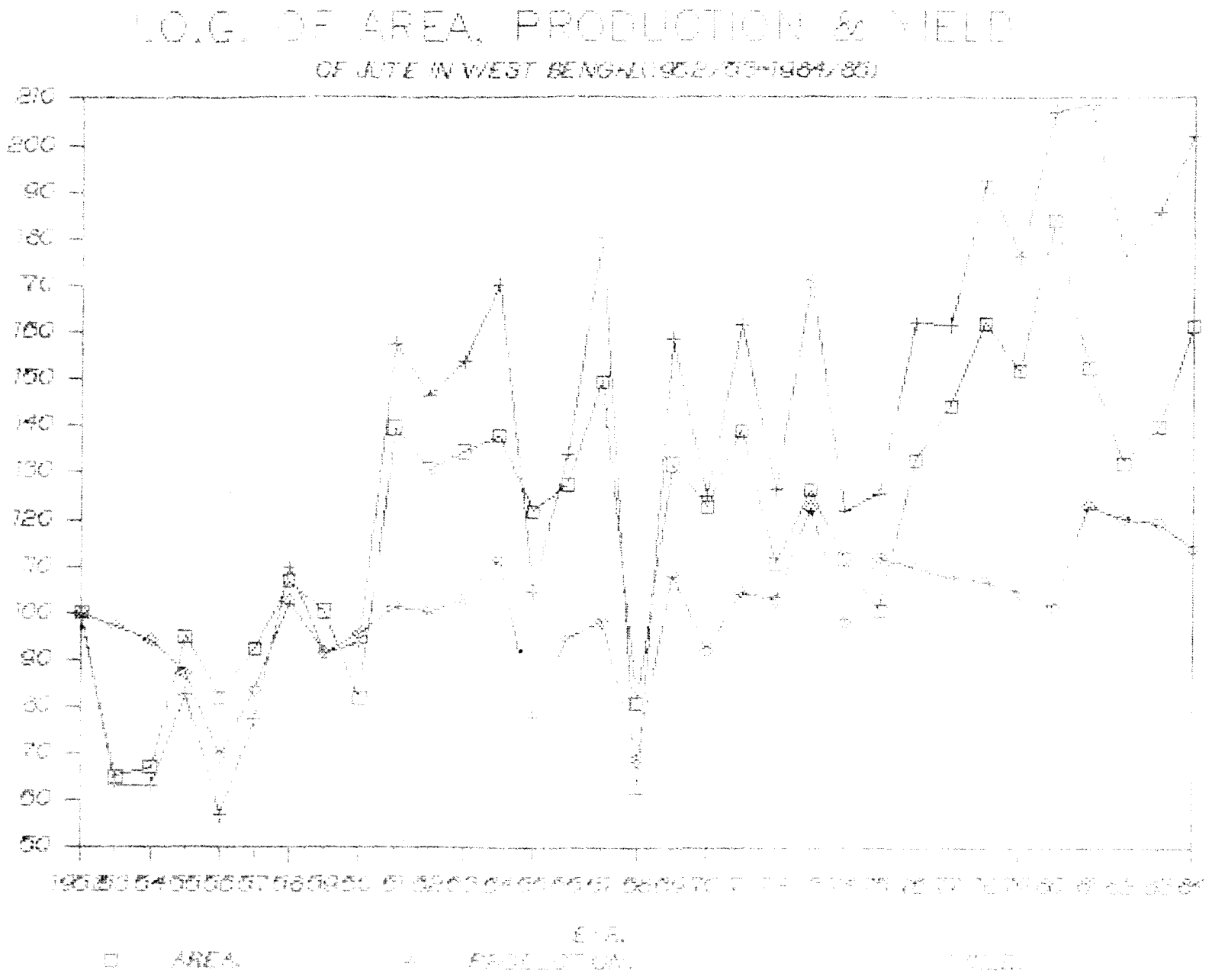
TRENDS OF AREA, PRODUCTION & YIELD
OF JUTE IN WEST BENGAL (62/63-1984/85)
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
AREA
PRODUCTION
YIELD

FIG - 2:XVIII

growth rate in these elements over the thirty year period.

v) Jute:

Jute is the most important industrial crop in West Bengal and West Bengal has been and is the highest producer of Jute in India.

The indices of growth of area, production and yield of Jute in 1984-85 were 161, 202, and 113, respectively (base year 1952-53=100). Even though the index of yield was relatively less, it had experienced steady growth throughout the period, unlike the indices of area and output. Area under jute and production of jute increased rapidly till 1970-71 and then fluctuated till 1984-85 with the result that the figures for area and production area almost the same in 1984-85 as compared to 1970-71.

Four districts of South Bengal i.e. Hooghly, 24-Parganas, Nadia and Murshidabad, along with Cooch Behar in North Bengal, were the significant contributors in area and output of jute throughout the thirty year period. However, in 1980-83, two districts of North Bengal - West Dinajpur and Jalpaiguri - had come

TABLE : 2.21

SHARE IN AREA AND OUTPUT OF JUTE OF THE DISTRICTS IN WEST BENGAL

(in Percent)

S.No	Districts	1950-53		1960-63		1970-73		1980-83	
		Area	Output	Area	Output	Area	Output	Area	Output
1.	Burdwan	3.3	3.9	3.0	3.2	2.3	3.1	2.8	4.6
2.	Birbhum	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
3.	Bankura	0.4	0.3	0.3	0.3	0.3	0.4	0.2	0.3
4.	Midnapore	5.6	6.1	2.5	3.0	2.7	3.2	2.9	4.1
5.	Howrah	2.2	2.6	1.6	2.2	0.8	1.2	1.1	1.1
6.	Hooghly	10.1	12.4	9.4	13.1	6.0	9.1	5.6	7.9
7.	24-Parganas	14.9	15.9	10.4	11.9	9.4	11.6	11.3	13.3
8.	Nadia	13.4	11.1	11.6	11.8	17.2	17.6	19.8	21.4
9.	Murshidabad	19.4	16.9	15.9	14.3	16.7	17.0	14.8	14.8
10.	W. Dinajpur	6.9	6.2	13.9	10.6	14.8	11.2	14.1	9.6
11.	Malda	8.6	8.6	6.2	4.7	4.9	3.8	5.4	4.1
12.	Jalpaiguri	5.1	5.5	10.3	11.1	10.0	9.1	9.2	8.1
13.	Darjeeling	0.5	0.5	0.8	1.1	1.3	0.6	0.6	0.4
14.	CoochBehar	9.4	11.4	12.8	12.4	13.7	11.8	12.1	10.0
15.	Purulia	-	-	0.1	0.1	0.02	0.01	0.0	0.0
16.	WEST BENGAL	100	100	100	100	100	100	100	100

Source : Same as for table : 2.4

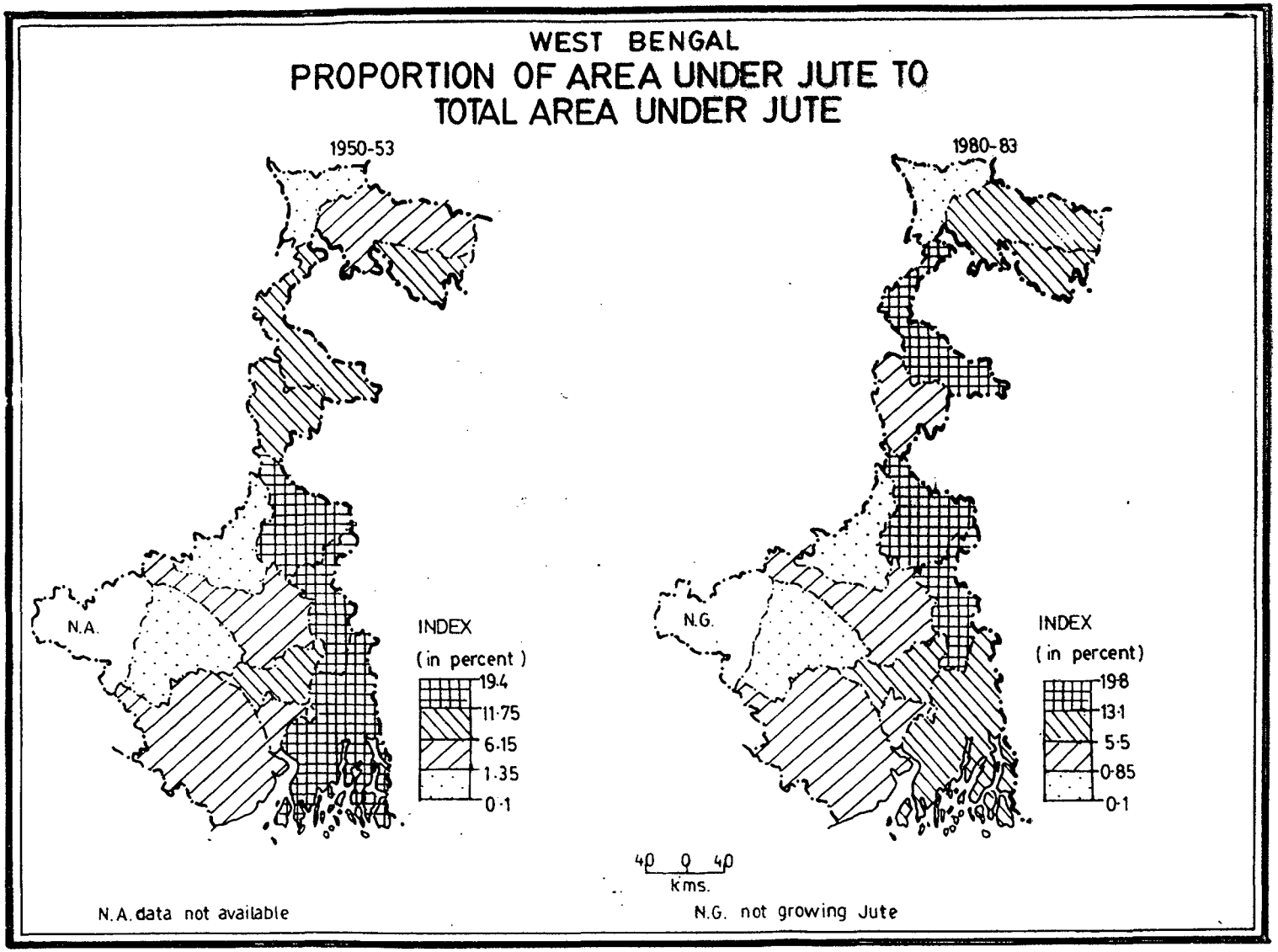
WEST BENGAL
PROPORTION OF AREA UNDER JUTE TO
TOTAL AREA UNDER JUTE
1950-53
1980-83
N.A.
N.G.
INDEX
(in percent)
19·4
11·75
6·15
1·35
0·1
INDEX
(in percent)
19·8
13·1
5·5
0·85
0·1
40 0 40
kms.
N.A. data not available
N.G. not growing Jute

FIG.-2·XIX

up significantly and accounted for increased shares especially for area under jute.

Most of the districts in South Bengal in 1980-83 accounted for a greater share in output as compared to area. This implied higher productivity for these districts as compared to the state as a whole. The districts of North Bengal on the other hand, accounted for a greater shares of area than output, indicating lower productivity than for the state as a whole.

The yield levels reveal that nine districts were above the state average of 1163 kg/hectare, while five districts were below it. Area under jute was fairly evenly distributed among the various yield level ranges, with the exception of the low yield range which had just one district, Darjeeling, accounting for a mere 0.5 percent of area under jute. In 1960-63, eight districts were above the state average of 1283 kgs/hectare, while seven districts were below it. More than 62 per cent of area under jute was accounted for by districts in the low and very low yield ranges. In 1970-73, ten districts were above the state average of 1290 kgs per hectare, while five districts were below it. About

TABLE : 2.22

YIELD LEVELS OF JUTE IN WEST BENGAL

Year	Yield Levels (Kg/hect)	Category	Names of Districts	Number of Districts	Percentage of the Total Area Under Crop
1950-53	1298-1432	Very High	Burdwan, Howrah, Hooghly, Cooch-Behar	4	25.0
	1163-1298	High	Birbhum, Midnapore, 24-Parganas, Malda, Jalpaiguri	5	34.3
	1063-1163	Low	Darjeeling	1	0.5
	963-1063	Very Low	Bankura, Nadia, Murshidabad, West Dinajpur	4	40.1
1960-63	1544-1804	Very High	Howrah, Hooghly, Darjeeling	3	11.8
	1283-1544	High	Burdwan, Birbhum, Bankura, 24-Parganas, Jalpaiguri	5	24.1
	1132-1283	Low	Midnapore, Nadia, Murshidabad, Cooch-Behar	4	42.8
	980-1132	Very Low	West Dinajpur, Malda, Purulia	3	20.2
1970-73	1617-1944	Very High	Burdwan, Birbhum, Bankura, Howrah, Hooghly, Purulia	6	9.5
	1290-1617	High	Midnapore, 24-Paraganas, Nadia, Murshidabad	4	45.8
	1133-1290	Low	Jalpaiguri	1	10.0
	976-1133	Very Low	West Dinajpur, Malda, Darjeeling, Cooch Behar	4	34.7
1980-83	1944-2404	Very High	Burdwan, Birbhum, Midnapore, Hooghly	4	11.4
	1484-1944	High	Bankura, Howrah, 24-Parganas, Nadia, Murshidabad	5	47.2
	1201-1484	Low	Jalpaiguri, Darjeeling, Cooch-Behar	3	21.9
	927-1201	Very Low	West Dinajpur, Malda	2	19.5

Source : Same as for table 2.4

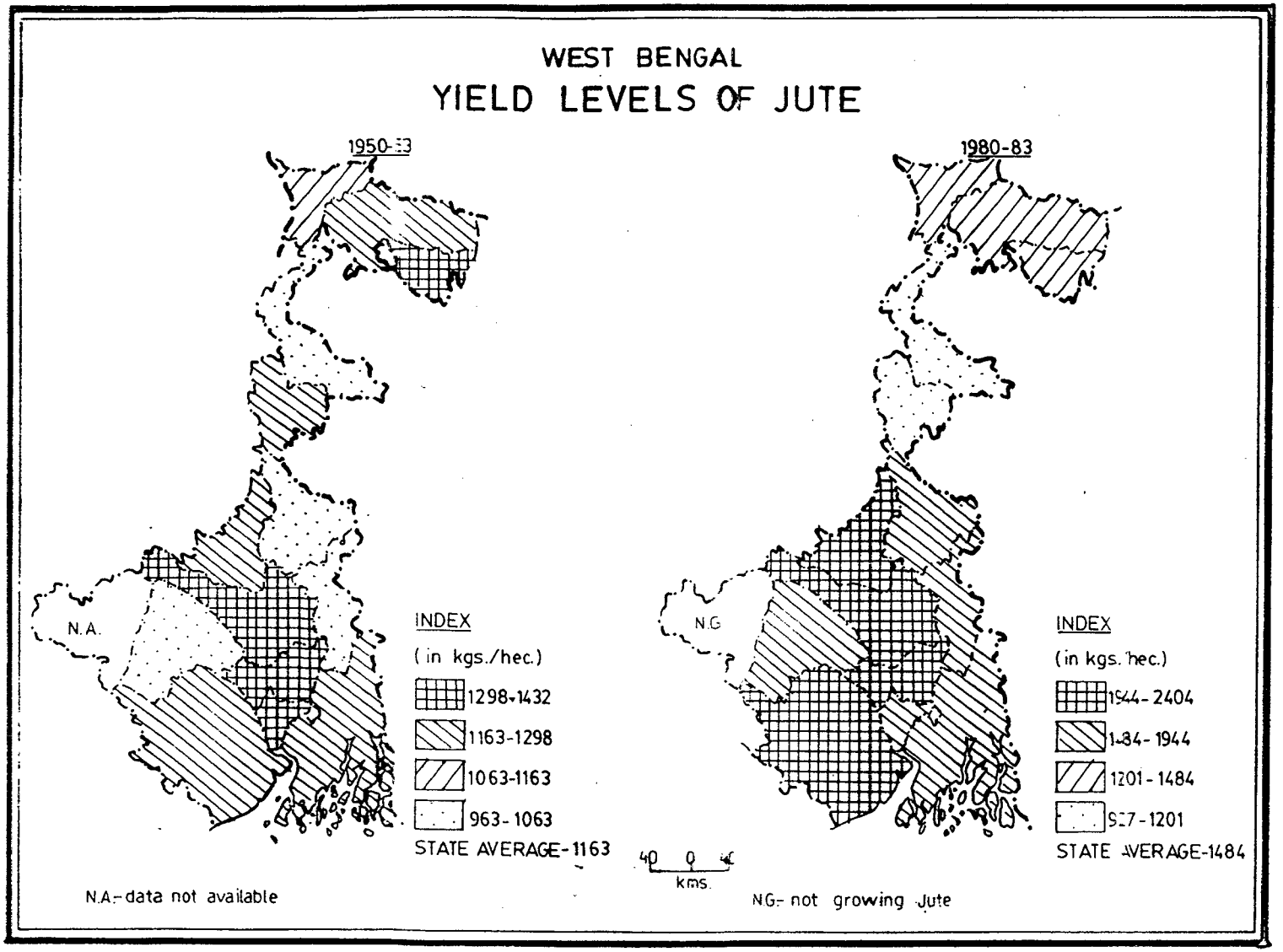
WEST BENGAL
YIELD LEVELS OF JUTE
1950-53
N.A.
INDEX
(in kgs./hec.)
1298-1432
1163-1298
1063-1163
963-1063
STATE AVERAGE-1163
N.A.-data not available
1980-83
N.G
INDEX
(in kgs. hec.)
1944-2404
1484-1944
1201-1484
917-1201
STATE AVERAGE-1484
40 0 40
kms.
N.G- not growing Jute

FIG-2 >

46 percent of the area under jute was accounted for by four districts in the high yield range. In 1980-83, nine districts were above the state average yield and these districts together accounted for around 60 percent of the total area under jute.

In case of area, the districts of Birbhum, Bankura, Midnapore, Howrah and Hooghly had negative growth rates for the period as a whole. However, these districts except for Howrah registered high growth rates of yield, which were above the growth rate experienced by the state as a whole. This implied that despite a rate of growth of yield higher than the state average, these districts experienced a reduction of the area under jute. West Dinajpur and Cooch-Behar were the only two districts that exhibited negative rate of growth for yield over the period as a whole.

For the state as a whole the maximum growth of area, production and yield were recorded in the first and third sub periods. Growth in the second subperiod, while positive, was only marginal. This was surprising as in case of all other crops so far studied, the second subperiod was the period of maximum growth. However, it has to be noted that none of the other crops were industrial crops.

TABLE : 2.23

GROWTH RATES OF AREA, PRODUCTION AND YIELD OF JUTE IN WEST BENGAL

(in Percent)

S.NO.	Districts	1950-53 to 1960-63			1960-63 to 1970-73			1970-73 to 1980-83			1950-53 to 1980-83		
		Area	Pro-duction	Yield	Area	Pro-duction	Yield	Area	Pro-duction	Yield	Area	Pro-duction	Yield
1.	Burdwan	1.3	1.5	-0.02	-2.0	-0.1	2.3	4.1	7.8	3.4	1.1	3.0	1.9
2.	Birbhum	-1.3	-0.02	0.5	2.1	4.6	2.7	-2.1	-1.5	1.1	-0.4	0.9	1.4
3.	Bankura	1.7	1.5	3.2	0.3	2.8	2.6	0.6	1.8	1.2	-0.3	2.1	2.3
4.	Midnapore	-5.8	-3.7	-0.1	1.3	1.0	2.9	3.0	6.5	3.4	-0.6	1.2	1.7
5.	Howrah	-0.6	1.8	2.1	-6.0	-5.4	0.9	3.8	2.8	-0.7	-1.0	-0.3	0.7
6.	Hooghly	1.6	3.9	2.3	-4.1	-3.2	1.5	1.6	2.3	0.9	-0.3	0.9	1.3
7.	24-Parganas	-1.3	0.4	1.8	-0.6	0.1	0.5	4.2	5.1	1.2	0.7	1.8	1.2
8.	Nadia	0.8	4.0	2.9	4.3	4.5	0.2	3.8	5.7	2.2	3.0	4.7	1.7
9.	Murshidabad	0.2	1.6	1.3	0.9	2.2	1.6	1.1	2.2	1.0	0.7	2.0	1.3
10.	W. Dinajpur	9.7	8.9	-0.7	1.1	0.9	-0.1	1.9	2.1	0.1	4.3	3.9	-0.2
11.	Malda	-1.0	-2.8	-1.7	1.8	-1.6	0.5	3.2	4.3	1.1	0.1	-0.1	0.8
12.	Jalpaiguri	9.7	10.9	1.0	0.1	-1.5	1.5	1.5	2.4	0.9	3.7	3.8	0.1
13.	Darjeeling	8.3	12.7	3.9	-0.5	-4.6	-4.0	0.3	0.02	1.9	2.6	2.4	0.6
14.	CoochBehar	5.4	4.2	-1.3	1.1	-0.1	-1.1	1.0	1.9	0.8	2.5	2.0	-0.5
15.	Purulia	-	-	-	-9.5	-19.3	4.8	*	*	*	-	-	-
16.	WEST BENGAL	2.3	3.3	1.0	0.4	0.4	0.1	2.3	3.7	1.4	1.6	2.5	0.8

Source : Same as for table : 2.4

*Indicates that there was no production and area under the crop in the terminal year.

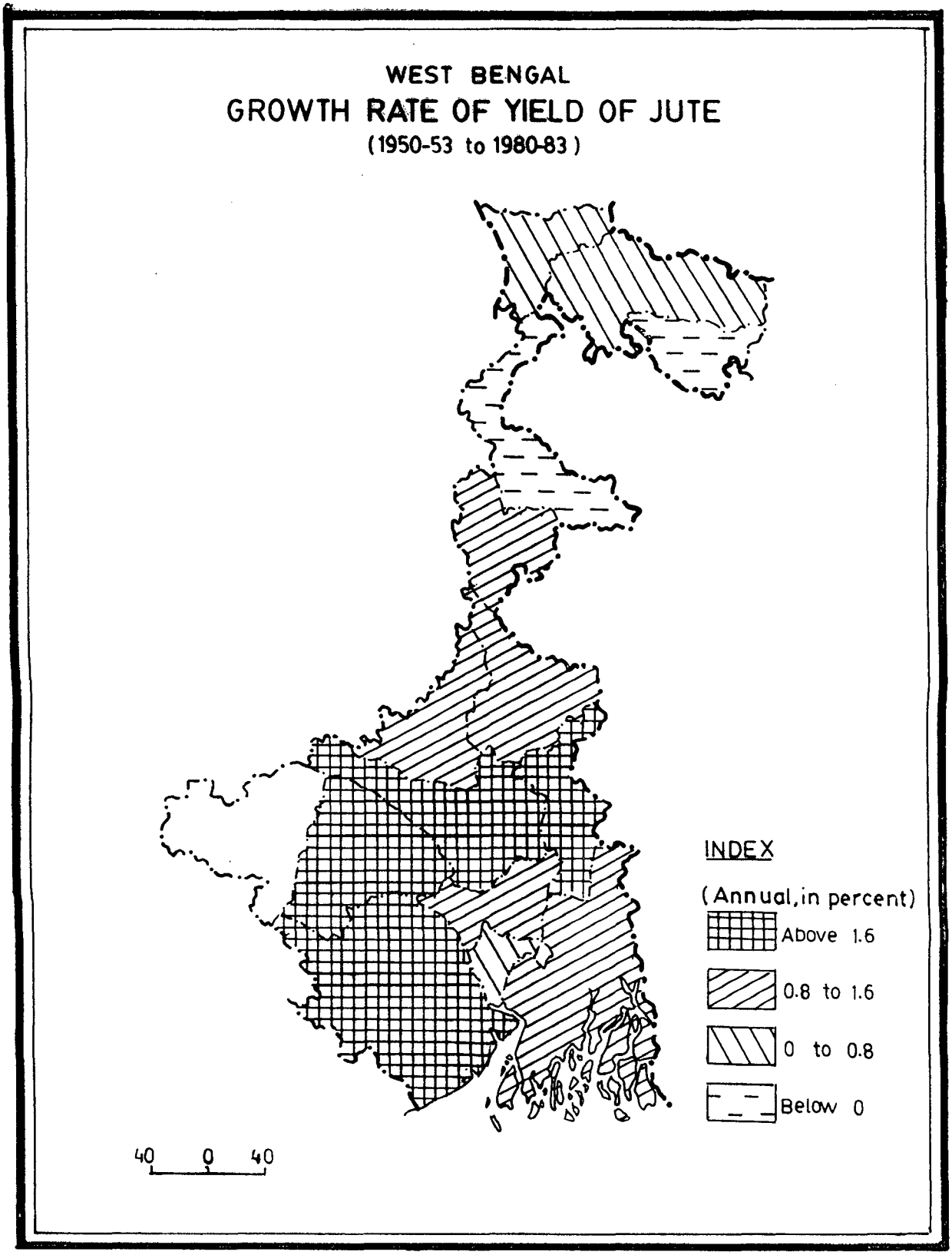
WEST BENGAL
GROWTH RATE OF YIELD OF JUTE
(1950-53 to 1980-83)
INDEX
(Annual, in percent)
ABove 1.6
0.8 to 1.6
0 to 0.8
Below 0
40 0 40

FIG.- 2·XXI

E) Productivity in Money Terms for all Crops:

This variable is very important for judging the degree of agricultural development in a spatial unit at any point of time. The analysis of its growth enables inter comparisons to be made between district or states or regions.

While constructing the ranges for the yield levels the state average has been taken as the mid-point of all the ranges. Threre are in all four ranges - two above the midpoint and two below it. The two upper range have been termed as high and very high, while the two lower ranges have been termed as low and very low.

The map of yield levels reveals that the area between the left bank of the river Bhagirathi and the right bank of the Damodar river had been the most developed region throughout the four subperiods. This area includes the districts of Burdwan, Birbhum, Howrah, Hooghly with the fringe districts of Bankura, Midnapore and Murshidabad. Darjeeling ranked high in terms of yield in the first two subperiods. This was primarily because of the initial high level of development of the tea planation economy. The colonial period witnessed

TABLE : 2.24

AGGREGATE YIELD LEVELS IN MONETARY TERMS IN WEST BENGAL

(Valuations at 1981-82 Prices)

Year	Yield Levels (Rs/hect)	Category	Names of Districts	Number of Districts	Percentage of Total Area Under the Crop
1950-53	2785-3100	Very High	Birbhum, Burdwan, Bankura, Darjeeling	4	23.43
	2470-2785	High	Midnapore, Howrah, Hooghly	3	24.22
	2234-2470	Low	Murshidabad, Jalpaiguri	2	15.95
	1998-2234	Very Low	24-Parganas, Nadia, W. Dinajpur, Malda, Cooch Behar	5	35.48
1960-63	3165-3578	Very High	Burdwan, Birbhum, Bankura, Howrah, Hooghly	5	26.26
	2751-3165	High	Darjeeling		1.81
	2421-2751	Low	Midnapore, 24-Paragnas, Murshidabad, Jalpaiguri, Purulia	5	45.86
	2090-2421	Very Low	Nadia, W. Dinajpur, Malda, Cooch Behar	4	26.57
1970-73	3550-4252	Very High	Burdwan, Birbhum, Hooghly	3	18.64
	3113-3550	High	Bankura, Midnapore, Howrah	3	21.78
	2676-3113	Low	24-Parganas, Nadia, Murshidabad, Darjeeling, Purulia	5	33.7
	2239-2676	Very Low	W. Dinajpur,Malda, Jalpaiguri, Cooch Behar	4	25.7
1980-83	3715-4330	Very High	Burdwan, Hooghly	2	12.72
	3099-3715	High	Birbhum, Bankura, Howrah, Nadia, Murshidabad, Malda	6	35.35
	2685-3099	Low	Darjeeling	1	1.64
	2271-2685	Very Low	Midnapore, 24-Parganas, W. Dinajpur, Jalpaiguri, Cooch-Behar, Purulia.	6	50.24

Source : Same as for table 2.4

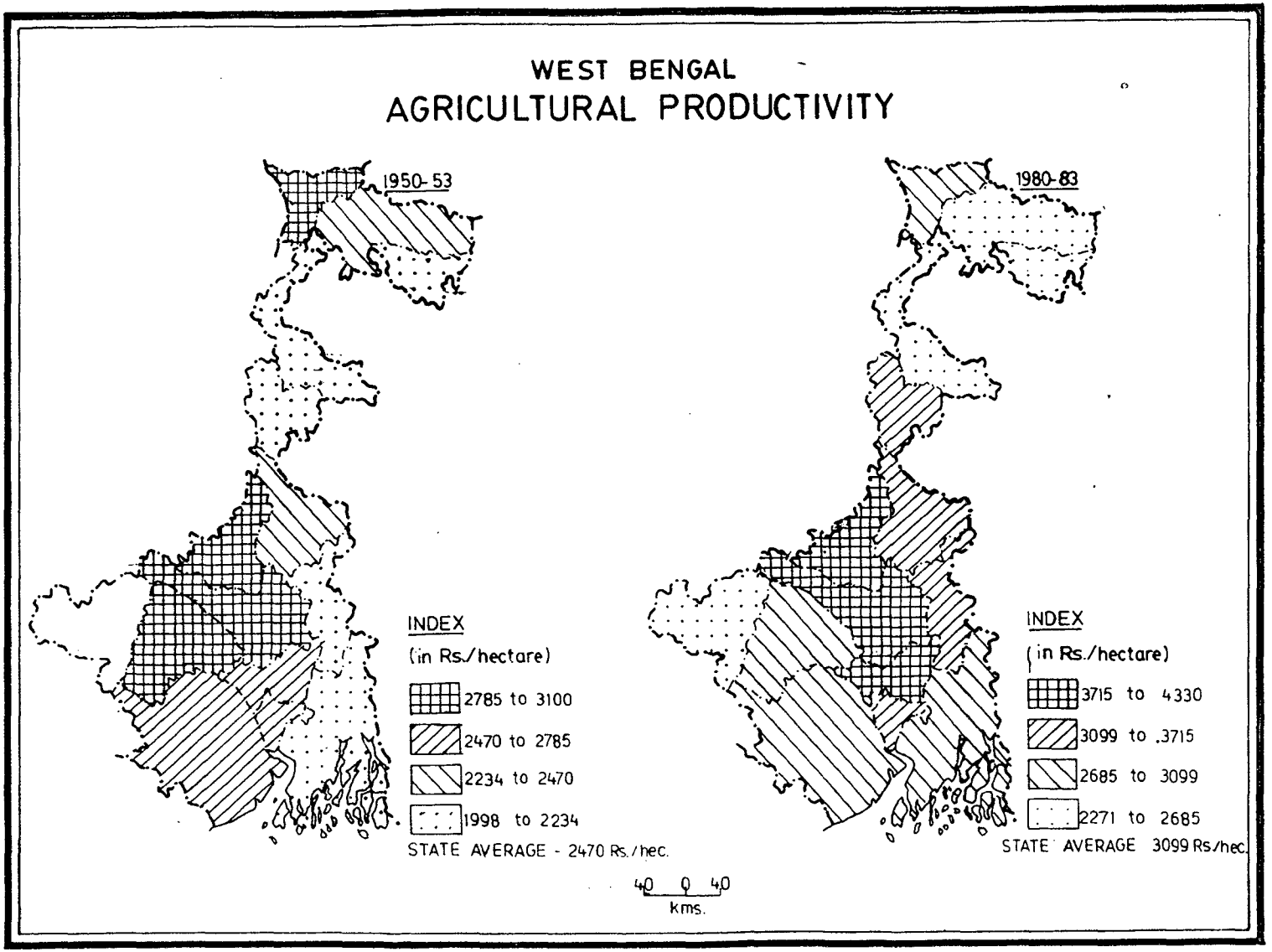
WEST BENGAL
AGRICULTURAL PRODUCTIVITY
1950-53
INDEX
(in Rs./hectare)
2785 to 3100
2470 to 2785
2234 to 2470
1998 to 2234
STATE AVERAGE - 2470 Rs./hec.
1980-83
INDEX
(in Rs./hectare)
3715 to 4330
3099 to .3715
2685 to 3099
2271 to 2685
STATE AVERAGE 3099 Rs./hec.
40 0 40
kms.

FIG-2·XXII

higher levels of investment in the agriculture of Darjeeling as compared to other districts. The other districts of North Bengal-Jalpaiguri, Cooch Behar, West Dinajpur and Malda had low yield levels throughout the four sub-periods, with the exception of Malda in the last subperiod, which had a yield level above the state average.

In 1950-53, seven districts were above the state average of Rs. 2470/hectare. Out of these seven districts, Burdwan, Birbhum, Bankura and Darjeeling were in the very high yield category and these four districts accounted for almost one fourth of the gross cropped area of the state. There were seven districts below the state average in 1950-53, out of which five districts were in the very low category. These five districts, 24-Parganas, Nadia, West Dinajpur, Malda and Cooch-Behar - accounted for more than one third of the gross cropped area of the state.

In 1960-63, six districts were above the state average of Rs. 2751/hectare. Out of these, five districts were in the very high category and occupied 26.26 percent of the gross cropped area of the state. However, during this time period, nine districts

accounting for 72.43 percent of the total gross cropped area were under the state average, out of which four districts occupying slightly more than a quarter of gross cropped area were in the very low yield range.

In 1970-73, six districts were above the state average and nine districts were below it. Even though the distribution of districts among the yield ranges was the same as the previous period, there was a major difference in that less than 60 percent of the gross cropped area was accounted for by the districts in the low and very low yield ranges.

In 1980-83, eight districts, Burdwan, Birbhum, Bankura, Howrah, Hooghly, Nadia, Murshidabad and Malda occupying around 48 percent of the gross cropped area were above the state average. The remaining seven districts which were below the state average, again occupied slightly above 50 percent of the gross cropped area of the state. A notable feature was that these seven districts, with the exception of Darjeeling, were in the very low yield range. Thus, almost half of the gross cropped area of the state was accounted for by districts with very low yield. A look at the growth rates of aggregate yield over the thirty year period

reveals that among the districts having positive growth rates, seven districts were above the state average and seven were below it. Darjeeling was the only district which had experienced negative growth rate of aggregate yield for the period as a whole. Out of the seven districts above the state average, Hooghly and Nadia experienced growth at more than twice the state average and, hence, were in the high range category. Burdwan, Hooghly and Howrah were the districts which were not only in the high yield range for three of the four sub-periods but also experienced higher rate of growth above those experienced by the state as a whole for all the sub-periods. Birbhum and Bankura, which were in the very high yield range in the first two sub-periods, dropped to the high yield range by the end of the thirty year period. This was primarily due to the low growth rates experienced by these two districts for the period as a whole, which were lower than that experienced by the state as a whole for the same period.

The state as a whole experienced a growth rate of 0.76 percent for the thirty year period of study. This was primarily due to the positive growth rates witnessed in the first and the second sub-periods,

TABLE : 2.25

PRODUCTIVITY IN MONEY TERMS AND ITS GROWTH IN WEST BENGAL

S.No	Districts	Productivity in Money Terms Rs/hect				Growth Rates, in Percent			
		1950-53	1960-63	1970-73	1980-83	1950-53 to 1960-63	1960-63 to 1970-73	1970-73 to 1980-83	1950-53 to 1980-83
1.	Burdwan	2929	3578	3989	4225	2.0	1.1	0.6	1.2
2.	Birbhum	3100	3367	3903	3535	0.8	1.5	-0.9	0.4
3.	Bankura	2883	3187	3412	3103	1.0	0.7	-0.9	0.2
4.	Midnapore	2585	2683	3171	2876	0.4	1.7	-0.9	0.4
5.	Howrah	2768	3189	3469	3477	1.4	0.8	0.02	0.8
6.	Hooghly	2699	3245	4252	4330	1.9	2.7	0.2	1.6
7.	24-Parganas	2175	2680	2820	2970	2.1	0.5	0.5	1.0
8.	Nadia	2004	2228	2807	3270	1.1	2.3	1.5	1.6
9.	Murshidabad	2284	2500	3035	3137	0.9	1.9	0.3	1.1
10.	W. Dinajpur	1998	2320	2526	2271	1.5	0.8	-1.1	0.4
11.	Malda	2209	2090	2665	3154	-0.6	2.5	1.7	1.2
12.	Jalpaiguri	2302	2728	2239	2346	1.7	-2.0	0.5	0.1
13.	Darjeeling	2925	2929	2731	2774	0.01	-0.7	0.2	-0.2
14.	CoochBehar	2022	2173	2537	2352	0.7	1.6	-0.8	0.5
15.	Purulia	-	2594	2963	2679	-	1.3	-1.0	0.2*
16.	WEST BENGAL	2470	2751	3113	3099	1.08	1.2	-0.05	0.76

Source : Same as for table 2.4

*For period 1960-63 to 1980-83

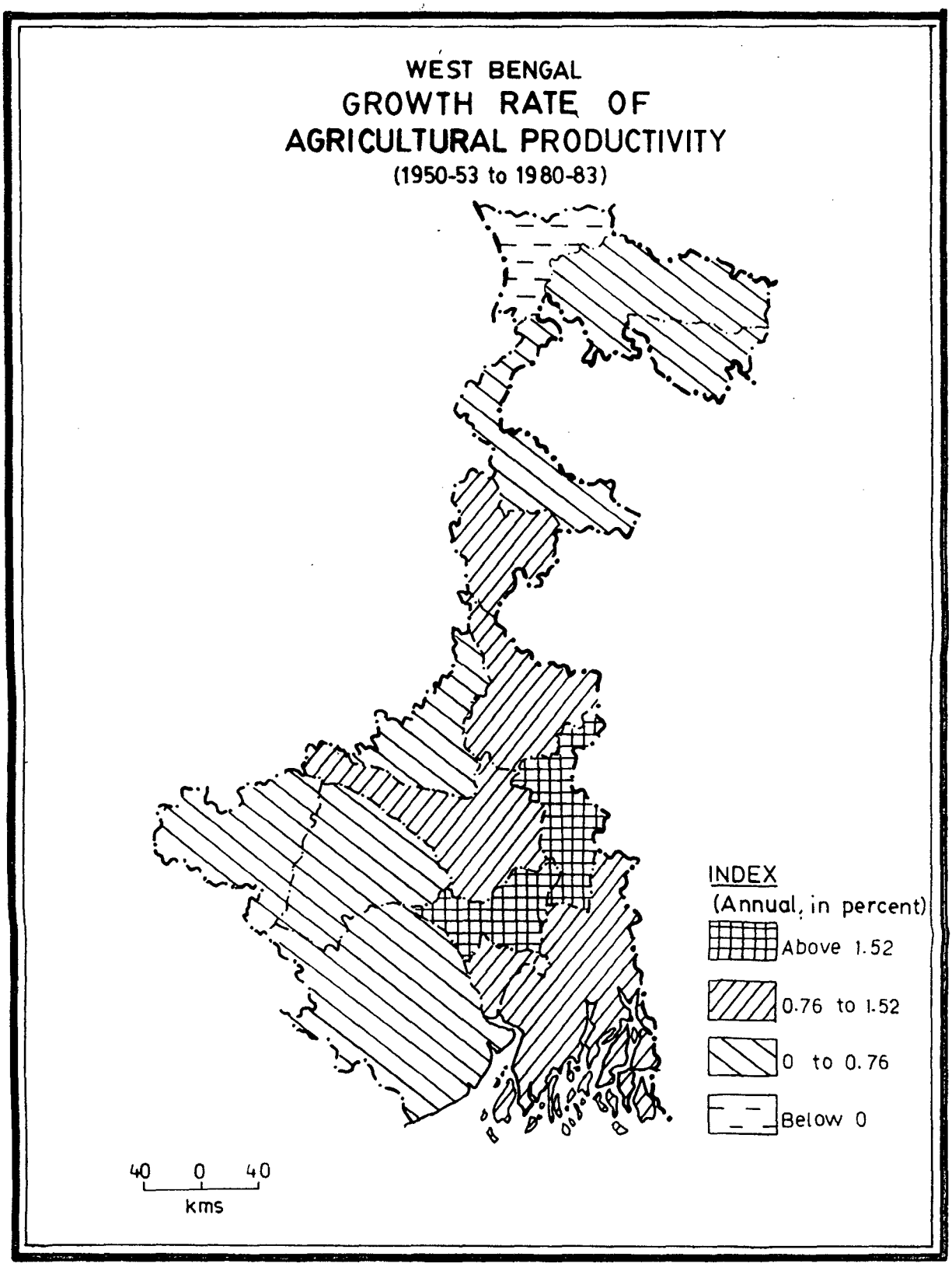
WEST BENGAL
GROWTH RATE OF
AGRICULTURAL PRODUCTIVITY
(1950-53 to 1980-83)
INDEX
(Annual, in percent)
Above 1.52
0.76 to 1.52
0 to 0.76
Below 0
40 0 40
kms

FIG-2.XXIII

1950-53 to 1960-63 and 1960-63 to 1970-73, which offset the negative growth rate witnessed during the third sub-period.

In the first sub-period seven districts-Burdwan, Howrah, Hooghly, 24-Parganas, Nadia, West Dinajpur and Jalpaiguri - contributed to the growth rate of 1.08 percent experienced by the state as a whole. Malda was the only district experiencing negative growth in this sub-period. The remaining seven districts experienced growth rates which, while positive, were less than that of the state as a whole. There were no districts in the very high category and all the seven districts experiencing growth rates hihger than the state average were in the high category.

The second sub-period witnessed a marginal increase in the gowth rate of the state as a whole which increased to 1.2 per cent in 1970-73 from 1.08 percent in 1960-63. This decade witnessed the highest growth rate of aggregate yield as compared to the other decades under study. Eight districts - Birbhum,

TABLE 2.26

CLASSIFICATION OF DISTRICTS BY GROWTH RATES OF AGGREGATE PRODUCTIVITY IN MONEY TERMS

Year	Range (in Percent)	Category	Names of Districts	Number of Districts
1950-53 to 1960-63	2.16 & above	Very High		0
	1.08-2.16	High	Howrah, Hooghly, 24-Parganas, Nadia, W. Dinajpur, Jalpaiguri, Burdwan	7
	0 -1.08	Low	Birbhum, Bankura, Midnapore, Murshidabad, Darjeeling, Cooch behar	6
	Below 0	Very Low	Malda	1
1960-63 to 1970-73	2.4 & above	Very High	Hooghly, Malda	2
	1.2-2.4	High	Birbhum, Midnapore, Nadia, Murshidabad, Cooch Behar, Purulia	6
	0 -1.2	Low	Burdwan, Bankura, Howrah, 24-Parganas, W. Dinajpur	5
	Below 0	Very Low	Jalpaigur, Darjeeling	2
1970-73 to 1980-83	0 & above	Very High	Burdwan, Howrah, Hooghly, 24-Parganas, Nadia, Murshidabad, Malda, Jalpaiguri, Darjeeling	9
	-0.05-0	High		0
	-0.10--0.05	Low	Birbhum, Bankura, Midnapore, Cooch behar, Purulia	5
	Below-0.10	Very Low	W. Dinajpur	1
1950-53 to 1980-83	1.52 & above	Very High	Hooghly, Nadia	2
	0.76-1.52	High	Burdwan, Howrah, 24-Parganas, Murshidabad, Malda, Purulia*	5
	0 -0.76	Low	Birbhum, Bankura, Midnapore, W. Dinajpur, Jalpaigur, Cooch Behar Purulia*	7
	Below 0	Very Low	Darjeeling	1

Source: Same as for table 2.4

* for the time period 1960-63 to 1980-83.

Midnapore, Hooghly, Nadia, Murshidabad, Malda, Cooch-Behar and Purulia experienced growth rates higher than the state average. Out of these Malda and Hooghly belonged to the very high category while the remaining six districts were in the high category. The districts of Jalpaiguri and Darjeeling experienced negative growth. Thus, Darjeeling witnessed negative growth rates for two decades in succession.

The decade 1970-73 to 1980-83 witnessed negative growth rates in productivity. This negative growth rate, however, was marginal (0.05 percent for the decade). The districts of Birbhum, Bankura, Midnapore, West Dinajpur, Cooch-Behar and Purulia registered negative growth and these were responsible for the negative growth rate of the state as a whole. The remaining nine districts witnessed growth rates which were above the state average and were positive as well. All the six districts experiencing negative growth rates recorded yield levels lower than that of the state as a whole. It is noted that in this decade Darjeeling, which had experienced negative growth rate in the first two decades of the period of study, witnessed positive rate of growth which was also above the state average.

At the time of Independence in 1947, agriculture

in Bengal was in a state of stagnation. The first half of the 20th century witnessed a decline in all-crop output, negative growth rates for both area and yield but a considerable increase in intensity of cropping. Agriculture in West Bengal in the period after independence, however, exhibited considerable differences as compared to the first half of the century.

A slow but steady increase of the net sown area accompanied by substantial increase in the proportion of cultivated area to cultivable area was witnessed. Consequently, the present potential for the physical extension of the cultivated area is low. It also emerged that most of the highly developed districts in terms of productivity in value terms had been mono-crop regions with Aman rice as the dominant crop. The districts which had a diversified cropping pattern (more than three crop combinations) had overall high rates of growth in agriculture productivity in value terms. The agriculture productivity in value terms of the state showed an increase over the period exhibiting a growth rate of 0.76 percent.

The analysis of crops at an aggregate level for West Bengal as a whole revealed that for the entire

period the growth rates of all-foodgrains and all cereals had followed the growth rate patterns of rice, the dominant crop. Total pulses had negative growth for all three elements of area, output and yield. Of these, the negative growth rate for yield was relatively marginal. The area under oilseeds had a very high growth rate leading to an even higher growth rate (4.10 per cent) in output.

Rice occupied 86 percent of the area under food-grains in 1985-86. This study indicates that there had been reasonably high growth rates in the first two decades for all three elements. However, there had been negative growth in the third decade (1970-73 to 1980-83) in both output and yield.

A more disaggregated analysis of different varieties of rice indicated that during the decade 1970-73 to 1980-83 the growth rate of yield of Boro and Aus had declined. However, Boro still had more than double the yield of Aman, which is the main variety.

Jute, which was the main industrial crop of the state had high growth of area, output and yield over the period as a whole. The rates of growth in the first and third decades contributed significantly

to this. The overall area growth rate of jute was higher than the yield growth rate, the latter being marginal.

Some regions emerged clearly in terms of development considering the aggregate yield in money terms. In this context, the South Bengal region forming a contiguous spatial unit of Burdwan, Birbhum, Bankura, Howrah and Hooghly emerged as the most developed region at all points of time.

The aggregate yield in money terms of the state both in 1950-53 to 1960-63 and 1960-63 to 1970-73 had annual growth of more than unity. However, the last decade exercised a dampening effect on the growth rate of aggregate yield with a negative growth rate, even though it was marginal. It is a matter of investigation as to whether this negative growth rate can be taken as an indicator of stagnation of agriculture of West Bengal during the seventies.

CHAPTER III

TRANSFORMATION OF TECHNOLOGY AND INFRASTRUCTURE IN AGRICULTURE OF WEST BENGAL

It can be observed from the high proportion of cultivated area to the cultivable area in 1981-82 (table 2.4) that there is very little scope for increase in output through the physical extension of area. Thus, the only other way to increase output is either through raising productivity or raising the cropping intensity or a combination of both. In the latter case, the gross cropped area has to be raised in proportion to the net sown area. However, considering the exhaustion of the natural nutrients of soil with intensive cropping, there is also a limit to the increase in cropping intensity even with application of bio-chemical fertilizers. However, in both cases technological and infrastructural facilities would primarily determine increase in output. Hence, it would be relevant to evaluate the development of these determinants of productivity after independence. This chapter has been divided into two sections; section I deals with the transformation of technological variables, while section II has been devoted to an

evaluation of the pattern of development of some selected variables of agricultural infrastructure.

SECTION -I

GROWTH OF TECHNOLOGICAL DETERMINANTS :

In this section, the decadal growths of irrigation, biochemical and mechanical technology would be analysed to the extent permitted by the availability of data.

Irrigation:

It would not be exaggerating the significance of irrgation if it is stated that presently it is the most important factor determining agricultural productivity. After the new agricultural strategy with its package of complementary technology was introduced, the importance of irrigation increased manifold. In order to fully realise the potential of HYV of seeds and chemical fertilizers, timely and assured water supply is essential. Hence, assured irrigation becomes essential for obtaining maximum profit from the investment made in inputs like seeds, fertilizers and pesticides. There are two sources which can be

exploited for irrigation; surface water and ground water. It would have been helpful if one could have analysed source wise irrigation in the state. This was not possible as data is not available in this regard. In 1970-71, for 42.2 percent of the irrigated area the main sources were government canals, for 22.2 percent, private canals, for 20.3 percent, tanks, for percent, wells and for 14 percent, other sources.

Among the sources of surface flow irrigation, canal irrigation is the most important. In the case of this study, the percentage of area irrigated by the government canals to net sown area was the only upto-date data which was available. However, it should be noted from the 1970-71 data that, among the canal network system, public and government canals were the most important.

Area Irrigated by Government Canals:

The pattern of area irrigated by government canals remained more or less unchanged over the three decades, 1961-62, 1971-72 and 1981-82. There was no irrigation through government canals, throughout the period, in the four districts of 24-Parganas, Nadia, West Dinajpur and Malda. These four district are located on the

TABLE 3.1 : PROPORTION OF AREA IRRIGATED BY GOVERNMENT CANALS TO NET AREA SOWN AND ITS TREND OF GROWTH. (1961-62 to 1981-82)

S.NO	Districts	Percentage of area Irrigated			Growth Rates (Percent)		
		1961-62	1971-72	1981-82	1961-62 to 1971-72	1971-72 to 1981-82	1961-62 to 1981-82
1	Burdwan	44.9	61.84	52.48	3.26	- 1.63	0.78
2	Birbhum	45.66	50.94	49.99	1.10	- 0.19	4.52
3	Bankura	13.22	17.16	42.31	2.64	9.44	6.00
4	Midnapore	5.54	13.66	18.80	9.44	3.24	6.30
5	Howrah	2.26	5.30	3.13	8.90	- 2.46	3.06
6	Hooghly	23.55	37.91	35.23	4.88	- 0.73	2.03
7	24-Parganas	0	0	0	0	0	0
8	Nadia	0	0	0	0	0	0
9	Murshidabad	10.52	13.92	11.71	2.84	- 1.71	0.54
10	W. Dinajpur	0	0	0	0	0	0
11	Malda	0	0	0	0	0	0
12	Jalpaiguri	0.44	1.00	2.06	8.56	7.49	8.02
13	Darjeeling	7.28	8.90	6.01	2.03	- 3.85	- 0.95
14	Cooch-Behar	0.04	0.07	0.09	5.76	2.54	4.14
15	Purulia	0.27	00.63	4.84	8.84	22.62	15.52
	Mean	10.25	14.09	16.89			
	S.D.	15.71	20.11	20.27			
	Co-efficient Variation in Percentage	153.34	142.75	122.13			
	WEST BENGAL	10.73	14.84	16.45	3.30	1.03	2.16

Source : Calculated from Economic Review 1970-75, 1986-87 and Statistical Abstract 1975, Bureau of Applied Economics and Statistics, Ministry of Agriculture, Government of West Bengal and Unpublished data.

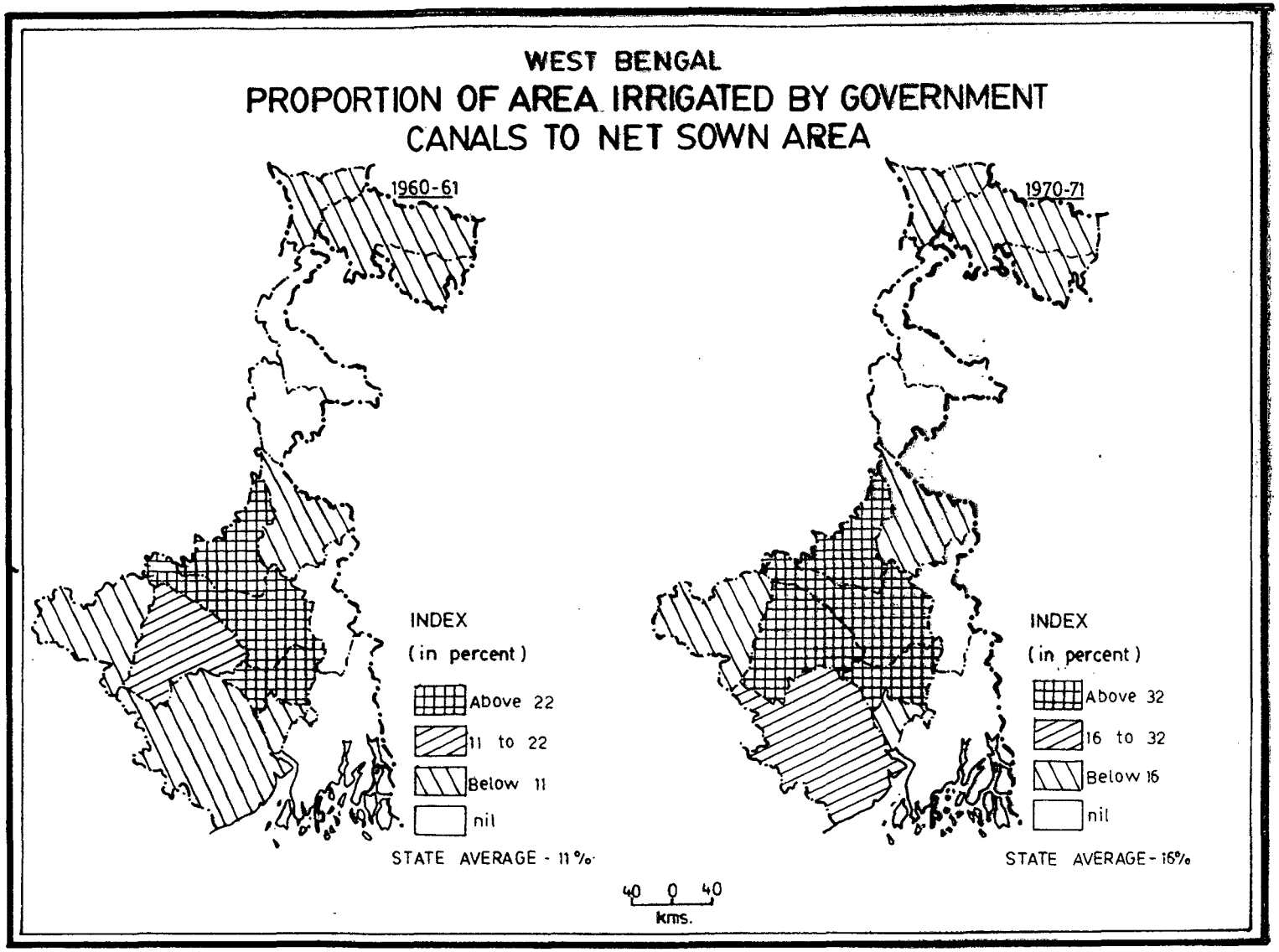
WEST BENGAL
PROPORTION OF AREA IRRIGATED BY GOVERNMENT CANALS TO NET SOWN AREA
1960-61
INDEX
(in percent)
Above 22
11 to 22
Below 11
nil
STATE AVERAGE - 11%
1970-71
INDEX
(in percent)
Above 32
16 to 32
Below 16
nil
STATE AVERAGE - 16%
40 0 40
kms.

FIG. - 3-I

eastern side of the state and are away from the catchment area of the main Padma-Bhagirathi river system. In 1961-62 and 1971-72, Birbhum, Burdwan and Hooghly had a very high percentage of net sown area irrigated by government canals, while in 1981-82, Bankura was also one of the districts in the very high category along with the districts already mentioned (table 3.1). These were all contiguous districts in the west-central part of South Bengal and owe their high percentages mainly to the flow of the Damodar river, a tributary of the Bhagirathi river, with the Damodar Valley Project being one of the major irrigation projects in the state. In 1961-62 and 1971-72, Bankura was the only district in the medium range while in 1981-82, Midnapore also entered this range. All the other districts, namely Darjeeling, Jalpaiguri and Cooch Behar in North Bengal and Purulia, Howrah and Murshidabad in South Bengal had percentages of area irrigated by government canals lower than the state average. Thus, it can be seen that the districts of North Bengal, possibly because of their high altitude and quick changes of gradient leading to channel choking, had very little area irrigated by government canals, whereas the central and western districts of South Bengal with the exception of Purulia had a high percentage of their net sown area

irrigated by government canals.

The overall annual growth rate (1961-62 to 1981-82) revealed that Birbhum recorded very high growth rate (table 3.1). Bankura and Midnapore also had recorded very high growth rate and this had been reflected in their moving up from their respective categories by the end of the period. Purulia and Jalpaiguri had also shown a very high growth rate, but this was primarily due to their low base in 1961-62. Howrah and Cooch Behar registered growth rates above the state average because of their low base in 1961-62. Hooghly, Burdwan, Murshidabad and Darjeeling showed growth rates lower than the state average of 2.16 percent out of which Darjeeling had a negative growth rate.

The analysis of the growth rates of the proportion of net sown area irrigated by government canals in the two decades (1961-62 to 1971-72 and 1971-72 to 1981-82) reveal s that the state as a whole witnessed a higher growth of 3.3 percent than the decade of the seventies (1.03 percent). In the decade of the sixties there were no negative growth rates for the individual districts, whereas in the period 1971-72 to 1981-82, there were negative growth rates in Burdwan, Birbhum, Howrah, Hooghly, Murshidabad and Darjeeling. It may

be mentioned that the districts of Burdwan, Birbhum and Hooghly had a developed system of irrigation through government canals. In the same decade, Bankura and Midnapore made a breakthrough in terms of the annual rate of growth and so did the districts of Jalpaiguri and Purulia. However, in the case of Purulia, it was because of the initial low base that the growth rate seemed to be phenomenal at 22.6 percent over the decade.

The ground water resources, in the decade of the fifties, were not exploited very efficiently. Traditional water lifts like counterpose, chainpumps, picotta using human power, rope and bucket lifts and Persian Wheels using both human and animal power were utilised. The Persian Wheel was a device used throughout the state more or less extensively till the early sixties but it became more and more extinct as modern devices like tubewells and pumpsets started being adopted. Modern ground w ater lift technology has two distinct devices - firstly, an open or dug well equipped with a pumpset and secondly, a tubewell operated by a power pump. A tubewell can be either shallow or deep. The shallow tubewells derive their water supply through rain water seepage and percolation and high water table, whereas the latter derives the

water from the permanent acquifer zones, which account for their depth.

Spatial Pattern of Tubewells:

The number of deep tubewells per 1000 hectares of net sown area was very low in West Bengal (0. 41 in 1971 and 0.42 in 1981). In 1971, the districts having more than one deep tubewell per 1000 hectares of net sown area were Howrah, Hooghly and Nadia (table 3.2). The other districts having more deep tubewells than the state average were Burdwan, Murshidabad and Malda. In 1981, the pattern of distribution remained the same. However, the annual growth rates of deep tubewell in 1981 over 1971 showed a peculiar pattern. The districts having tubewells above the state average in both the years experienced negative growth rates for the decades, while those having figures below the state average experienced positive growth rates.

The number of shallow tubewells per 1000 hectares of net sown area in 1971 (11.09) was higher than the number of deep tubewells. In this year, the same districts which had comparatively high numbers of deep tubewells had numbers of shallow tubewell higher than the state average (Burdwan, Howrah, Hooghly, 24-Parganas,

TABLE 3.2: NUMBER OF SHALLOW AND DEEP TUBEWELLS PER 1000 HECTARES OF NET SOWN AREA AND THEIR GROWTH (1971-1981)

S.No	Districts	Deep Tubewells			Shallow Tubewells		
		1971	1981	Growth Rate(%)	1971	1981	Growth (%) Rate
1	Burdwan	0.66	0.61	-0.78	15.59	0.83	-25.42
2	Birbhum	0.13	0.13	0.00	9.12	0	*
3	Bankura	0.16	0.18	1.18	4.32	0	*
4	Midnapore	0.17	0.20	1.64	6.94	0.21	-29.52
5	Howrah	1.02	0.94	-0.81	18.21	0.32	-33.24
6	Hooghly	1.12	1.02	-0.93	26.78	1.54	-24.84
7	24-Parganas	0.33	0.32	-0.31	12.58	0.45	-28.34
8	Nadia	1.71	1.61	-0.60	25.59	1.87	-23.02
9	Murshidabad	0.93	0.90	-0.33	17.34	2.19	-18.69
10	W. Dinajpur	0.24	0.25	0.41	9.83	0.43	-26.87
11	Malda	0.46	0.46	0.00	20,0	0.86	-26.99
12	Jalpaiguri	0.10	0.10	0.00	1.21	0.74	- 4.80
13	Darjeeling	0.01	0.02	8.31	0	0	0.00
14	Cooch-Behar	0.05	0.06	1.84	7.04	0.34	-26.14
15	Purulia	0	0	0.00	0	0	0.00
16	WEST BENGAL	0.41	0.42	0.24	11.09	0.61	-25.18

* Indeterminate

Source: Same as table 3.1

Nadia, Murshidabad, Malda). There was a drastic fall in the numbers of shallow tubewells in 1981 (0.61 per 1000 hectares from 11.09 in 1971) and all the districts, without any exception, showed negative growth rates (table 3.2).

As far as total tubewells are concerned, in 1971, Malda, Nadia and Hooghly had larger numbers as compared to the state average, along with Murshidabad, Burdwan and 14-Parganas (table 3.3). The negative growth of shallow tubewells from 1971 to 1981 reflected itself on the annual compound growth rate of the number of total tubewells. This phenomenal decline in the number of shallow tubewells in 1981 over 1971, could possibly be a result of declining water table in the higher zones. This could explain as to why the deep tubewells have not been affected in the same period. Another possible reason could be that the operation of every additional deep tubewell could have put a number of shallow tubewells out of operation. Though tubewells were never an important source of irrigation even in 1970-71 (as per the data on source-wise irrigation referred to earlier in this chapter) the probable decline of the water table could have constrained the cultivation by small and marginal farmers who were dependent on

TABLE 3.3 : TUBEWELLS PER UNIT AREA AND ITS GROWTH OVER THE DECADE 1971 to 1981

S. No.	Districts	No. of Tubewells/1000 Hectare 1971	No. of Tubewells/1000 Hectare 1981	Growth Rate (Percent)
1	Burdwan	16.25	1.43	-21.58
2	Birbhum	9.23	0.13	-34.70
3	Bankura	4.21	0.17	-27.45
4	Midnapore	7.10	o.41	-24.71
5	Howrah	19.22	1.26	-23.83
6	Hooghly	27.90	2.56	-21.25
7	24-Parganas	12.91	0.78	-24.47
8	Nadia	27.30	3.48	-18.61
9	Murshidabad	18.27	3.08	-16.31
10	W. Dinajpur	10.07	0.68	-23.62
11	Malda	20.46	1.32	-23.97
12	Jalpaiguri	1.30	0.84	- 4.27
13	Darjeeling	0.01	0.02	- 8.31
14	Cooch-Behar	7.09	5.77	- 2.04
15	Purulia	0	0	0.00
	Mean	12.08	1.62	
	S.D.	9.22	1.68	
	Co-efficient Variation in Percentage	76.31	103.78	
	WEST BENGAL	11.50	1.03	

Source: Same as table 3.1

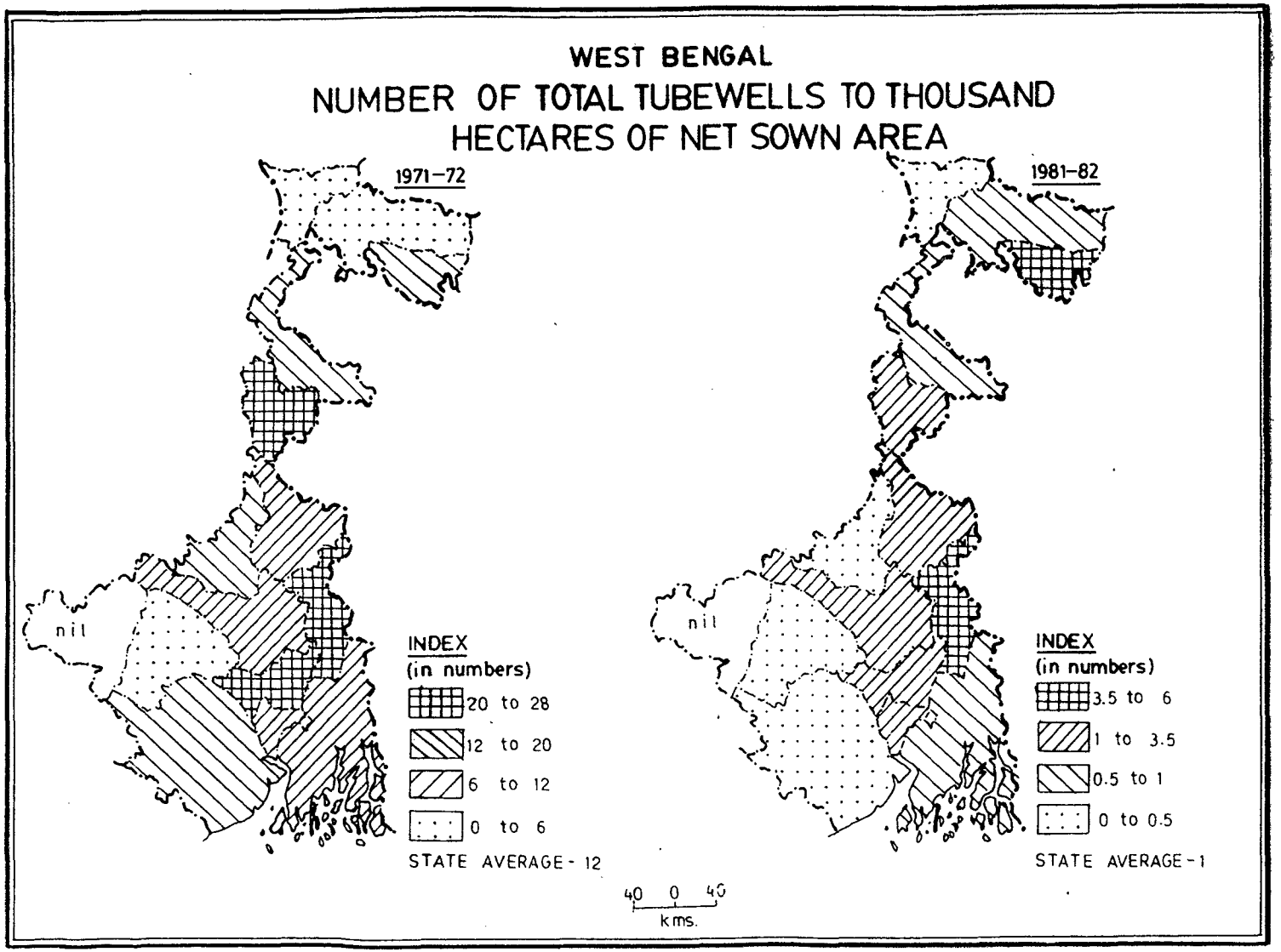
WEST BENGAL
NUMBER OF TOTAL TUBEWELLS TO THOUSAND HECTARES OF NET SOWN AREA
1971–72
nil
INDEX
(in numbers)
20 to 28
12 to 20
6 to 12
0 to 6
STATE AVERAGE - 12
1981–82
nil
INDEX
(in numbers)
3.5 to 6
1 to 3.5
0.5 to 1
0 to 0.5
STATE AVERAGE - 1
40 0 40
kms.

FIG-3·II

shallow tubewells for irrigation. These farmers can neither use the relatively traditional techniques when the water table goes down to an uneconomic depth nor are they able to afford the capital intensive technology of deep tubewells. It might be noted that the districts having a higher number of shallow tubewells, specially Malda, Nadia and 24-Parganas had no government canal irrigation.

Spatial Pattern of Pumpsets :

A pumpset is an effective substitute for the traditional waterlift systems. In West Bengal pumpsets were generally owned privately. A privately owned pumpset, provided there is steady water availability, can provide a very reliable irrigation system. However, pumpsets which are electrically operated can be efficient only in areas of assured electric supply. West Bengal being a state where the power supply is of low reliablity, the number of diesel pumpsets was far greater than electric pumpsets in all points of time except 1951 (table A-3.1).

The number of pumpsets (electric and diesel) per 1000 hectares of net sown area increased significantly in West Bengal in the period 1961-62 to

TABLE 3.4 : NUMBER OF PUMPS (ELECTRIC AND DIESEL) PER '000 HECTARES OF NET SOWN AREA AND ITS TREND OF GROWTH (1961 to 1981)

S.No	Districts	No. of Pumps/'000 Hectares			Growth Rates (Percent)		
		1961	1971	1981	1961 to 1971	1971 to 1981	1961 to 1981
1	Burdwan	0.25	1.97	58.16	22.93	40.29	31.32
2	Birbhum	1.58	0.32	23.32	-14.76	53.55	14.41
3	Bankura	0.29	0.45	23.15	4.49	48.30	24.48
4	Midnapore	0.84	1.10	39.04	3.28	42.13	21.16
5	Howrah	1.07	12.97	41.14	28.34	12.24	20.02
6	Hooghly	1.19	2.56	157.02	7.96	50.93	27.65
7	24-Parganas	0.46	1.16	50.36	9.69	45.80	26.46
8	Nadia	0.15	2.75	87.48	33.76	41.34	37.49
9	Murshidabad	0.14	1.75	33.12	28.73	34.18	31.43
10	W. Dinajpur	0	0.65	8.49	*	29.30	*
11	Malda	0.29	0.71	16.03	9.37	36.57	22.22
12	Jalpaiguri	0.05	0.52	NA	26.38	NA	NA
13	Darjeeling	0.24	0.15	NA	- 4.59	NA	NA
14	Cooch-Behar	6.52	1.82	6.58	-10.50	13.71	0.88
15	Purulia	0.14	0.12	3.25	- 1.53	39.08	17.02
	Mean	0.81	1.94	42.09			
	S.D.	1.39	3.17	41.81			
	Co-efficient of Variation in Percentage	170.16	163.53	99.34			
	WEST BENGAL	0.71	1.32	37.76	6.40	39.84	21.98

* Indeterminate

Source : Statistical Abstract, 1965, 1977 and unpublished data, BAES, Government of West Bengal.

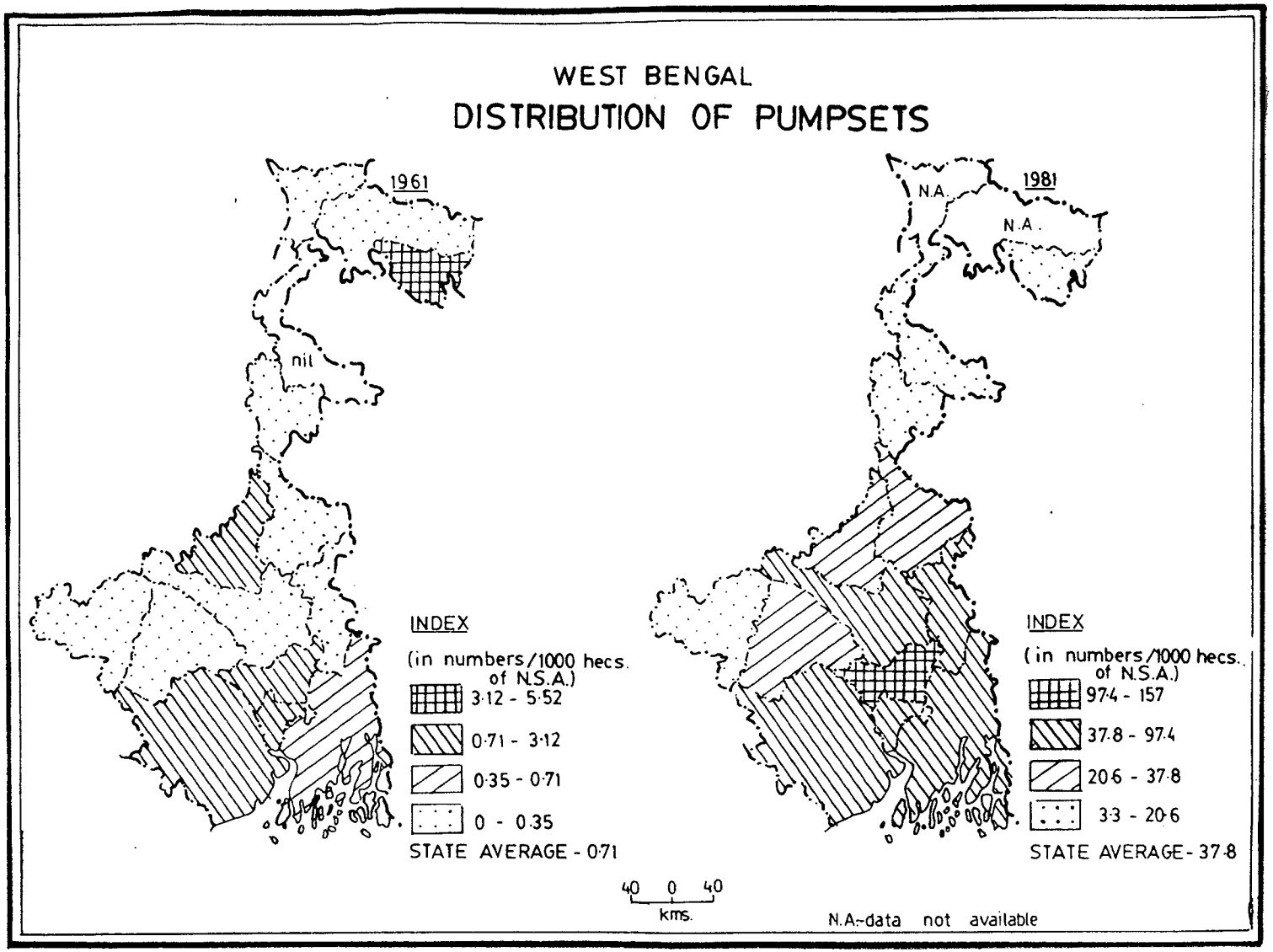
WEST BENGAL
DISTRIBUTION OF PUMPSETS
1961
nil
INDEX
(in numbers/1000 hecs. of N.S.A.)
3·12 - 5·52
0·71 - 3·12
0·35 - 0·71
0 - 0·35
STATE AVERAGE - 0·71
1981
N.A.
N.A.
INDEX
(in numbers/1000 hecs. of N.S.A.)
97·4 - 157
37·8 - 97·4
20·6 - 37·8
3·3 - 20·6
STATE AVERAGE - 37·8
40 0 40
kms.
N.A.-data not available

FIG.-3·III

1981-82 especially in the decade 1971-72 to 1981-82 (table 3.4). In 1961, the number of pumpsets were hardly significant in West Bengal (0.71 per 1000 hectares). This figure increased to 1.32 in 1971. In the same year, Hooghly was by far the leading district with almost 13 pumpsets per 1000 hectares. Besides, Burdwan, Nadia, Mushidabad and Cooch-Behar also had number of pumpsets more than the state average. Purulia, Birbhum and Bankura, out of the districts of South Bengal, and West Dinajpur, Darjeeling and Jalpaiguri out of the districts of North Bengal had very low number of pumpsets as compared to the state average. By 1981, the state figure had jumped to 38 pumpsets per 1000 hectares and this increase indicated the growing importance of private sources of irrigation. In 1981, Hooghly had a very high figure as compared to any other district (157 pumps/1000 hectare). Burdwan, Midnapore Howrah, 24-Parganas and Nadia also had figures above the state average. The districts of North Bengal along with Purulia had very low numbers of pumps unit area. A look at the overall annual compound growth rate from 1961 to 1981, it emerged that Burdwan, Nadia and Murshidabad experienced very high growth rates (table 3.4). Bankura, Hooghly, 24-Parganas and Malda also experienced growth which was above the state average figure of 22 percent.

A comparison of government canal, tubewell and pumpset distribution figures revealed that the areas which had highly developed government canal systems were not so well developed in tubewells and pumpsets. While the western districts of South Bengal, such as Birbhum, Burdwan, Bankura and Hooghly, had well developed government canal irrigation systems, the eastern districts of Nadia, 24-Parganas and Murshidabad were important for tubewell and pump irrigation. Here, Hooghly deserves special mention as it was the only district which was highly developed in all the three systems.

B.D. Dhawan[1] has carried out a comparison between the traditional and modern technology in which he concludes that;

(a) the unit variable cost is far more for the traditional technology as compared to the modern technology. This is to say that once the fixed cost, which is very high for the latter, has been incurred, modern technology is far-more efficient as compared to the traditional technology in terms of cost.

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1. Dhawan, B.D. (1975) "Economics of Ground Water Utilisation-Traditional versus MOdern Techniques" Economic and Political Weekly, Review of Agricultural June, 1975, p. A-31.

(b) the creation and maintenance of the modern ground water lifts have to be procured by cash payment from the non-farm sector of the economy.

The above can be a possible explanation as to why West Bengal had not developed substantially in modern ground water lift techniques. The small farmers were dominant in agricultural population in West Bengal, which was reflected in the average size of the operational holding of 0.94 hectares as compared to the Punjab average of 3.79 hectares and the Indian average of 1.82 hectares. Given the resource constraints of the small and the marginal farmers, it was likely that the large initial expenditures would be a major inhibiting factor to undertaking the investment.

From the report of the Economic Review of west Bengal, 1985-86 and 1986-87, it was clear that the State Government gave a very hopeful picture of the irrigation conditions for the last four years, starting with 1982-83. According to these reports, "in the last four years ending 1985-86, on the average, about 50 to 55 thousand hectares of minor irrigation potential has been created each year. In 1986-87, it is expected that about 84 thousand hectare of irrigation potential will be created through minor irrigation schemes."[2] Minor

2. "Economic Review", 1986-87, Government of West Bengal p. 14.

irrigation schemes have been taken up by IRDP, NREP, RLEGP and by district plans. However, the implementation of these irrigation programmes and their effectiveness can only be judged from the growth of agricultural yield of the state in the coming year.

Bio-chemical Technology:

HYV Seeds :

This subsection deals with the adoption of HYV seeds and chemical fertilizers in the districts of West Bengal. Data was not available at the district level on HYV seeds. The beliefs associated with the high yielding variety seeds are that [3]

(i) The HYV seeds give more response to chemical fertilizers than the local varieties of seeds.

(ii) The HYV seeds need fertilizer and assured irrigation for realising their higher response.

(iii) The HYV's respond "synergetically" to the package technology of chemical fertilizers (nitrogen, phosphorus and potash) and irrigation. This is to say that the working together of the inputs produces an effect greater than the sum of the individual effects.

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3. Vaidya Nathan, A. (1978) "HYV & Fertilizer : Synergy or substitution?" Economic Political Weekly, June 1978, p. 1031.

A Vaidya Nathan[4] has commented on the work of Kirit S. Parikh[5] in which he has stated that the HYV's produce more grain per unit of plant nutrient partly because, as compared to the traditional varities, they have substantially lower straw grain ratio.

Considering the importance of HYV seeds in 'package' technology and its relationship with irrgation and fertilizer use, it would have been of importance to analyse the use of HYV seeds in the districts. Since districtwise data is not available, the variations in the extension of area under HYV seeds for different crops has been examined for the state as whole.

An examination of table A-3.2, reveals that the two crops-Boro and wheat, which were using HYV extensively right from 1972-73, had reached 100 percent area coverage in 1985-86. The point to be noted here is that both these crops are rabi crops and, as there is no winter rain in West Bengal, they have to depend

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4. Ibid.

5. Parikh, Kirit S. (1978) "HYV and Fertiliser: Synergy or Substitution," Economic and Political Weekly Review of Agriculture, March 1978, p. p. A-2.

on irrigation. In fact, from the data on area and production, it can be seen that expansion of area under these two crops started from the early seventies and this expansion coincided with the usage of HYV seeds and with the relative development of tubewells, pumpsets and government canal irrigation. As Aman rice is grown in the monsoon, it is the crop depending the least on irrigation. Hence, it is also the crop which uses the lowest proportion of HYV seeds. In 1972-73, only 8.67 percent of area under Aman rice was under HYV and in 1985-86, this proportion had increased to 31.98 percent. This, under no circumstances, can be termed a significant breakthrough. Aus rice, which is sown in April, does not always have assured rainfall in the pre-monsoon season and consequently has to depend more on irrigation than Aman. In 1971-72, 11.23 percent of its area was under HYV seeds and this proportion increased to 37.88 percent in 1985-86.

Thus, in West Bengal, irrigation appears to have a clear relationship with adoption of HYV sees. However, the relationship of HYV seeds with fertilizers cannot be determined from the type of data available from the Ministry of Agriculture, Government of West Bengal. For determining that relationship, data on

either cropwise consumption of fertilizer or district-wise extension of HYV seeds are needed. All that can be said from the available data is that, at the state level, both the area under HYV seeds and consumption of fertilizer had been increasing steadily from the early 1970s to the mid 1980s. Thus, the relationship between these two inputs can probably be established for the state of West Bengal as a whole. From the limited data available on HYV seeds in West Bengal, it appears that the farmers are not readily adopting high yielding variety seeds if the crop is rainfed (as in case of Aman, which is the single most important crop in West Bengal). If the yield of HYV seeds was higher in West Bengal than of the local varieties even in the rainfed areas, there should be no reason why it should not be adopted even in case of rainfed crops. However, if this yield is only marginally more than of the local varieties in case of rainfed crops, then the farmers might not be willing to change the whole mode of operation for this marginal increase in yield.

Consumption of Chemical Fertilizer :

The use of chemical fertilizers in the state as a whole had been rising steadily from the early

1970s. The ratio of Nitrogen, Phosphorus and Potash used had remained mo: or less unchanged in the recent years and was broadlyin the order of 1 : 0.3 : 0.1 in 1985-86.

The amount of nutrients which can be effectively assimilated by plants depends on various physical factors like soil quality, temperature and sunshine, moisture content of the soil at various stages of the plant growth and the genetic potential of seeds. The use of chemical fertilizer is to replenish the nutrients which are being utilised by plants for their growth and it is also to ensure higher yield in future. The natural source of soil moisture - rainfall, is of a highly variable nature and, hence, cannot be depended on to provide assured and timely water supply. The higher the uncertainity of rainfall, lower would be both the expected yield and use of fertilizers.

As assured water supply can be ensured by a well developed irrigation system and hence there is a close relationship between irrigation and application of fertilizers. Again, it can be postulated that areas having ground water sources (which are less dependent on the vagaries of monsoon) are likely to have a greater

TABLE 3.5

QUANTITY OF CHEMICAL FERTILISER APPLIED PER UNIT AREA (kg/hect) AND ITS GROWTH (1971-72 to 1981-82)

S.NO	Districts	Fertiliser (N, P,K)Applied Kg/Hect 1971-72	1981-82	Growth Rate (Percent)
1	Burdwan	37	80	8.02
2	Birbhum	40	58	3.78
3	Bankura	26	36	3.31
4	Midnapore	17	37	8.09
5	Howrah	69	138	7.18
6	Hooghly	73	137	6.50
7	24-Parganas	25	36	3.71
8	Nadia	39	62	4.74
9	Murshidabad	35	46	2.77
10	W. Dinajpur	5	24	16.98
11	Malda	19	46	9.24
12	Jalpaiguri	2	13	20.58
13	Darjeeling	7	80	27.58
14	Cooch-Behar	4	25	20.11
15	Purulia	9	21	8.84
	Mean	27.13	57.38	
	S.D.	22.18	39.21	
	Co-efficient of Variation in Percentage	81.75	68.32	
	WEST BENGAL	24	47	6.95

Source : Economic Review 1983-84 and unpublished data; BAES Government of West Bengal

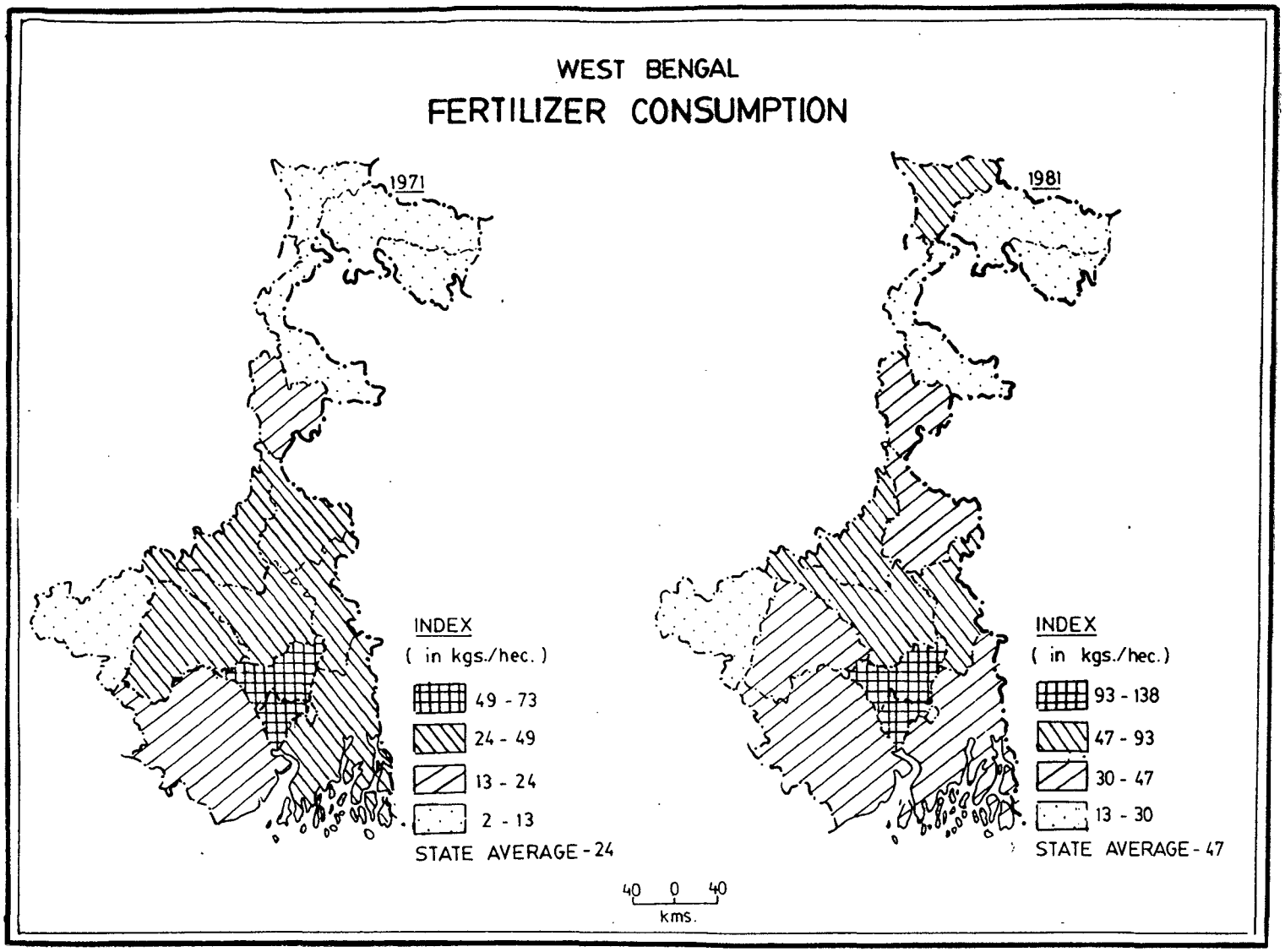
WEST BENGAL
FERTILIZER CONSUMPTION
1971
INDEX
(in kgs./hec.)
49 - 73
24 - 49
13 - 24
2 - 13
STATE AVERAGE - 24
1981
INDEX
(in kgs./hec.)
93 - 138
47 - 93
30 - 47
13 - 30
STATE AVERAGE - 47
40 0 40
kms.

FIG. - 3.12

relation with the use of fertilizers.

The HYV seeds, because they make more efficient use of fertilizers than the local variety of seeds, are likely to be coexisting in the same regions. As yields of different crops do not react similarly to change in application of fertilizer, there could be a change in the quantity of fertilizer used if there is a change in the cropping pattern of that area.

An analysis of the districtwise changes in the use of fertilizers both in 1971-72 and 1981-82 reveal that in the earlier years of the decade 1971-72 to 1981-82, the districts which were the highest users of fertilizers were Howrah and Hooghly (table 3.5). All the districts of North and Central part of South Bengal including the districts of Birbhum, Burdwan, Bankura, Nadia, 24-Parganas and Murshidabad were in the high range category, using more than the state average of 24 kg/hectare of fertilizer. Malda and Midnapore were in the low range (just below the state average) while all the districts of North Bengal, other than Malda, and Purulia were in the very low range of 2 to 13 kg/hectare. Again in 1981-82, Howrah and Hooghly were in the very high range category. In the

high range category there were three districts of South Bengal - Burdwan, Birbhum and Nadia and one district of North Bengal, Darjeeling. It is to be noted here that in case of Darjeeling, data for only 3 subdivisions had been reported for 1981-82. Bankura, Murshidabad and 24-Parganas, which were in the high category in 1971-72, had declined to the low category which was below the state average (47 kg/hectare). Malda and Midnapore, which were in the low category in 1971-72, remained in the same range in 1981-82. Jalpaiguri, Cooch-Behar and Purulia also remained in the very low category as in 1971-72.

Darjeeling was the only district which was in the very high growth rate range well above the growth rate of the state as a whole. This figure can be slightly misleading as the data for only three subdivisions had been reported in 1981. In the high growth range, above the state average (7 per cent), were included all the other four districts of North Bengal and three districts of South Bengal, Burdwan, Midnapore and Howrah. The high growth experienced by these districts was primarily as a result of their low base in 1971 (table 3.5). Low growth rates had been recorded

by Hooghly and Nadia, while very low growth rates, (below 4.5 per cent annually) had been registered by the remaining districts of South Bengal. It can be said that the state has made a breakthrough in use of fertilizers from 1971, since the lowest growth rate experienced by a district was 2.77 per cent, which is by no standards and in absolute terms, a low growth rate.

The relationship between application of fertilizers and irrigation can be clearly seen from figures 3.I, 3.II and 3.IV. The districts using higher quantity of chemical fertilizer were either developed in government canal irrigation (like Howrah, Hooghly, Burdwan and Birbhum) or tubewell irrigation (Nadia, Murshidabad and 24-Parganas).

Mechanical Technology:

Tractor Equivalent :

Analysis of mechanical technology has been done using tractor equivalent (which takes into consideration tractors, wooden and iron ploughs) and the index of mechanisation of the districts.

As mentioned earlier West Bengal has very low

average farm size. As mechanical technology such as tractors and harvest combines are size biased, there is not much scope for its development in the state. Hence, in analysing the ploughing machinery, wooden and iron ploughs converted into tractor equivalent have been considered.

As argued by Hanumantha Rao[6], the biological source of energy (bullock power) is becoming more and more expensive and it might be profitable in some cases to substitute it with tractors, as tractors are the basic substitutes for animal labour. In contrast, the combine harvester, which displaces human labour, might not prove to be socially beneficial in a labour abundant economy.

The scope of this study being limited, we are only interested in seeing as to how well equipped the state is in ploughing technology. In 1961, the distribution of ploughing machinery in terms of tractor equivalents per 1000 hectares was the maximum in the districts of Purulia, Hooghly and 24-Parganas (table 3.6). In Purulia, it was the abundance of wooden ploughs which had resulted in a high figure. Other than these districts Jalpaiguri, Cooch Behar and West Dinajpur

6. Rao, C.R., Hanumantha, (1972), "Farm Machanisation in Labour Abundant Economy" Economic and Political Weekly Annual Number, 1972 February, 2, p. 393.

TABLE : 3.6 : NUMBER OF TRACTOR EQUIVALENT PER'000 HECTARES OF NET AREA SOWN AND ITS GROWTH(1961-1981)

S.No	Districts	No. of Tractor Equivalent/ '000 Hectares			Growth Rates (Percent)		
		1961	1971	1981	1961 to 1971	1971 to 1981	1961 to 1981
1	Burdwan	7.24	8.67	15.39	1.82	5.91	3.84
2	Birbhum	9.02	1.18	11.85	-18.39	25.39	1.37
3	Bankura	9.25	8.43	13.17	- 0.92	4.56	1.78
4	Midnapore	8.21	3.53	14.03	- 8.09	14.81	2.72
5	Howrah	8.45	8.37	6.27	- 0.95	- 2.8	-1.48
6	Hooghly	10.75	3.52	15.15	-10.56	15.71	1.73
7	24-Parganas	10.01	7.01	10.10	- 3.5	3.72	0.04
8	Nadia	7.38	1.90	8.28	-12.69	15.86	0.58
9	Murshidabad	8.13	3.92	5.24	- 3.12	- 1.21	-2.17
10	W. Dinajpur	8.76	2.36	3.12	-12.29	2.83	-5.03
11	Malda	5.54	6.14	8.30	1.03	3.06	2.04
12	Jalpaiguri	8.04	1.12	NA	-17.89	NA	NA
13	Darjeeling	2.65	1.88	NA	- 3.37	NA	NA
14	Cooch-Behar	8.57	10.45	13.02	2.00	2.22	2.11
15	Purulia	11.30	5.40	12.08	- 7.12	8.38	0.33
	Mean	8.22	5.06	10.46			
	S.D.	2.09	3.08	3.94			
	Co-efficient of Variation in Percentage	25.43	60.91	37.61			
	WEST BENGAL	7.93	5.04	10.06	- 4.49	7.22	1.20

NA Indicates data not available.

Source : Same as table 3.4.

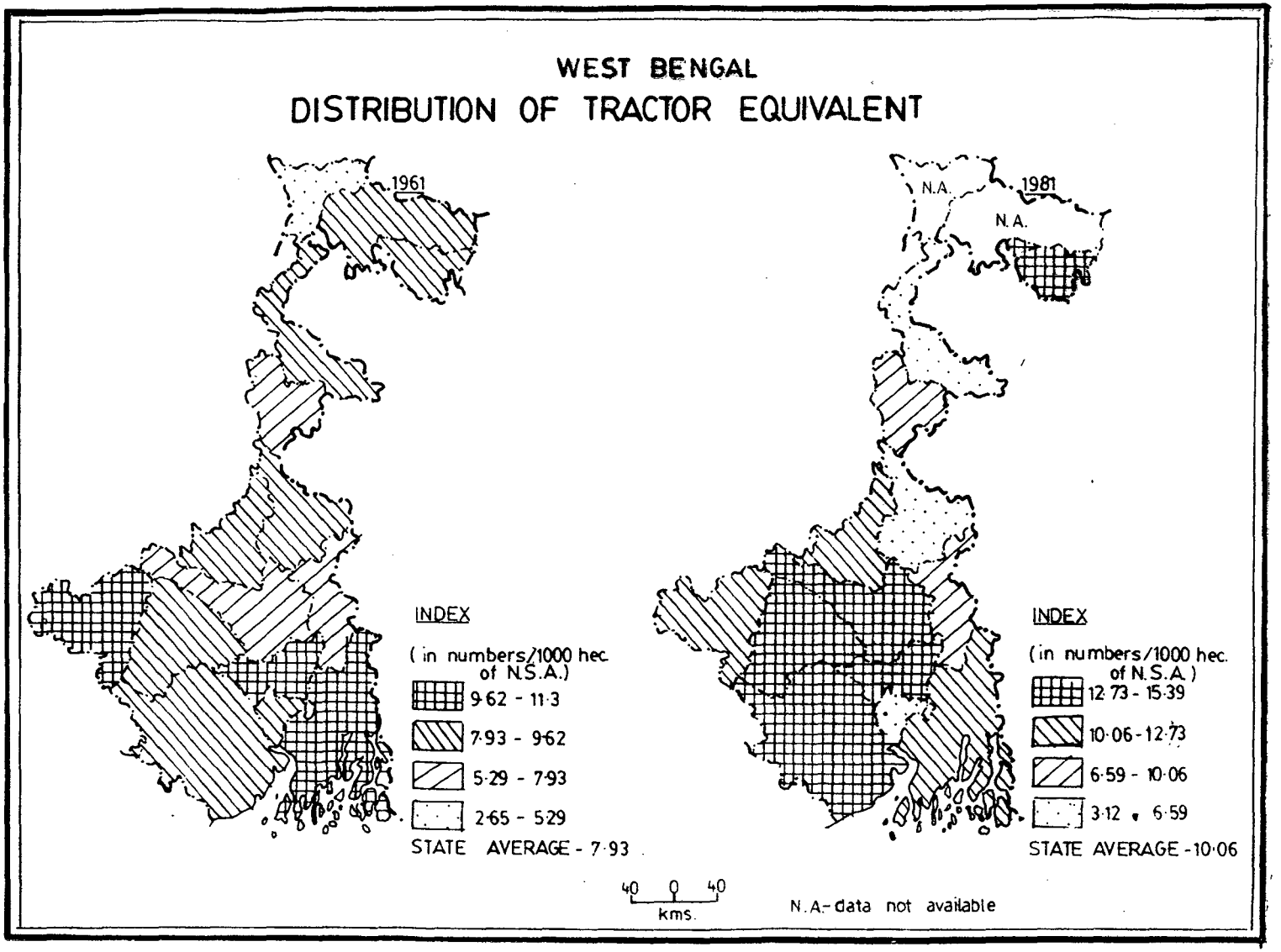
WEST BENGAL
DISTRIBUTION OF TRACTOR EQUIVALENT
1961
INDEX
(in numbers/1000 hec. of N.S.A.)
9·62 - 11·3
7·93 - 9·62
5·29 - 7·93
2·65 - 5·29
STATE AVERAGE - 7·93
N.A.
1981
N.A.
INDEX
(in numbers/1000 hec. of N.S.A.)
12·73 - 15·39
10·06 - 12·73
6·59 - 10·06
3·12 - 6·59
STATE AVERAGE - 10·06
40 0 40
kms.
N.A.- data not available

FIG.-3·V

in North Bengal and Birbhum, Murshidabad, Bankura and Midnapore in South Bengal were above the state average of 7.93 tractor equivalent per 1000 hectares. No obvious relationship seemed to exist between this and yield levels as except for Birbhum, Bankura and Hooghly, none of the other districts were among the top ranking districts, in so far agricultural productivity in value terms was concerned.

In 1971, the pattern of distribution of ploughing machinery changed. More districts of South Bengal- Burdwan, Bankura, Howrah, 24-Parganas, Murshidabad and Purulia were above the state average of 5.01 per 1000 hectare than in 1961. It must be noted that the state average declined in 1971 from 1961 (7.93 to 5.01 per 1000 hectare).

In 1981, Cooch Behar, Burdwan, Bankura, Midnapore and Hooghly were in the very high category. Purulia and 24-Parganas maintained their positions in the high category, along with Birbhum. Malda and Nadia were in the low category with 10.0 tractor equivalents per 1000 hectare, while West Dinajpur, Murshidabad and Howrah were in the very low category.

During the period 1961 to 1981, Burdwan and Midna-

pore experienced growth rates which were more than twice the growth rate of the state as a whole (table 3.6). Bankura, Hooghly, Birbhum, Malda and Cooch Behar experienced growth rates between the state average and twice the state average. Purulia, 24-Parganas and Nadia had growth rates below the state average. The three districts of West Dinajpur, Murshidabad and Howrah showed negative growth rates.

The decade 1961-1971 witnessed negative rate of growth for the state as a whole and for twelve out of fifteen districts as well. In this period, the number of tractors had doubled while the number of wooden ploughs had become almost half and iron ploughs had decreased in number by about 25 per cent. As the number of ploughs were far higher as compared to tractors the decline in the number of ploughs had a dominant effect resulting in a negative growth rate of tractor equivalent figures for the decade.

Index of Mechanisation :

The index of mechanisation has been worked out by taking the machinery for ploughing and irrigation. The index showed changed patterns at all the three points of time i.e. 1961, 1971 and 1981. The changes in the

TABLE 3.7 INDEX OF MECHANISATION AND ITS GROWTH (1961-1981)

S.NO	Districts	Index of Mechanisation			Growth Rate (Percent)		
		1961	1971	1981	1961 to 1971	1971 to 1981	1961 to 1981
1	Burdwan	0.88	1.60	1.70	6.16	0.61	3.35
2	Birbhum	1.32	0.20	0.80	-17.20	14.87	-2.47
3	Bankura	1.12	1.51	1.10	3.03	2.60	0.18
4	Midnapore	1.11	0.75	1.39	3.84	6.36	1.13
5	Howrah	1.02	3.04	0.75	11.72	13.20	-1.58
6	Hooghly	1.32	0.80	2.07	- 4.88	9.97	2.28
7	24-Parganas	1.16	1.23	1.21	0.59	- 0.16	0.21
8	Nadia	0.60	0.51	0.98	- 1.61	6.75	2.48
9	Murshidabad	0.70	0.83	0.51	1.72	- 4.75	-1.58
10	W. Dinajpur	0.88	0.41	0.23	- 7.35	- 5.62	-6.49
11	Malda	1.05	0.82	0.55	2.44	- 3.92	-3.18
12	Jalpaiguri	0.89	0.27	NA	-11.24	--	--
13	Darjeeling	0.33	0.33	NA	0.00	--	--
14	Cooch-Behar	1.77	1.73	0.73	- 0.23	- 8.30	-4.33
15	Purulia	1.32	0.91	NA	- 3.65	--	--

NA Indicates data not available

Source : Same as for table 3.4.

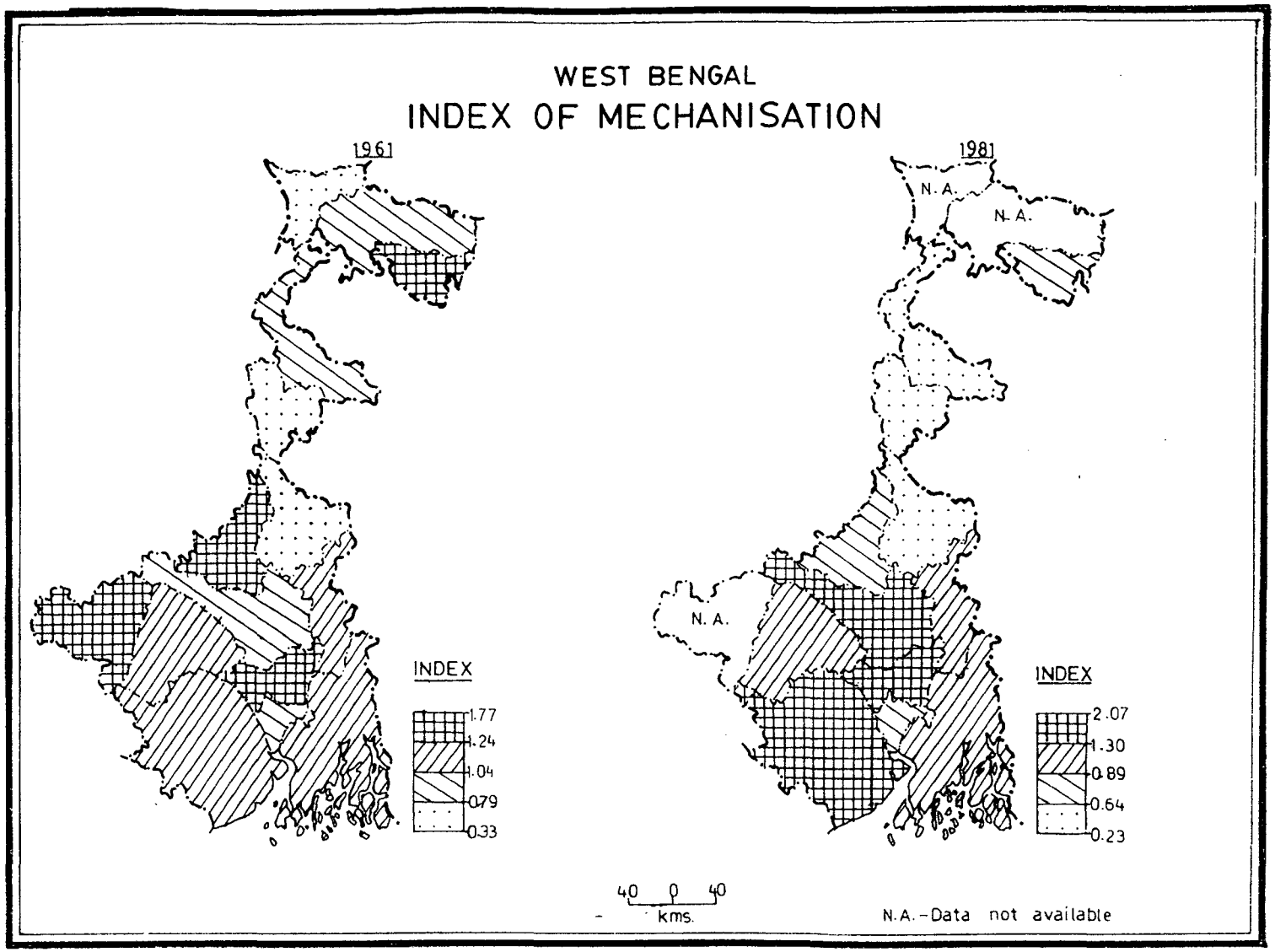
WEST BENGAL
INDEX OF MECHANISATION
1961
INDEX
1.77
1.24
1.04
0.79
0.33
1981
N.A.
N.A.
N.A.
INDEX
2.07
1.30
0.89
0.64
0.23
40 0 40
kms.
N.A.-Data not available

FIG. 3·VI.

pattern of mechanisation were such which indicate that it (as defined by M.N. Pal's formula) had not developed in any region. In 1961, Birbhum, Purulia, Hooghly and Cooch Behar were in the high range category (table 3.7). Out of these only Cooch Behar could retain its position in the same category in 1971. The medium category included Bankura, Midnapore, Nadia and 24-Parganas in 1961 out of which only 24-Parganas remained in this category throughout the time period. Jalpaiguri, West Dinajpur, Howrah and Burdwan were in the low category in 1961, while Darjeeling, Malda and Murshidabad were in the very low category.

In 1971, Bankura, Burdwan, Howrah and Cooch Behar were in the high category while Birbhum, Darjeeling and Jalpaiguri were in the very low category. In 1981, Burdwan, Hooghly and Midnapore were in the very high range, while Murshidabad, Malda and West Dinajpur were in the very low category.

In the period 1961 to 1981 out of twelve* districts, six had experienced negative growth rates, while six had experienced positive growth rates. Over

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* Data for the districts of Darjeeling, Jalpaiguri and Purulia were not available in 1981.

the two decades, all the districts of South Bengal with the exception of Murshidabad, Birbhum and Howrah showed positive growth. These three districts along with the districts of North Bengal showed negative growth. From a study of decadal growth rates, an interesting fact emerged which was that the districts which experienced negative growth rates in the first decade were not the districts which experienced negative growth rates in the second decade. The only exceptions were West Dinajpur and Cooch Behar, which experienced negative growth rates in both the decades. Burdwan was the only district which had positive growth rates in both the decades.

From the above study it emerged that there had been no region - not even at the individual district level, which had consistently developed in mechanisation. The small farmers' incapability to invest in mechanical technology and the constraint of the small average size of the farm (0.94 hectare) are probably the reasons which hindered the growth of mechanisation. However, considering the high density of population and the large number of small and marginal farmers and landless labourers - any kind of human-labour displacing mechanisation might not have a beneficial effect either

socially or economically.

SECTION - II

CHANGES IN SELECTED INFRASTRUCTURAL VARIABLES AFTER INDEPENDENCE:

The technological factors discussed earlier may be deemed to be the direct determinants of productivity but the infrastructural variables are important in affecting yield in a more indirect fashion. Regulated marketing facilities, for example, have to be well established to save the cultivator from the malpractices of unscrupulous traders and assure him a good price for his products. Marketing facilities would also enable him to procure more easily both consumer products and agricultural inputs. Secondly, as irrigation partly depends on assured electric supply, electrification of a larger number of villages should ensure better operation of pumps and tubewells operated by electricity. Thirdly, a good transport network ensures the quick transport of the perishable products from the farms to the markets. Also the inputs needed for the farms could be supplied with greater efficiency. Intensive development of an agricultural economy also calls for a considerable provision of warehousing facilities for

storing agricultural inputs like fertilizers and pesticides and for storage of agricultural produce which need not be marketed immediately. Need for credit would increase more and more as improved and more expensive inputs are applied in the farms. Both long term loans for land improvement and acquisition of tractors and short term loans for the seasonal requirements of cultivation (for example, application of biochemical technology) have to be facilitated by a strong credit co-operative network.

a) Regulated Markets:

Among the regulated markets there are principal market yards which are less in number but cater to a wide range of customers and wider range of products. Sub-market yards are more in number and are primarily for essential weekly transactions.

In 1971, the numbers of principal market yards per 10 square kilometres of area was 0.003 for the state in general, which increased to 0.007 in 1981 (table 3.8). In relation to the state average, the districts of Hooghly, Murshidabad and Cooch Behar were in the very high range category at both points of time. In

1971, in addition to the above three districts, Burdwan, Bankura and Nadia were also in the same category. In 1971, West Dinajpur, Malda and Darjeeling were in the high range category, that is, the districts had figures just above the state average. All the other districts were below the state average and in the very low category, Purulia being the only district in the low range category. During 1971-1981 a large contiguous part of the South Bengal which was in the very high range category in 1971 had broken up by 1981 into small uncontiguous parts. Burdwan and Nadia, which were in the very high category had declined to the high category in 1981. Malda and West Dinajpur, in the high category in 1971, had shifted down to the low category. However, Midnapore and Jalpaiguri had climbed up to the low category in 1981 from the very low range in 1971.

Though the relative positions of the districts had generally shifted down over the period their absolute positions had become better which is evident from the annual growth rate figures (table 3.8). Birbhum, Midnapore, Howrah and Jalpaiguri had experienced very high growth rates (above twice the rate of growth experienced by the state as whole which was 8.84 per cent). Bankura,

TABLE 3.8 : REGULATED MARKETS PER UNIT AREA AND ITS GROWTH (1971-1981)

S.NO	Districts	Principal Market Yards			Sub-Market Yards		
		No. Per 10 sq. Km. 1971	No. Per 10 sq. Km. 1981	Growth Rate (Percent)	Number Per 10 sq. Km 1971	Number Per 10 sq. Km 1981	Growth Rate (Percent)
1	Burdwan	0.007	0.008	1.34	0.029	0.049	5.38
2	Birbhum	0	0.003	*	0	0.003	*
3	Bankura	0.007	0.014	7.18	0.009	0.016	5.92
4	Midnapore	0	0.005	*	0	0.013	*
5	Howrah	0	0.011	*	0	0.053	*
6	Hooghly	0.006	0.013	8.04	0.038	0.298	22.87
7	24-Parganas	0	0	0.00	0	0	0.00
8	Nadia	0.008	0.009	1.18	0.003	0.019	20.27
9	Murshidabad	0.006	0.012	7.18	0.009	0.023	9.84
10	W. Dinajpur	0.004	0.004	0.00	0.005	0.024	16.98
11	Malda	0.003	0.004	2.92	0.006	0.022	13.87
12	Jalpaiguri	0	0.006	*	0	0.040	*
13	Darjeeling	0.003	0.040	29.57	0.006	0.395	52.00
14	Cooch-Behar	0.009	0.015	5.24	0.006	0.349	50.13
15	Purulia	0.002	0.003	4.14	0.006	0.024	14.87
	WEST BENGAL	0.003	0.007	8.84	0.006	0.051	23.86

* Indeterminate

Source : Same as for table 3.1.

Hooghly, Murshidabad and Cooch Behar had experienced growth rates below the state average. All the other districts had experienced very low growth rates. None, however, experienced a negative growth rate.

The number of sub-market yards had grown considerably over the ten year period starting 1971. In 1971 Burdwan and Hooghly were in the very high range category. The latter district remained in the same category even in 1981 (table 3.8). The high category included the three districts of North bengal, Malda, Darjeeling and Cooch Behar and three districts of South Bengal, Bankura, Murshidabad and Purulia. All the other districts including the two remaining districts of North Bengal, Jalpaiguri and West Dinajpur were below the state average of 0.008 per 10 square kilometres of area.

In 1981, as in the case of principal market yards, the relative positions of the districts had undergone a general downward shift in relation to the state average. Bankura, Nadia, Murshidabad, West Dinajpur, Malda and Purulia which were in higher categories in 1971 had shifted down to the very low range in 1981.

However, again as in the case of principal market

yards, there had been an upward shift of the absolute position of the individual districts. No district experienced negative growth rates in the decade 1971 to 1981. However, only Darjeeling and Cooch Behar experienced very high growth rates and were the only two districts having growth rates above that experienced by the state as a whole. However, four districts i.e. Birbhum, Midnapore, Howrah and Jalpaiguri which had no principal or sub-market yards in 1971 had a number of regulated markets in 1981. It also has to be noted that the state average for 1981 was as high as 23.86 percent.

b) Electrified Villages :

The proportion of electrified villages to total inhabited villages had improved significantly in 1981 as compared to 1971 (table 3.9). The state average had shot up to 37.51 percent in 1981 from its meagre figure of 7.14 percent in 1971. The coefficient of variation of 1981 was almost half as much as in 1971 and hence electricity supply in the state can be said to be better distributed in 1981. However, as compared to the 100 percent electrification of inhabited villages of Punjab in 1984-85, the figure for West Bengal is quite dismal.

TABLE 3.9

PROPORTION OF ELECTRIFIED VILLAGES TO INHABITED VILLAGES AND ITS GROWTH (1971-1981)

S.No	Districts	Percentage of Electrified Villages 1971	Percentage of Electrified Villages 1981	Growth Rate (Percent)
1	Burdwan	19.93	60.27	11.70
2	Birbhum	3.98	44.55	27.32
3	Bankura	2.68	23.28	24.27
4	Midnapore	2.09	21.99	26.53
5	Howrah	15.95	62.38	14.61
6	Hooghly	18.18	63.45	13.31
7	24-Parganas	11.29	43.14	14.34
8	Nadia	33.96	83.59	9.42
9	Murshidabad	12.17	50.80	15.36
10	W. Dinajpur	0.57	30.99	49.12
11	Malda	4.66	53.44	27.63
12	Jalpaiguri	21.91	50.14	8.63
13	Darjeeling	28.01	29.44	0.50
14	Cooch-Behar	1.14	22.43	34.71
15	Purulia	2.32	21.17	24.75
	Mean	11.92	44.73	
	S.D.	10.69	19.89	
	Co-efficient of Variation in Percentage	84.65	44.47	
	WEST BENGAL	7.14	37.51	18.04

Source : Same as for table 3.4

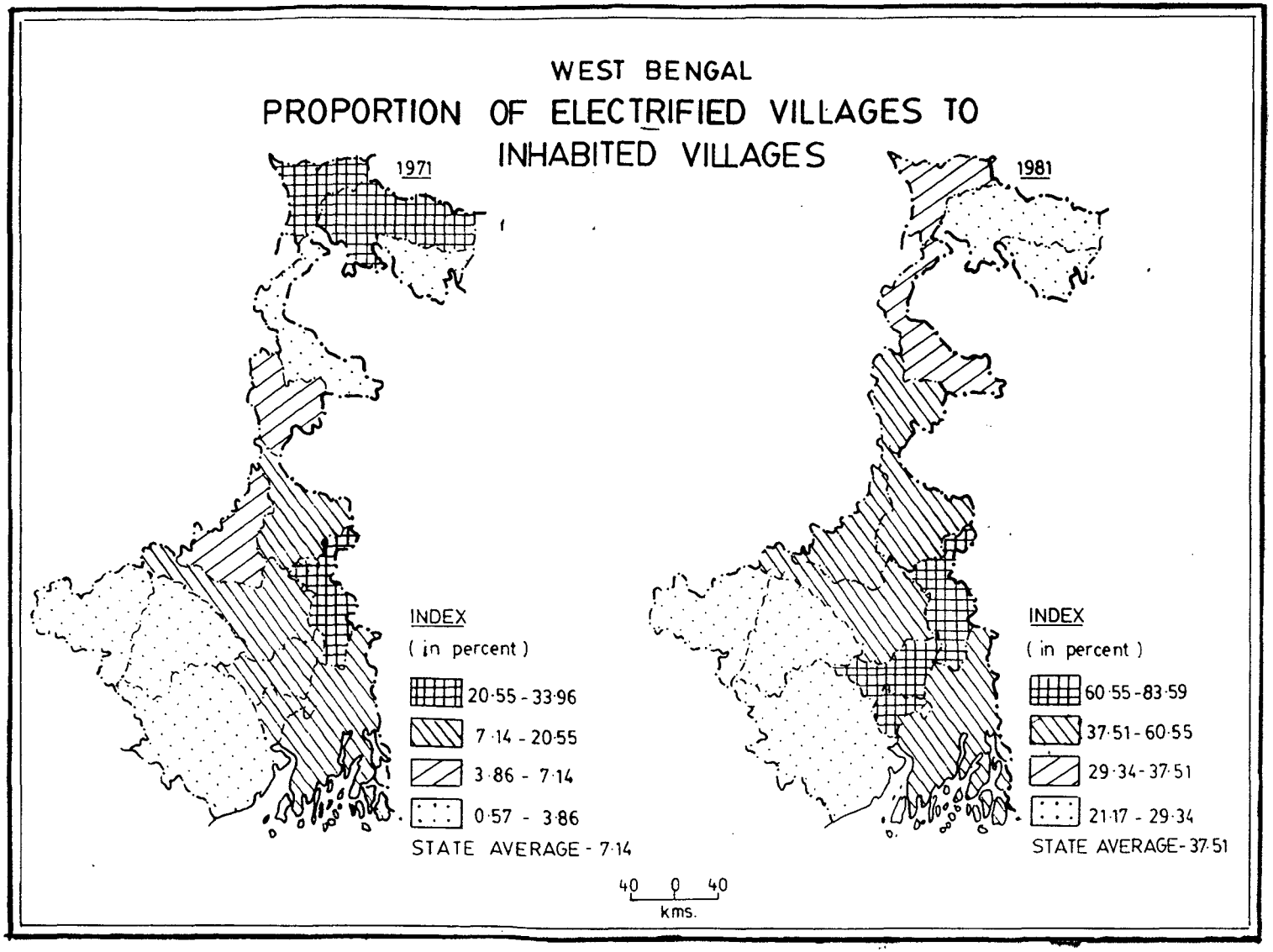
WEST BENGAL
PROPORTION OF ELECTRIFIED VILLAGES TO INHABITED VILLAGES
1971
1981
INDEX
(in percent)
20·55 - 33·96
7·14 - 20·55
3·86 - 7·14
0·57 - 3·86
STATE AVERAGE - 7·14
INDEX
(in percent)
60·55 - 83·59
37·51 - 60·55
29·34 - 37·51
21·17 - 29·34
STATE AVERAGE - 37·51
40 0 40
kms.

FIG-3·VII

Comparing the relative positions of the districts, it emerged that there had been a general upward shift from 1971 to 1981 (figure 3. IX). Only the four districts of Jalpaiguri, Darjeeling, Malda and Birbhum shifted down in the range categorisation of 1981 from that of 1971. With the exception of Birbhum, Purulia, Bankura and Midnapore in 1971, and Purulia, Bankura and Midnapore in 1981, all the other districts of South Bengal had percentages of electrified villages to total villages above the state average. There seemed to be a distinct relationship between the percentage of electrified villages and the number of tubewells. For example, in 1981, the districts of Nadia, Howrah, Hooghly, Murshidabad and Malda were developed in both aspects. Such a distinct relationship with pumpsets could not be seen as most of these in West Bengal were operated with diesel.

The power situation of West Bengal, in absolute terms had definitely improved over the ten years. It was observed that the districts not so developed in electricity in 1971 (West Dinajpur, Malda, Cooch Behar, Bankura, Midnapore and Purulia) had rates of growth above the state average, while the districts having greater electrification had lower growth rates. This

was the underlying reason for the lower coefficient of variation in 1981, as compared to 1971.

c) Road Density:

The road density of the extra-municipal roads followed a regular pattern in all the three years, 1961, 1971 and 1981 (table 3.10). In all the three points of time the three high altitude districts of North Bengal, i.e. Cooch Behar, Darjeeling and Jalpaiguri had a relatively high road density. This was because of the scope for vertical as well as horizontal growth of roads existing in hilly areas. Apart from these three districts, the relatively developed districts (in terms of yield) of Burdwan, Birbhum, Howrah and Hooghly also had high road densities. Nadia was the only other district which consistently had high road density. Bankura, Midnapore, Purulia, 24-Parganas, West Dinajpur and Malda had road densities consistently below the state average.

As far as the overall annual growth rates were concerned, the districts developed in terms of road densities viz; Burdwan, Birbhum, Howrah, Hooghly, Nadia and Darjeeling, experienced high growth rates (table 3.10). Apart from this, the underdeveloped districts

TABLE 3.10: ROAD DENSITY OF EXTRA MUNICIPAL ROADS AND ITS GROWTH (1961-1981)

S.NO	Districts	Road Density (Km/Km^2)			Growth Rates (Percent)		
		1961	1971	1981	1961 to 1971	1971 to 1981	1961 to 1981
1	Burdwan	0.09	0.18	0.21	7.18	1.55	4.32
2	Birbhum	0.08	0.17	0.20	7.83	1.64	4.69
3	Bankura	0.06	0.13	0.16	8.04	2.10	5.03
4	Midnapore	0.05	0.12	0.13	9.15	0.80	4.89
5	Howrah	0.09	0.24	0.39	10.30	4.97	7.61
6	Hooghly	0.12	0.33	0.34	10.64	0.29	5.34
7	24-Parganas	0.06	0.23	0.17	8.04	1.96	5.34
8	Nadia	0.08	0.21	0.23	31.21	0.91	5.42
9	Murshidabad	0.08	0.16	0.18	7.18	1.81	4.14
10	W. Dinajpur	0.06	0.14	0.16	8.84	1.34	5.03
11	Malda	0.08	0.14	0.17	5.76	1.96	.84
12	Jalpaiguri	0.10	0.18	0.17	6.05	0.57	2.69
13	Darjeeling	0.18	0.24	1.04	2.72	15.79	9.17
14	Cooch-Behar	0.33	0.39	0.41	1.68	0.50	1.09
15	Purulia	0.04	0.08	0.11	7.18	3.23	5.19
	Mean	0.10	0.19	0.22			
	S.D.	0.07	0.08	0.10			
	Co-efficient of Variation in Percentage	71.91	43.67	44.30			
	WEST BENGAL	0.08	0.16	0.19	7.18	1.73	4.42

Source : Calculated from same source as for table 3.4

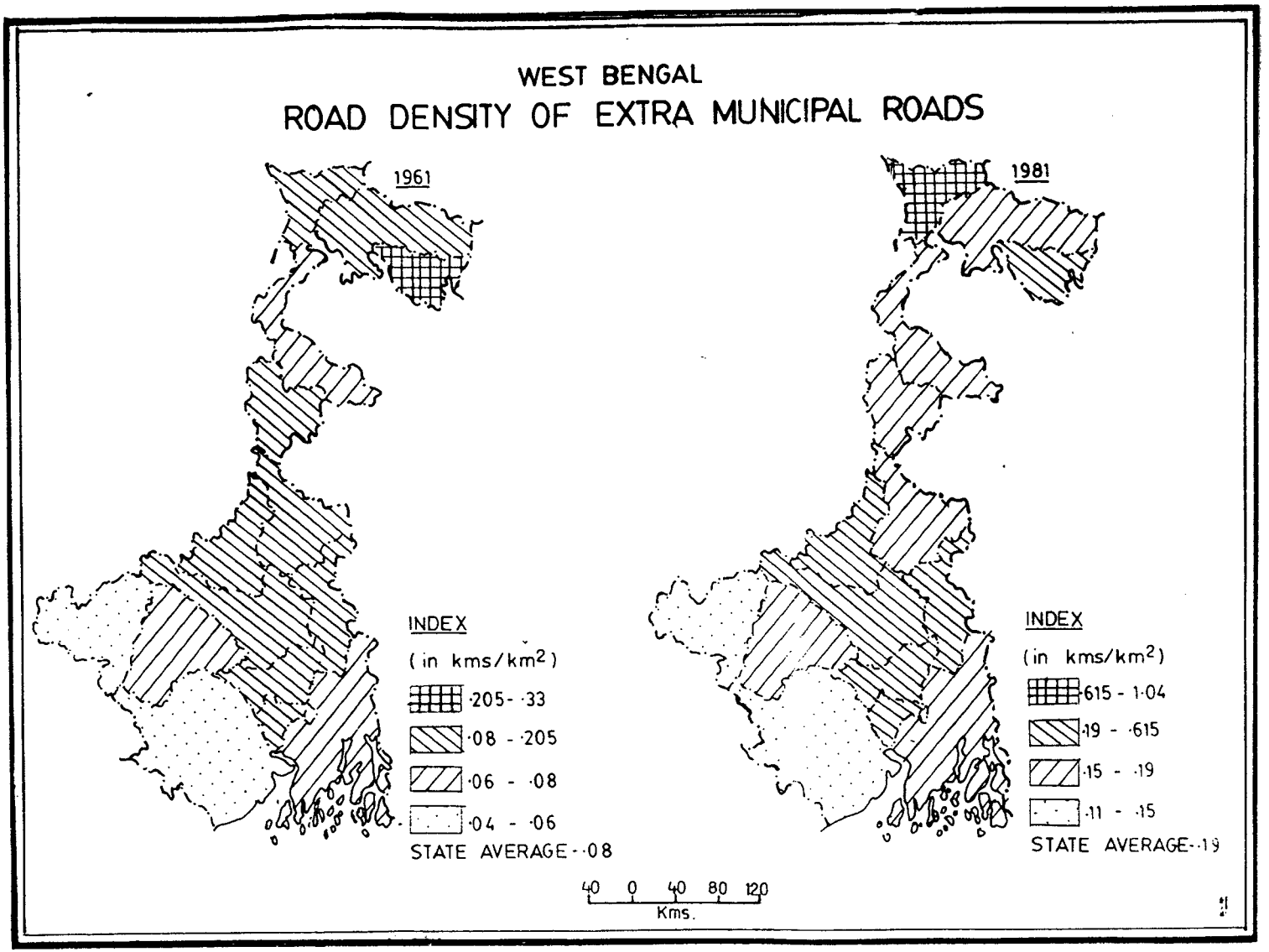
WEST BENGAL
ROAD DENSITY OF EXTRA MUNICIPAL ROADS
1961
INDEX
(in kms/km²)
·205 - ·33
·08 - ·205
·06 - ·08
·04 - ·06
STATE AVERAGE - ·08
1981
INDEX
(in kms/km²)
·615 - 1·04
·19 - ·615
·15 - ·19
·11 - ·15
STATE AVERAGE - ·19
40 0 40 80 120
Kms.

FIG.-3·VIII

of 24-Parganas, Midnapore, West Dinajpur and Purulia had high growth rates. Howrah and Darjeeling were the only districts which had experienced an overall growth rate more than twice the state growth rate of 4.42 percent. Burdwan was the only well developed district which had an over all growth rate lower than the state average.

Analysis of the decadal growth rates showed that the decade of 1961 to 1971 had a far greater impact on the overall growth rate (7.18 percent for the state as a whole) as compared to the far lower growth rate in the decade 1971 to 1981 (1.73 percent). Most of the districts which experienced higher growth rates than the state average in one decade experienced growth rates lower than the state average in the other decade. Only the five districts of Bankura, Howrah, 24-Parganas, Murshidabad and Purulia had higher or equal growth rates to the state averages in both the decades.

The coefficient of variation which was the highest in 1961 remained almost the same in 1971 and 1981 (1981 figure being marginally higher than the 1971 figure). Hence, it can be said that there had been very little improvement over the period as far as distribution

of roads was concerned.

d) Storage Facility :

The capacity of the state warehousing corporation had increased steadily as can be seen by the following table :

TABLE : 3.11
STORAGE CAPACITY OF THE STATE WAREHOUSING CORPORATION

Years	1975	'76	'77	'78	'79	'80	'81	'82	'83	'84	'85	'86
Capacity in KGs Per Unit Hect. of Area	14	15	16	16	18	19	21	22	22	23	24	26

Source: Same as Table 3.1.

within the last eleven years, the annual compound growth rate for the state has been a significant 5.96 percent.

e) Credit Supply:

That the co-operative movement of West Bengal had made a break-through in supplying credit is evident from table : A-3.3. In case of state and central Banks and Agricultural credit societies, though the numbers have been decreasing, the number of members, the working capital and loans advanced had increased. In case of

the land mortgage banks, renamed as the Land Development Banks since 1975-76, the numbers of societies along with members, working capital and loans advanced had increased considerably.

f) Agricultural Work Force :

The proportion of agricultural male workers to total male workers in West Bengal had gone up from 1951 to 1971 but from 1971 to 1981 it fell from 58.58 percent to 55.09 percent (table A-3.6). In Howrah and Darjeeling, the proportion was low throughout the period. While in Howrah, it was because of widespread urbanisation, in Darjeeling, it was because of unsuitable terrain that agriculture as an occupation had lower prominence. Also, workers of tea plantations are not termed as agricultural workers but instead are termed as workers in the tea industry.

In the proportion of cultivators to total agricultural workers there had been a drastic fall from 1961 to 1971 (from 72.9 percent to 57.3 percent). Consequently, in 1971 the proportion of agricultural labourers to total workers rose significantly. However, the more or less stagnant proportion of cultivators

to total agricultural workers from 1971 to 1981 (table A-3.4) could be because of the success of land reforms in distributing land to the landless.

In conclusion it might be said that, in general, a more equitable distribution for the districts was being reached in case of almost all variables (from 1961 to 1981 in some cases and 1971 to 1981 in some other cases) excepting in the case of tractor equivalent and tubewells. In case of the latter, there has been a decline in their number over the period in the state as a whole. The coefficient of variation increased in 1981, indicative of a more skewed distribution in that year.

From the analysis of tractor equivalent it emerged that there had been a decline in the number of tractor equivalent from 1961 to 1971. Its coefficient of variation increased over the period. In 1981 the number of tractor equivalent was more than the figures for both the earlier years, but the coefficient of variation was less than in 1971 but more than in 1961. This meant that it was most equitably distributed in 1961 as compared to the two later points of time.

In case of all the other variables namely government canal irrigation, number of pumpsets, use of fertilizer, number of regulated markets and proportion of electrified villages, there had been a transformation for the better both in terms of growth and equality.

CHAPTER IV

AGRICULTURAL TRANSFORMATION AND ITS DETERMINANTS

Section I - Stepwise Regression Analysis:

In the second chapter it had been established that productivity is a crucial indicator of agricultural transformation. In the third chapter, a number of variables theoretically identified as proximate and indirect determinants of productivity have been discussed. It is being attempted to examine the nature of the relationship between the dependent variable (productivity) and the explanatory variables.

"The study of a causal relationship between a dependent and one or more independent variable become useful when the relationship is defined in terms of a mathematical form".[1] Multiple linear regression analysis is such a method which is useful in assessing the relative influence of each independent variable on the dependent variable and in making predictions about how

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1. Mahmood, Aslam (1986), "Statistical Methods in in Geographical Studies", Rajesh Publications New Delhi, p. 61.

the movement of the independent variables would determine the movement of the dependent variable .

Stepwise multiple regression is a series of multiple regressions where additional regressors are introduced at every step according to their goodness of fit, till all the variables are added and the final regression equation is obtained. In each step, the regression coefficients are the best values for the predictors included and the regression equation obtained is the optimum for the same predictors.

There are several advantages of adopting stepwise multiple regression. The contribution of an added variable can be determined at every step in terms of the value of coefficient of determination (R^2). It can also be judged as to whether including a new variable is beneficial to the model or not, with the help of the value of $\bar{R}^2$ or the coefficient of determination adjusted for the degrees of freedom.

Two common tests of significance of the estimates, the t test for regression coefficients and the F test for the model as a whole have been used. R^2 or the coefficient of determination or the squared multiple correlation coefficient shows the "percentage of the

variation of y explained by the regression plane"[2] that is, by the predictors. In stepwise regression the value of $\bar{R}^2$ becomes important because the inclusion of an additional explanatiory variable will never reduce R^2 value, which is the proportion of explained sum of squares by total sum of squares (Appendix-3). To correct this defect R^2 is adjusted by taking into account the degrees of freedom and thus it can determine whether a variable can be included in the model or not.

The Results of Multiple Regression Analysis :

1961-62 (Set-I)

Five regressors were added at the various steps of the regression analysis. Here, the dependent variable is (Y) = productivity in money terms (1960-63). The various predictors were -

X_1 = Percentage of area irrigated to net sown area.

X_2 = Number of pumpsets per 1000 hectares of net sown area.

X_3 = Number of tractor equivalent per 1000 hectares of net sown area.

X_4 = Percentage of agricultural workers to total workers (males).

X_5 = Length of extra municipal roads (km) per square kilometre of geographical area.

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2. Koutsoyiannis, A (1977) "Theory of Econometrics", 2nd Edition, Macmillian Publishers Ltd., London, p.122.

An examination of table 4.2 reveals that the proportion of government canals irrigation (X_1) explained the maximum proportion of variation of Y (60.1 per cent) followed by percentage of agricultural workers to total workers (X_4) which explained 17.6 per cent, ploughing machineries (X_3) which explained 5.2. per cent and number of pumpsets which explained 7 percent. R^2 remained unchanged from step 4 to step 5, when road density was added. So this variable was not worth including in the model. Also, even though R^2 increased very marginally from step 3 to step 4 (.007), the $\bar{R}^2$ value started decreasing from step 4 onwards. This indicated that the contribution of X_2 in step 4 in increasing the value of R^2 is not strong enough to offset the reverse effect on the explanatory power of the model due to increase in the degrees of freedom (n-K). Hence, the optimum regression equation is that of step 3.

TABLE : 4.1

CORRELATION MATRIX 1961-62

Y	X_1	X_2	X_3	X_4	X_5
	.775	-.153	.123	-.475	-.191
	1	.002	.055	-.074	-.086
		1	.135	.209	.843
			1	.318	-.271
				1	-.030
					1

TABLE 4.2
RESULTS OF STEPWISE REGRESSION ANALYSIS : 1961-62

Variables	Regression Co-efficient	t Value	R^2	Increase in R^2	$\bar{R}^2$	F Value
Step 1						
X_1	23.017	4.425**	.601	-	.601	19.584**
Step 2						
X_1	22.094	5.441**	.777	0.176	.760	20.877**
X_4	-10.479	-3.073* *				
Step 3						
X_1	21.525	5.777**				
X_4	-12.430	-3.772**	.829	.052	.800	17.762**
X_3	53.921	1.831*				
Step 4						
X_1	21.556	5.638**				
X_4	-12.023	-3.500**	.836	.007	.792	12.765**
X_3	55.406	1.828*				
X_2	-29.583	-0.669				
Step 5						
X_1	21.519	5.218**				
X_4	-12.068	-3.189**				
X_3	54.145	1.227	.836	0	.771	9.193**
X_2	-24.665	-0.193				
X_5	-103.498	-0.041				

** Significant at 1 Percent level of significance
* Significant at 5 Percent level of significance

The t values of the regression coefficients from step 1 to step 3 revealed significant values for government canal irrigation (X_1) and proportion of agricultural workers (X_4) at both one and five per cent level of significance. However, proportion of agricultural workers showed negative relationship with productivity.

The value of F was significant at both one and five percent levels of significance in all the steps. This means that the explanatory power of the whole model is significant.

Till step 3, the variables government canal irrigation, proportion of agricultural workers in total workforce (males) and ploughing machineries together explain 82.9 percent of the variation of productivity in money terms.

1971-72 (Set II):

Ten regressors were included in the model of 1971-72, five being common to the regressors used in the regression analysis of 1961-62. The variables entering the exercise were as under :-

Dependent Variable:

Y = Productivity in money terms (1970-73).

The regressors were :

X_1 = Percentage of area irrigated by government canals

TABLE 4.3

CORRELATION MATRIX - 1971-72

Y	X_1	X_2	X_3	X_4	X_5	X_6	X_7	X_8	X_9	X_{10}
1	.855	.394	.782	.246	.132	-.215	.127	.091	.642	.024
	1	.195	.474	-.062	.003	-.110	.088	.127	.618	.068
		1	.747	.418	.075	-.163	.280	.328	.432	.342
			1	.646	.119	-.441	.280	.059	.465	.291
				1	.337	-.553	.303	-.137	-.049	.212
					1	.009	.194	.364	.174	-.331
						1	-.272	.257	-.184	-.708
							1	.459	.363	.275
								1	.521	.145
									1	.199
										1

to net sown area.

X_2 = Number of tubewells per 1000 hectares of net sown area.

X_3 = Kilograms of chemical fertilizer used per hectare.

X_4 = Number of pumpsets used per 1000 hectares of net sown area.

X_5 = Number of tractor equivalent per 1000 hectares of net sown area.

X_6 = Proportion of agricultural workers to total workers (males).

X_7 = Road density (km/km^2).

X_8 = Number of principal market yards per 100 sq. km. of geographical area.

X_9 = Number of submarket yards per 100 sq. km. of total geographical area.

X_{10} = Percentage of electrified villages to total inhabited villages.

Table 4.4 reveals that among the regressors, percentage of area irrigated by government canals (X_1) explained the maximum proportion of variation of y (73.1 per cent) followed by X_3, amount of chemical fertilizers per hectare (18.3 per cent), X_{10}, proportion of electrified villages to total inhabited villages (12.9 per cent), X_2, number of tubewells (1.3 per cent), X_9, number of submarket yards (1.1 per cent), X_4, number of pumps (.5 per cent), X_7 road density (.2 per cent), X_8, number of principal market yards (.2 per cent).

TABLE : 4.4

RESULTS OF STEPWISE REGRESSION ANALYSIS : 1971-72

Variables	Regression Co-efficient	t Value	R^2	Increase in R^2	$\bar{R}^2$	F Value
Stept 1						
X_1	25.146	5.937**	.731	-	.731	35.248**
Step 2						
X_1	18.361	6.493**	.914	.183	.907	63.812**
X_3	12.978	5.062**				
Step 3						
X_1	17.894	7.383**				
X_3	-14.553	6.350**	.943	.029	.933	60.114**
X_{10}	-9.794	-2.333				
Step 4						
X_1	16.850	7.277**				
X_3	18.458	5.945**	.956	.013	.943	53.800**
X_{10}	- 8.577	-2.180*				
X_2	-11.670	-1.716				
Step 5						
X_1	14.212	5.513**				
X_3	18.970	6.694**				
X_{10}	- 9.089	-2.536*	.967	.011	.954	52.827**
X_2	-15.424	-2.363*				
X_9	802.250	1.769				

Continued

TABLE : 4.4 (Continued)
RESULTS OF STEPWISE REGRESSION ANALYSIS : 1971-72

Variables	Regression Co-efficient	t Value	R^2	Increase in R^2	$\bar{R}^2$	F Value
Step 6						
X_1	12.743	4.508**				
X_3	22.550	5.435**				
X_{10}	- 8.494*	-2.494*	.972	.005	.956	45.966**
X_2	- 17.481	-2.631*				
X_9	670.269	1.460				
X_4	-22.183	-1.162				
Step 7						
X_1	12.624	4.325**				
X_3	22.086	5.107**				
X_{10}	- 8.355	-2.269*				
X_2	-17.279	-2.520*	.974	.002	.954	37.146**
X_9	820-835	1.588				
X_4	-17.437	-0.841				
X_7	-379-211	-0.726				
Step 8						
X_1	22.646	4.151**				
X_3	23.023	4.862**				
X_{10}	- 8.252	-2.145*				
X_2	-10.213	-2.482*	.976	.002	.951	29.899**
X_9	670.211	-1.143				
X_4	-16.940	-0.783				
X_7	-524.905	-0.891				
X_8	1090.555	0.654				

** Significant at 1 Percent level of significance
* Significant at 5 percent level of significance

The tractor equivalent (x_5) and the proportions of agricultural workers to total workers (X_6) do not explain any proportion of variation of y. While the value of R^2 increased till step 8, the value of $\bar{R}^2$ started decreasing from step 7 onwards. Hence, road density (X_7) and number of principal market yards, though contributing marginally to R^2, could not be considered when the degrees of freedom (n-k) was taken into account. It would be superfluous to include step 7 in the analysis. Thus, the optimum regression equation of the analysis was derived in step 6.

The t values of regression coefficients from step 1 to step 6 indicated that government canal irrigation (X_1) and quantity of chemical fertilizers (X_3) were significant at both 5 and 1 per cent levels of significance. The proportion of electrified villages (X_{10}) and number of tubewells (X_2) were significant at 5 percent level of significance. The two latter predictors had negative relationship with y.

The F value was significant throughout the analysis at both 5 and 1 per cent levels of significance. In step 6, the six explanatory variables together explained 97.2 percent of variation of y.

TABLE : 4.5

CORRELATION MATRIX - 1981-82

Y	X_1	X_2	X_3	X_4	X_5	X_6	X_7	X_8	X_9	X_{10}
1	.668	-.061	.788	.736	.426	-.565	.236	.203	.095	.665
	1	-.306	.284	.270	.621	-.023	-.075	.173	-.011	.032
		1	.083	.218	-.015	.063	.671	.630	.717	.263
			1	.712	.109	-.774	.613	.360	.280	.670
				1	.318	-.516	.337	.279	.357	.650
					1	-.034	.076	.160	.380	-.190
						1	-.434	-.069	-.012	-.555
							1	.641	.765	.318
								1	.613	.123
									1	-.036
										1

1981-82 (Set III) :

The regressors are identical to that of the set of 1971-72.

However, the number of observations were only thirteen, in spite of there being fifteen districts in the same time period. Darjeeling and Jalpaiguri have not been included in the analysis, because data regarding the number of pumpsets and ploughing machineries were not available for these two districts. Also, the net sown area of Darjeeling reported for this time period took into account only three subdivisions of the district.

In this model, the maximum proportion of variations of y was explained by X_3, quantity of chemical fertilizers (62.2 per cent) followed by X_1, government canal irrigation (21.4 per cent), X_{10}, percentage of electrified villages (9.7 per cent), X_6, number of ploughing machineries (2.6 percent), X_7, road density (2.1 per cent), X_6, proportion of agricultural workers (1 per cent), X_4, number of pumps (.6 per cent), X_9, number of submarket yards (.4 per cent) and X_2, number of tubewells (.2 per cent). The value of R^2 increased till step 9. However, the value of $\bar{R}^2$ started declining

TABLE : 4.6
RESULTS OF STEPWISE REGRESSION ANALYSIS: 1981-82

Variables	Regression Co-efficient	t Value	R^2	Increase in R^2	$\bar{R}^2$	F Value
Step 1						
X_3	12.375	4.251**	.622	-	.622	18.069**
Step 2						
X_3	10.224	4.874**	.836	.214	.821	25.447**
X_1	14.401	3.611**				
Step 3						
X_3	5.648	2.684*				
X_1	16.479	5.547**	.922	.097	.906	35.454**
X_{10}	12.550	3.153**				
Step 4						
X_3	5.140	2.805**				
X_1	12.666	3.982**	.948	.026	.931	36.766**
X_{10}	14.626	4.083**				
X_5	33.967	2.023*				
Step 5						
X_3	7.832	3.962**				
X_1	9.942	3.386**				
X_{10}	13.436	4.433**	.969	.021	.953	43.441**
X_5	41.176	2.868**				
X_7	-1284.389	-2.137*				

Continued

TABLE 4.6 (Continued)
RESULTS OF STEPWISE REGRESSION ANALYSIS : 1981-82

Variables	Regression Co-efficient	t Value	R^2	Increase in R^2	$\bar{R}^2$	F Value
Step 6						
X_3	8.222	4.022**				
X_1	10.462	3.461**				
X_{10}	13.862	4.471**	.973	.004	.953	35.53**
X_5	33.093	1.949*				
X_7	-2003.789	-2.021*				
X_9	69.888	0.918				
Step 7						
X_3	10.343	3.906**				
X_1	9.801	3.301**				
X_{10}	17.239	4.198**	.979	.006	.958	32.90**
X_5	38.942	2.278*				
X_7	-3102.754	-2.343*				
X_9	154.007	1.517				
X_4	-2.958	-1.201				
Step 8						
X_3	8.021	3.265**				
X_1	13.092	4.441**				
X_{10}	19.291	5.539**	.989	.010	.973	44.65**
X_5	23.060	1.433				
X_7	-4249.522	-3.470**				
X_9	289.027	2.675*				
X_4	-4.264	-2.029*				
X_6	-8.801	-1.917				

Continued

TABLE 4.6 (Continued)
RESULTS OF STEPWISE REGRESSION ANALYSIS : 1961-62

Variables	Regression Co-efficient	t Value	R^2	Increase in R^2	R^2	F Value
Step 9						
X_3	9.745	2.812*				
X_1	13.211	4.227**				
X_{10}	16.823	3.410**				
X_5	23.834	1.398				
X_7	-4470.198	-3.245*	.991	.002	.972	35.456*
X_9	256.643	2.100*				
X_4	-4.456	-1.989				
X_6	-9.175	-1.877				
X_2	47.129	0.753				

** Significant at 1 percent level of significance
* Significant at 5 percent level of significance

from step 9 onwards and thus it would have been superfluous to proceed after step 8 of the analysis (table 4.6). X_8, the number of principal market yards failed to contribute to any increase in R^2. X_2, number of tubewells, contributed marginally to R^2, but its inclusion in the model failed to raise the values of $\bar{R}^2$. Thus step 8 could be considered as the optimum regression equation obtained from the stepwise regression model.

In step 8, out of eight regressors, six were significant at 5 percent level of significance. Out of these, four regressors - X_3, quantity of chemical fertilizer, X_1, government canal irrigation, X_{10}, electrified villages and X_7, road density were significant at both 5 and 1 percent levels of significance. X_9, number of sub market yards and X_4, number of pumps were significant at 5 percent level of significance. However, the variables road density and number of pumpsets showed a negative relationship with productivity (table 4.6).

F value remained significant at 1 per cent level of significance throughout the analysis. All the eight variables in step 8 taken together explained 98.9 percent of the variation in y.

The overall comparitive results showed that the regressors in the optimum regression equations in 1961-62 explained 82.9 percent of the variation of y, the regressors of 1971-72 explained 97.2 percent and the regressors of 1981-82 explained 98.9 percent of variation of y. The optimum regression equation after which $\bar{R}^2$ started to decrease was step 3 in Set I (1961-62), step 6 in Set II (1971-72) and step 8 in Set III (1981-82). The variable government canal irrigation was positively significant at both 5 and 1 percent levels of significance in all the three sets. It was the first predictor to be entered in Set I & II and the second predictor to be entered in Set III. The quantity of chemical fertilizers which was introduced as a regressor from 1971-72 onwards, was positively significant for both Set II and Set III at both 5 and 1 percent levels of significance. X_{10} or percentage of electrified villages was also significant at 5 percent level in Set II and both 5 and 1 percent levels of significance in Set III. However, it should be noted that whereas in 1971-72, it had a significant negative relationship with productivity, in 1981-82 it had a significant positive relationship with productivity.

Other than these, none of the other significant variables were common to any two sets. Number of

principal market yards, which was introduced as a regressor from 1971-72 onwards got rejected from the analysis in both time periods.

From the above comparision of the three sets of regressions, it emerges that government canal irrigation had a strong positive influence in determining the productivity of agriculture in West Bengal in 1961-62, 1971-72 and 1981-82. Chemical fertilizers had also played a vital role in influencing the trend of productivity in the two later time periods.

A high percentage of electrified village, in 1971-72 probably was not indicative of a high proportion of area under cultivation. One of the factors influencing the variable could have been villages around urban centres being electrified as a spillover effect of the extension and development of those urban centres. However, the reason for which it had a significant negative relationship with productivity is a subject matter for further investigation. In 1981-82, however, the same variable showed a very strong positive relationship with productivity. Hence, rural electrification can be definitely said to have undergone a transformation from 1971-72 to 1981-82, in terms of raising agricultural productivity in West Bengal.

In 1961-62 (Set I), ploughing machinery had a significant positive relationship with productivity. It has to be remembered that in the above mentioned time period, the wooden plough was the most important ploughing machinery followed by the iron plough. In the same set, the proportion of agricultural workers to total work force (males) had a strong negative relationship with y. In an area with a density of population as high as West Bengal, this kind of a relationship is probably not surprising. However, this relationship can be better explained if variables such as productivity per labourer, and number of agricultural workers per hectare of total sown area are taken into account.

In 1971-72, the number of tubewells showed a negative relationship with y. It has to be mentioned in this context, that districts which had no government canal irrigation depended primarily on tubewell irrigation. Data regarding the percentage of area irrigated by tubewell would have probably clarified this relationship better. It could have then been established whether a large number of tubewells effectively meant a high percentage of area irrigated by the same source.

In 1981-82, along with government canal irrigation

and quantity of chemical fertilizer, the number of sub-market yards and percentage of electrified villages showed a significant positive relationship with productivity in money terms. As compared to 1971-72, the situation in 1981-82 can definitely be called a transformation in terms of agricultural infrastructures. However, significant negative relationship was observed between the number of pumpsets and road density and the dependent variable, productivity. As these variables should theoretically have a positive effect on productivity, a deeper analysis has to be made to explain these two relationships.

Section II - Principal Component Analysis :

The multiple regression analysis reflects the overall relationship of different explanatory variables with the dependent variable, but it does not show the spatial pattern of agricultural development. In order to analyse the pattern of agricultural development over different points of time, it is necessary to derive a composite index of agricultural development.

Since the different indicators do not have the same influence on agricultural development, it becomes necessary to assign weights to them. These weights,

however, cannot be assigned arbitrarily or be based on subjective valuation. If the weights are not derived properly, the resultant index could be more misleading than an unweighted index. A scientific way of determining these weights is a sophisticated statistical technique called 'Factor Analysis'. 'Factor Analysis' technique not only provides weights for the variables but also provides 'factor loadings' for each variable which are the co-efficient of co-relation between the given variables and the principal components corresponding to the factor loadings.[3]

In the analysis for each point of time only the principal components associated with eigen values whose cumulative percentage, that is, the percentage of total variations of the indicators accounted for, exceeded 80 per cent were selected. The factor loadings of the principal components selected were then examined to determine, on the basis of tests of significance of the factor loadings, which component reflected best the state of agricultural development.

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3. Rao, Hemlata (1984), "Regional Disparities and Development in India", Ashish Publishing, New Delhi, p. 33.

The variables used in the factor analysis are the same as used in the multiple regression. Thus, six indicators were used for 1961-62 and eleven indicators were used for both 1971-72 and 1981-82.

Results of Factor Analysis for 1961-62:

Three principal components were selected by the computer on the basis of the above stated criterion. An examination of the factor loadings associated with each component revealed that four variables, two variables and two variables were associated significantly (at 1 percent level of significance) with the first, second and third principal components respectively. Thus, the scores of the first principal component were best suited as the composite index of agricultural development.

Out of the four variables showing significant co-relation with the first principal component, two variables-productivity and percentage of area irrigated by government canals, showed positive corelation while two variables - number of pumpsets per 1000 hectare and road density, showed negative co-relation. Number of tractor equivalent and percentage of agricultural workers to total workers were the two variables which

TABLE : 4.7
FACTOR LOADINGS - 1961

Variables	Factor Loadings		
	I	II	III
X_1	0.81140*	0.51516	0.15739
X_2	0.62375*	0.54675	0.35774
X_3	-0.66882*	0.64645*	0.30907
X_4	0.06926	-0.19108	0.84427*
X_5	-0.45703	-0.35700	0.62988*
X_6	-0.67087*	0.71042*	-0.12709
Eigen Value	2.15849	1.65087	1.37395
Percentage of Cumulative Variance	35.98	63.49	86.39

* Significant at 1 percent level of significance

did not show any significant co-relation (table 4.7).

The composite index of agricultural development for 1961-62 indicated that the districts of Burdwan, Birbhum, Hooghly, Howrah and Bankura were agriculturally the most developed (table 4.10 and fig. 4.I). These districts (index score 1 and above) form a contiguous space in the west-cental part of South Bengal. The districts of medium development (index score 0-1) were Darjeeling, Jalpaiguri and 24-Parganas. The former two districts together constituted the northern most part of the state while 24-Parganas was in the south-eastern fringe of the highly developed agricultural region of the state. Low agricultural development (index score -1 to 0) had been experienced by five districts, Purulia, Midnapore, Nadia, Murshidabad and West Dinajpur. The first four of these were adjacent to the highly developed region. Malda and Cooch-Behar had a very low level of development according to the composite index (index score below -1). These two districts were adjacent to either the medium or low developed regions.

Results of Factor Analysis for 1971-72 :

Four principal components accounted for 81.98 percent of variations of the indicators. An examination

TABLE : 4.8

FACTOR LOADINGS - 1971

Variables	Factor Loadings			
	I	I	III	IV
X_1	0.78881*	-0.30102	-0.45813	-0.19858
X_2	0.61451*	-0.43639	-0.53535	0.06654
X_3	0.71605*	0.05371	0.16910	-0.00114
X_4	0.89409*	0.15366	-0.15662	-0.24787
X_5	0.52217	0.57012	0.22457	-0.53132
X_6	0.21402	-0.28314	0.53094	-0.60881*
X_7	-0.52215	-0.70482*	0.06290	-0.11584
X_8	0.49836	0.01983	0.57402	0. 20972
X_9	0.33137	-0.54908	0.62419*	0.31836
X_{10}	0.72618*	-0.46789	-0.01401	0.27059
X_{11}	0.43731	0.55253	0.06308	0.63988*
Eigen Value	3.97230	2.03562	1.61021	1.39967
Percentage of Cumulative Variance	36.11	54.62	69.29	81.98

*Significant at 1 percent level of significance

of the factor loadings associated with each component revealed that five, one, one and two variables each were associated significantly (at 1 percent level of significance) with the first, second, third and fourth principal components respectively. Individually, the first principal component explained 36.1 percent of variation of the indicators while the second explained 18.5 percent, the third, 14.6 percent and the fourth, 12.7 percent (table 4.8). Accordingly, the scores of the first principal component were used as the composite Index.

All the five variables having significant co-relation with the first principal component showed a positive relationship. These variables were productivity, percentage of net sown area irrigated by government canals, number of tubewells per 1000 hectares of net sown area, fertiliser consumption (kg/hectare) and number of submarket yards per 100 square kilometres of area. Out of the remaining six variables which did not exhibit any significant co-relation with the first principal component, only one variable, percentage of agricultural workers to total workers, showed negative relationship.

In 1971-72 the highly developed agricultural

region consisted of three districts (table 4.10 and fig 4.I). These were the central districts of South Bengal, namely Burdwan, Hooghly and Howrah. The medium developed region (index score 0 to 2) was immediately to the north of the highly developed region and included the districts of Birbhum, Murshidabad and Nadia. Five districts were in the low development range (index score -2 to 0) but these districts did not lie contiguously. Three of these districts were immediately to the outside of the medium and high zones of development and can be termed 'transitional' districts connecting the medium and high range districts with the very low development range districts (fig. 4.I). These 'transitional' districts were Bankura, Malda and 24-Parganas. The remaining districts in this range were Darjeeling and Cooch-Behar in North Bengal. The districts of Jalpaiguri, West Dinajpur, Purulia and Midnapore were in the very low developed range and were in the extreme fringe of area, considering the highly developed areas as the focal point of development.

Results of Factor Analysis for 1981-82:

Three principal components together explained 81.37 percent of the variations of the indicators. Six variables were associated significantly (at 1 percent

TABLE 4.9

FACTOR LOADINGS - 1981

Variables	Factor Loadings		
	I	II	III
X_1	0.79270*	-0.54257	-0.14881
X_2	0.32705	-0.50316	-0.69797*
X_3	0.42067	0.80817*	0.07958
X_4	0.89043*	-0.24449	0.20281
X_5	0.81761*	-0.21575	0.01301
X_6	0.32471	-0.14068	-0.82972*
X_7	— 0.65005*	0.33963	-0.40870
X_8	0.73180*	0.54667	0.10718
X_9	0.57339	0.54359	-0.22452
X_{10}	0.54969	0.68995*	-0.32030
X_{11}	0.67089*	-0.26199	0.52414
Eigen Values	4.51823	2.58113	1.85162
Percentage of Cumulative Variance	41.08	64.54	81.37

* Significant at 1 percent level of significance

level of significance) with the first principal component while two variables each were significantly co-related with the second and third principal components. The first component explained 41.08 percent of the variations of the indicators while 23.46 percent and 16.83 percent were explained by the second and third principal components respectively (table 4.9). Of the six variables co-related significantly with the first principal component, five variables-productivity, fertiliser consumption (kg/hectare), number of pumpsets per 1000 hectares, road density and percentage of electrified villages were positively related while the sixth variable, percentage of agricultural workers, was negatively related.

In 1981-82, the pattern of development had not changed much since 1971-72. The scores of the first principal component of these two time periods, for the indicators of development chosen, were identical in both cases. In 1981-82, complete data for Darjeeling and Jalpaiguri was not available. Hence, these two districts had to be left out of the analysis in this particular time period.

As far as the distributional pattern of agricultural development regions are concerned, only

TABLE 4.10

SCORES OF FIRST PRINCIPAL COMPONENT
1961-62, 1971-72 & 1981-82

S.No	Districts	Scores of 1st Principal Component 1961-62	1971-72	1981-82
1.	Burdwan	3.536	6.018	3.968
2.	Birbhum	1.974	0.248	-1.108
3.	Bankura	1.166	-0.879	-1.743
4.	Midnapore	-0.218	-3.057	-3.265
5.	Howrah	1.333	5.107	5.233
6.	Hooghly	1.406	9.051	10.261
7.	24-Parganas	0.356	-1.671	-2.004
8.	Nadia	-0.854	1.905	2.515
9.	Murshidabad	-0.386	0.553	-0.788
10.	W. Dinajpur	-0.909	-4.126	-5.930
11.	Malda	-1.355	-2.009	-2.516
12.	Jalpaiguri	0.201	-4.147	-
13.	Darjeeling	0.150	-1.315	-
14.	Cooch Behar	-6.318	-1.489	0.727
15.	Purulia	-0.082	-4.187	-5.348

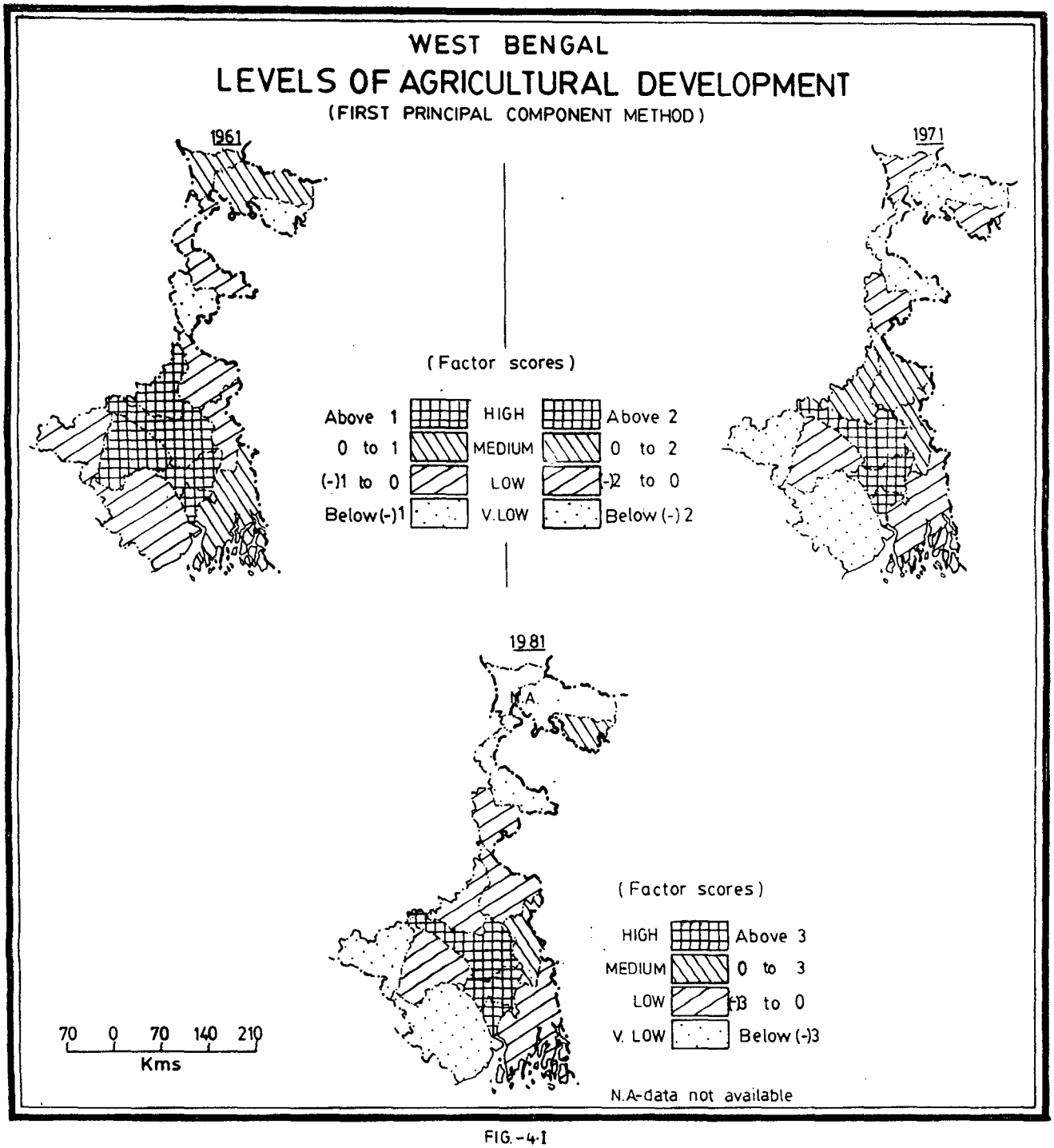
WEST BENGAL
LEVELS OF AGRICULTURAL DEVELOPMENT
(FIRST PRINCIPAL COMPONENT METHOD)
1961
1971
1981
N.A.
(Factor scores)
Above 1
HIGH
Above 2
0 to 1
MEDIUM
0 to 2
(-)1 to 0
LOW
(-)2 to 0
Below (-)1
V.LOW
Below (-) 2
(Factor scores)
HIGH
Above 3
MEDIUM
0 to 3
LOW
(-)3 to 0
V. LOW
Below (-)3
N.A-data not available
70 0 70 140 210
Kms

FIG.-4.1

three districts were in different categories as compared to 1971-72. Murshidabad and Birbhum, which had been in the medium development region in 1971-72, were in the low development region in 1981-82. Cooch-Behar, however, had improved in its relative position and was among the medium development region in 1981-82, as compared to its position in 1971-72, when it was among the low development region . A comparison of the factor loadings of the first principal components of the three time periods, revealed that productivity was the only indicator which had a significant positive correlation in all the time periods with the respective first principal components. Government canal irrigation had positive significant co-relation with the first component in 1961-62 and 1971-72, where as the amount of fertilizer consumed had a significant correlation with the composite index in the last two time periods. Road density, which had a negative correlation with the first component in 1961-62, had a positive correlation with the first principal component 1981-82.

SUMMARY AND CONCLUSION

Transformation of agriculture in West Bengal has been studied not only in terms of the changes in output, area under cultivation and productivity, but also in terms of changes in determinants of productivity. A positive growth in area and yield would definitely result in the growth of output. However, continuous increases in productivity can come about only with good infrastructural framework and increase in the use of technological inputs in cultivation. Two aspects may reflect the transformation in terms of deep rooted changes. These two aspects are (a) whether the growth has taken place, and (b) whether the growth is stable? Agricultural growth can be said to be stable only if the efficiency of cultivation shows an increasing trend over time.

Summary of Findings:

It is important to judge the significance of relative contributions of area and yield to the change in output. A slow increase in the proportion of the net area sown to total geographical area has taken place in the state over the period of study. The

proportion of net sown area to total cultivable area, however, has been increasing at a faster rate, and in 1981-82, accounted for 97 percent. The increase was the highest during the seventies while it was marginal in the other two decades. Hence, the potential for further physical extension of cropped area has been almost exhausted in the state and further increases in output through extension of physical area can only be marginal.

One way of increasing aggregate yield is to change the cropping pattern with more productive crops relplacing the less productive crops. However, there have been no significant changes in the cropping pattern of the state over the period of study except for three central districts of the state - Malda, Nadia and Murshidabad. These districts, which had fairly wide degree of diversification in 1951-52, had a larger degree of diversification in 1981-82. These districts also experienced high rate of growth in aggregate yield during the same period.

Most of the districts of South Bengal remained mono crop regions throughout the period of study. Within South Bengal, a contiguous region consisting of Burdwan, Birbhum, Bankura, Howrah and Hooghly remained an area

of high level of productivity throughout the period. This was probably due to a high degree of specialised production in cultivation of Aman rice.

An examination of the area, output and yield figures for the various crops revealed the following features.

Output of foodgrains which occupied about four-fifths of gross cropped area grew at a rate of 1.3 percent annually over the twenty year period (1960-63 to 1980-83). Yield contributed twice as much as area to this growth of output. The decade of the sixties witnessed the highest rate of growth of production of food grains. The decade of the seventies witnessed negative growth for all the three elements of area, production and yield though they were relatively marginal.

Rice is the most important cereal in West Bengal. In 1960-63, it occupied 82.9 percent of area under foodgrains. This figure increased to 86.1 percent in 1980-83. Output of rice increased at a rate of 1.5 percent over the thirty year period. Area contribution was at par with yield contribution in case of rice. The decade of the seventies witnessed negative growth

of yield and output, while growth of area was positive.

Aman, which is the most important variety of rice, constituting about four fifth of area under rice in 1980-83, did not register negative growth in any of the three elements both throughout the period as well as the three decades individually. For Boro, the overall contribution of area was far higher than the contribution of yield. This variety of rice grew in importance over the period of study.

In case of wheat, another crop of growing importance like Boro, even though the overall yield contribution was significant, the area contribution was more than twice that of the yield contribution.

Jute, which is the most important non-food grain crop, recorded a steady increase in area. The rate of growth of yield of jute was about half that of area over the period as a whole.

Productivity in money terms grew only slowly over the period of the study. The negative rate of growth of productivity in the decade of the seventies, though marginal, seriously dampened the growth in yield that had taken place in the first two decades of the period of study.

In 1950-53, the districts with high yield levels were Burdwan, Birbhum, Bankura, Howrah, Hooghly, Darjeeling and Midnapore. By 1980-84, however, Darjeeling and Midnapore lost their position and were replaced by Malda, Murshidabad and Nadia, which had registered high growth rates of yield in the period of study. Among the districts which maintained their high yield levels, Hooghly, Burdwan and Howrah exhibited high growth rates of yield throughout the period.

Out of the selected technological and infrastructural variables analysed, government canal irrigation, number of pumpsets, number of ploughing machineries, consumption of fertilizer, number of regulated markets and proportion of electrified villages, there had been transformation for the better, both in terms of growth and equity of distribution, over the respective study periods.

The number of tubewells, especially the shallow tubewells, declined over the decade ending 1981, in the state as a whole and for all individual districts without any exceptions.

The proportion of agricultural workers to total workforce had increased over the study period. However, there had been a marginal decline in 1981 as comapred

to 1971. The proportion of cultivators to agricultural workers declined over the period. However, this decline was relatively marginal as compared to the increase in proportion of agricultural labourers.

The central districts of South Bengal remained the most developed region agriculturally throughout the period of study. Two variables emerged significant in explaining spatial variations in productivity in all the sets of regressions where they were entered as predictors. These two variables were percentage of area irrigated by government canals and consumption of fertilizer. In 1961, the tractor equivalent per unit area alongwith percentage of agricultural workers to total workers also emerged as significant explanatory variables of inter-district variations in productivity. In 1971, in addition to government canal irrigation and consumption of fertilizers, the number of tubewells per unit area and percentage of electrified villages emerged as significant variables. Both the latter variables had a negative relationship with agricultural productivity which was rather surprising. In 1981, in addition to government canal irrigation and consumption of fertilisers, number of pumps per unit area and road density emerged as variables which were significant

in explaining spatial differences in productivity. Both the number of pumpsets and road density, had a negative relationship with productivity. Marketing facilities and electrification (as indicated by the statistics chosen to represent them) also emerged as positive significant explanatory variables in 1981.

The predictors chosen in 1961 in the optimum regression equation explained 82.9 percent of variations in inter-district productivity. In 1971, the regressors in the optimum regression equation explained 97.2 percent of interdistrict differentials in productivity. In 1981, the explanatory variables in the optimum regression equation explained 98.9 percent of spatial variations in productivity.

Analysis of the levels of development through factor analysis indicated that in 1961, agriculturally, the highly developed region lay in South Bengal and constituted the contiguous districts of Burdwan, Birbhum, Bankura, How rah and Hooghly. In 1971, only the districts of Hooghly, Burdwan and Howrah remained in this category. In 1981, as in 1971, Hooghly, Howrah and Burdwan were the most developed districts agriculturally. Thus, these three districts maintained their positions throughout the period of the study.

TABLE 5.1

LEVELS OF AGRICULTURAL DEVELOPMENT OF DISTRICTS AS PER FACTOR SCORES

Category	Years		
	1961	1971	1981
Highly Developed Districts	Burdwan Birbhum Bankura Howrah Hooghly	Burdwan Howrah Hooghly	Burdwan Howrah Hooghly
Medium Developed Districts	24-Parganas Darjeeling Jalpaiguri	Birbhum Nadia Murshidabad	Nadia Cooch Behar
Less Developed Districts	Midnapore Nadia Murshidabad West Dinajpur Purulia	Bankura 24-Parganas Malda Darjeeling Cooch Behar	Birbhum Bankura 24-Parganas Murshidabad Malda.
Least Developed Districts	Malda Cooch Behar	Midnapore West Dinajpur Jalpaiguri Purulia	Midnapore West Dinajpur Purulia

Darjeeling, Jalpaiguri and 24-Parganas were the medium developed region in 1961. In 1971, Birbuhum, Murshidabad and Nadia were in this category, while Nadia and Cooch Behar were the districts in the same category in 1981.

The less developed regions in 1961 were West Dinajpur, Purulia, Midnapore, Mursihdabad and Nadia. In 1971, however, a totally different set of districts, consisting of Bankura, 24-Parganas, Malda, Darjeeling and Cooch Behar occupied this category. In 1981, the three former districts along with Birbhum and Murshidabad formed this category.

In 1961, the districts of Nadia, West Dinajpur and Malda emerged as the least developed districts. In 1971, while West Dinajpur continued to remain in low category, Jalpaiguri and Purulia entered the least developed range of development. In 1981, West Dinajpur, Purulia and Midnapore were the least developed districts.

In conclusion it can be said that transformation in the state of West Bengal seems to have been hindred by the negative growth rate of yield and output in the decade of the seventies. This negative growth dampened the effect of the positive growth witnessed in the decade

of the fifties and sixties. Growth of both yield and area contributed to the overall growth of agricultural production in the state. Even though the determinants of yield have shown positive growth rates and a more equitable distribution over the periods of study, this does not seem to have generated transformation of agriculture in the state.

With scope for physical extension of area being almost exhausted, further increases in output have to come about through increases in productivity. There is need for greater adoption of technological inputs, especially irrigation, not only for increasing productivity but also for enabling optimal increase in cropping intensity. Diversification of cropping and replacing crops which are less productive with crops which are more productive also requires higher adoption of technological inputs especially irrigation.

Further, indepth investigation through generating primary data at lower units of study is required to analyse further the nature of relationship between productivity and some of its determinants as revealed in this study.

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APPENDIX -I : METHOD OF DETERMINING CROPPING PATTERN

The cropping pattern of each districts was derived by K.Doi's method. This is a modification of Weaver's method by devising a table of critical values for different ranks of crops against their cumulative percentages.

It has to be mentioned that regionalisation was first attempted by Rafiullah's method. However, the results in some cases were not tallying with Doi's method or Weaver's method. The district of Nadia emerged as a monocrop area in 1951. However, in Nadia, Aus occupied 21 percent, Aman, 20.1 percent and Gram, 16.8 percent of gross cropped area. Both by Doi's and Weaver's method the district emerged to be a three cropped area. This was a more likely result judging by the percentages of gross cropped area. This was probably because the theoretical base curve for monocrop is 50 instead of 100 (as in Weaver's method) and it gave an exceptionally large weightage to the deviation of the first crop, rather than the next two or three crops.

APPENDIX - II : FORMULA FOR INDEX OF MECHANISATION

$$I = \frac{S_{(P)}}{S_{(Q)}\,E_{(P)} + S_{(P)}\,E_{(Q)}} \times Q_1 + \frac{S_{(Q)}}{S_{(Q)}\,E_{(P)} + S_{(P)}\,E_{(Q)}} \times P_1$$

where

Q_1 = Number of tractor equivalent per 1000 hectare of GCA

P_1 = Number of irrigation machinery per 1000 hectare of GCA

$S_{(P)}$ = Standard deviation of the series P

$S_{(Q)}$ = Standard deviation of the series Q

$E_{(P)}$ = Mean of the series P

$E_{(Q)}$ = Mean of the series Q

I = Composite Index of mechanisation

Note : This method has been devised by M.N. Pal.

APPENDIX - III : SOME NOTES ABOUT MULTIPLE REGRESSION

Note 1 : With the assumption that a linear relationship exists between a dependent variable Y and k-1 independent variables X_2, X_3, ----- X_k, and a disturbance term u, this relationship between a set of such values can be written as follows:

$$Y_i = \beta_1 + \beta_2 X_{2i} + \beta_3 X_{3i} + \text{-------} + \beta_{ki} + u_i,$$

where i = 1,2, ---- n

Note 2: The inclusion of additional explanatory variables in the function can never reduce the co-efficient of multiple determination (R^2) and will mostly raise it. By introducing a new regressor, we increase the value of the numerator of the expression for R^2, while the denominator $= [\underline{Y}'Y - \frac{\Sigma Y_i^2}{n}]$ remains the same, which is given for any particular sample. Hence, it is better to use the value of R^2 adjusted for degrees of freedom ($\bar{R}^2$) to determine whether the additional variable should included in the optimum regression equation or not.

APPENDIX - IV : HARVEST PRICES OF IMPORTANT CROPS IN WEST BENGAL (1981-82)

Crops	Rs./Quintal
Aman (cleaned)	259.34
Aus (cleaned)	233.61
Boro (cleaned)	277.82
Wheat	181.51
Jowar	150.27
Maize	143.17
Jute	181.86
Sugarcane	246.18
Gram	291.32
Rape and Mustard	395.65

Source: Unpublished data Bureau of Applied Economics and Statistics, West Bengal.

STATISTICAL APPENDIX

TABLE : A-2.1

LAND UTILISATION PATTERN (AS PERCENTAGE OF TOTAL AREA) IN WEST BENGAL, 1951-52

(in percent)

S.NO	Districts	Area Under Forest	Area not Available for Irrigation	Fallows other than Current Fallows	Current Fallows	Net Sown Area
1.	Burdwan	0.00	20.2	9.2	6.5	64.1
2.	Birbhum	0.00	17.8	7.5	6.5	68.2
3.	Bankura	0.00	19.5	14.2	18.4	47.9
4.	Midnapore	0.00	20.1	7.5	7.7	64.7
5.	Howrah	0.00	22.2	4.1	1.5	72.1
6.	Hooghly	0.00	18.0	3.9	0.05	77.6
7.	24-Parganas	28.7	16.8	8.7	1.9	43.9
8.	Nadia	0.00	10.4	9.9	20.1	59.6
9.	Murshidabad	0.00	13.4	7.8	2.4	76.4
10.	W. Dinajpur	0.00	16.7	6.5	3.7	73.0
11.	Malda	0.00	9.5	6.2	8.5	75.8
12.	Jalpaiguri	22.9	13.8	14.4	4.1	43.6
13.	Darjeeling	37.7	23.2	6.4	3.6	29.1
14.	Cooch-Behar	18.8	10.5	12.7	8.1	66.7
15.	WEST BENGAL	8.6	17.0	9.0	6.7	58.7

Source: Statistical Abstract, West Bengal, 1955, Bureau of Applied Economics and Statistics, Government of West Bengal.

Note: Total area for the state and each district equal to 100 percent.

TABLE : A-22

LAND UTILISATION PATTERN (AS PERCENTAGE OF TOTAL AREA) IN WEST BENGAL, 1961-62

(in percent)

S.NO	Districts	Area Under Forest	Area not Available for Cultivation	Fallows Other than Current Fallow	Current Fallow	Net Sown Area
1.	Burdwan	2.6	19.7	5.1	5.1	70.9
2.	Birbhum	0.08	15.8	3.4	4.4	75.5
3.	Bankura	19.9	6.0	11.8	11.6	50.9
4.	Midnapore	10.5	10.3	6.7	4.4	67.9
5.	Howrah	0.00	25.2	2.5	2.0	70.2
6.	Hooghly	0.01	19.9	2.9	0.06	76.4
7.	24-Parganas	28.9	17.7	6.3	1.5	45.5
8.	Nadia	0.01	14,7	4.2	0.08	79.9
9.	Murshidabad	0.01	14.2	4.9	3.8	76.8
10.	W. Dinajpur	0.01	11.7	4.5	2.2	81.5
11.	Malda	0.02	9.9	4.3	8.8	76.8
12.	Jalpaiguri	27.1	15.9	7.7	1.1	47.9
13.	Darjeeling	38.1	23.5	4.9	0.07	32.7
14.	Cooch-Behar	0.00	13.7	7.9	2.9	75.4
15	Purulia	13.9	14.3	20.9	9.3	41.5
16.	WEST BENGAL	12.4	14.6	7.1	3.9	61.9

Source: Statistical Abstract, WEST BENGAL, 1965, Bureau of Applied Economics and Statistics, Government of West Bengal.

Note: Total area for the state and each district equal to 100 percent.

TABLE A-2.3
LAND UTILISATION PATTERN (AS PERCENTAGE OF TOTAL AREA) IN WEST BENGAL, 1971-72

(in percent)

S.NO	Districts	Area Under Forest	Area not Available For Cultivation	Fallows Other than Current Fallow	Current Fallow	Net Sown Area
1.	Burdwan	4.4	20.4	3.8	6.2	65.1
2.	Birbhum	3.4	15.9	2.8	2.3	75.3
3.	Bankura	20.5	6.0	10.4	7.9	55.1
4.	Midnapore	12.6	10.8	5.9	4.4	66.0
5.	Howrah	0.00	27.9	2.7	15.9	53.4
6.	Hooghly	0.01	20.6	2.7	8.5	68.0
7.	24-Parganas	29.1	18.1	5.7	3.4	43.6
8.	Nadia	0.03	15.4	4.1	3.9	76.2
9.	Murshidabad	0.01	18.2	5.5	2.1	73.8
10.	W. Dinajpur	0.02	8.0	2.7	0.04	88.5
11.	Malda	0.04	0.07	4.2	6.2	77.4
12.	Jalpaiguri	28.0	14.7	3.0	0.02	53.8
13.	Darjeeling	41.3	20.4	4.4	0.06	36.4
14.	Cooch-Behar	1.7	11.2	3.7	0.06	82.8
15.	Purulia	14.0	14.7	20.6	5.9	44.7
16.	WEST BENGAL	13.4	14.7	6.1	4.1	61.7

Source: Statistical Abstract, West Bengal, 1975, Bureau of Applied Economics and Statistics, Government of West Bengal

Note : Total area for the state and each district equal to 100 percent.

TABLE : A-2.4

LAND UTILISATION PATTERN (AS PERCENTAGE OF TOTAL AREA) IN WEST BENGAL, 1981-82

(in Percent)

S.No.	Districts	Area Under Forest	Area not Available for Cultivation	Fallows other than Current Fallow	Current Fallow	Net Sown Area
1.	Burdwan	4.4	22.9	0.05	1.5	70.6
2.	Birbhum	3.5	20.7	0.06	0.05	74.6
3.	Bankura	20.3	23.5	1.3	1.7	52.9
4.	Midnapore	12.6	20.7	1.0	1.5	64.1
5.	Howrah	0	33.7	0.06	0.05	65.1
6.	Hooghly	0.01	24.7	0.03	0.02	74.5
7.	24-Parganas	29.2	23.0	0.03	0.02	47.2
8.	Nadia	0.03	16.9	0.05	0.01	82.1
9.	Murshidabad	0.01	18.9	1.1	0,01	72.7
10.	W. Dinajpur	0.02	11.6	0.02	0.04	87.5
11.	Malda	0.04	22.0	0.01	0.01	77.3
12.	Jalpaiguri	28.0	18.9	0.03	0.03	52.4
13.	Darjeeling	26.9	17.2	1.1	0.05	54.3
14.	Cooch-Behar	1.7	20.9	0.02	0.01	77.1
15.	Purulia	14.0	31.0	2.9	4.5	47.5
16.	WEST BENGAL	12.5	21.7	0.07	1.0	64.0

Source: Unpublished data, Bureau of Applied Economics and Statistics, Government of West Bengal.

Note : Total area for the state and each district equal to 100 percent.

TABLE : A-2.5

INDICES OF GROWTH OF AREA UNDER TOTAL RICE, TOTAL CEREALS, TOTAL PULSES, TOTAL FOODGRAINS AND TOTAL OILSEEDS IN WEST BENGAL (1952-53=100)

Years (1)	Total Rice (2)	Total Cereals (3)	Total Pulses (4)	Total Foodgrains (5)	Total Oilseeds (6)
1952-53	100	100	100	100	100
1953-54	103	104	109	105	90
1954-55	96	97	113	99	96
1955-56	99	100	110	102	105
1956-57	99	101	91	99	96
1957-58	107	107	93	105	82
1958-59	103	104	118	105	109
1959-60	103	108	118	109	130
1960-61	111	111	124	113	106
1961-62	107	107	122	110	132
1962-63	108	108	117	109	113
1963-64	109	110	122	112	105
1964-65	113	113	126	115	119
1965-66	113	112	123	114	114
1966-67	113	113	126	115	120
1967-68	114	115	112	115	125
1968-69	117	119	119	119	130

Table Continued

TABLE : A-2.5 (Continued)

INDICES OF GROWTH OF AREA UNDER TOTAL RICE, TOTAL CEREALS, TOTAL PULSES, TOTAL FOODGRAINS AND TOTAL OILSEEDS IN WEST BENGAL (1952-53=100)

(1)	(2)	(3)	(4)	(5)	(6)
1969-70	122	126	113	124	120
1970-71	120	128	107	125	128
1971-72	121	130	95	126	139
1972-73	123	130	87	125	114
1973-74	126	133	105	130	156
1974-75	131	140	109	136	150
1975-76	131	144	116	140	152
1976-77	126	137	99	132	164
1977-78	131	141	90	134	164
1978-79	115	126	90	122	184
1979-80	119	129	89	124	177
1980-81	125	131	84	125	242
1981-82	126	130	70	122	268
1982-83	118	123	65	115	276
1983-84	130	136	63	126	275
1984-85	126	132	60	123	297

Source : Statistical Abstract, West Bengal, 1955, 1965, 1975 '1977-78 and unpublished data, Bureau of Applied Economics and Statistics, Ministry of Agriculture, Government of West Bengal.

TABLE : A-2.6

INDICES OF GROWTH OF PRODUCTION OF TOTAL RICE, TOTAL CEREALS, TOTAL PULSES, TOTAL FOODGRAINS AND TOTAL OILSEEDS IN WEST BENGAL (1952-53=100)

Years (1)	Total Rice (2)	Total Cereals (3)	Total Pulses (4)	Total Foodgrains (5)	Total Oilseeds (6)
1952-53	100	100	100	100	100
1953-54	132	132	106	130	70
1954-55	95	96	112	97	80
1955-56	105	105	97	105	94
1956-57	110	109	68	106	59
1957-58	109	108	65	105	60
1958-59	103	103	95	102	95
1959-60	106	106	84	104	67
1960-61	136	135	99	131	79
1961-62	120	119	86	117	75
1962-63	110	110	90	108	87
1963-64	133	132	98	129	70
1964-65	168	142	102	139	81
1965-66	122	122	110	121	98
1966-67	120	120	106	119	108
1967-68	130	130	92	127	91
1968-69	144	150	113	146	134

Table Continued

TABLE : A-2.6 (Continued)

INDICES OF GROWTH OF PRODUCTION OF TOTAL RICE, TOTAL CEREALS, TOTAL PULSES, TOTAL FOODGRAINS AND TOTAL OILSEEDS IN WEST BENGAL (1952-53=100)

(1)	(2)	(3)	(4)	(5)	(6)
1969-70	150	161	92	155	104
1970-71	153	173	95	166	98
1971-72	162	183	80	174	104
1972-73	141	157	72	150	106
1973-74	144	159	88	152	111
1974-75	163	182	95	174	126
1975-76	171	199	103	190	130
1976-77	148	172	89	165	99
1977-78	187	210	84	199	162
1978-79	166	189	67	178	157
1979-80	147	164	77	156	164
1980-81	186	195	60	183	249
1981-82	145	153	59	145	291
1982-83	123	137	54	130	291
1983-84	198	216	65	203	324
1984-85	202	219	56	205	391

Source : Same as for table: A-2.5

TABLE : A-2.7

INDICES OF GROWTH OF YIELD OF TOTAL RICE, TOTAL CEREALS, TOTAL PULSES, TOTAL FOODGRAINS AND TOTAL OILSEEDS IN WEST BENGAL (1952-53=100)

Years (1)	Total Rice (2)	Total Cereals (3)	Total Pulses (4)	Total Foodgrains (5)	Total Oilseeds (6)
1952-53	100	100	100	100	100
1953-54	128	126	97	124	77
1954-55	99	97	99	98	83
1955-56	106	104	89	103	80
1956-57	111	108	74	106	61
1957-58	102	106	70	99	73
1958-59	100	98	79	97	87
1959-60	99	97	71	95	52
1960-61	122	120	80	116	75
1961-62	112	110	70	106	57
1962-63	102	100	77	99	77
1963-64	121	119	81	115	67
1964-65	127	125	81	121	68
1965-66	108	107	90	106	86
1966-67	107	105	84	104	90
1967-68	114	112	82	111	72
1968-69	123	124	94	122	103

Table Continued

TABLE : A-2.7 (continued)

INDICES OF GROWTH OF YIELD OF TOTAL RICE, TOTAL CEREALS, TOTAL PULSES, TOTAL FOODGRAINS AND TOTAL OILSEEDS IN WEST BENGAL (1952-53=100)

(1)	(2)	(3)	(4)	(5)	(6)
1969-70	124	127	82	125	87
1970-71	128	134	89	133	76
1971-72	134	139	84	138	75
1972-73	116	120	82	120	92
1973-74	115	118	84	118	74
1974-75	124	129	88	128	84
1975-76	130	137	89	136	86
1976-77	118	125	89	125	84
1977-78	142	129	93	148	99
1978-79	144	148	75	146	85
1979-80	124	126	86	126	93
1980-81	149	148	72	147	103
1981-82	115	117	84	119	109
1982-83	105	111	83	113	105
1983-84	152	157	103	160	119
1984-85	160	164	92	167	132

Source ; Same as for table : A-2.5

TABLE : A-2.8

INDICES OF GROWTH OF AREA, PRODUCTION AND YIELD OF AUS, AMAN AND BORO IN WEST BENGAL

(1952-53=100)

INDICES OF GROWTH

Years	Aus			Aman			Boro		
	Area	Prod.	Yield	Area	Prod	Yield	Area	Prod	Yield
1952-53	100	100	100	100	100	100	100	100	100
1953-54	116	118	102	102	134	132	92	101	110
1954-55	92	89	97	97	96	99	86	87	102
1955-56	96	92	96	100	107	95	85	96	113
1956-57	93	84	90	99	113	114	92	108	118
1957-58	99	90	91	108	112	103	95	83	87
1958-59	94	74	79	105	106	102	98	105	108
1959-60	109	104	95	106	105	99	204	234	115
1960-61	116	114	98	111	138	125	169	203	120
1961-62	95	87	92	109	123	114	152	176	116
1962-63	100	90	91	109	112	103	121	144	119
1963-64	107	109	102	110	136	123	124	156	126
1964-65	111	133	119	113	173	128	115	146	127
1965-66	107	104	97	113	124	109	154	198	129
1966-67	119	117	98	111	120	108	141	215	153
1967-68	134	133	99	110	127	115	280	595	213
1968-69	157	160	102	109	136	125	464	1193	258

Table Continued

TABLE : A-2.8(Continued)

INDICES OF GROWTH OF AREA, PRODUCTION AND YIELD OF AUS, AMAN AND BORO IN WEST BENGAL
(1952-53=100)

Years	INDICES OF GROWTH								
	Aus			Aman			Boro		
	Area	Prod	Yield	Area	Prod	Yield	Area	Prod	Yield
1969-70	145	143	98	116	144	124	542	1703	313
1970-71	146	200	138	111	133	119	952	2878	303
1971-72	146	213	146	109	130	119	1552	5022	324
1972-73	150	175	117	112	118	106	1341	3919	293
1973-74	153	153	100	114	124	109	1659	3920	237
1974-75	177	192	109	115	136	118	1737	4604	266
1975-76	157	173	110	119	146	123	1636	4848	296
1976-77	149	142	95	116	130	111	1214	3843	317
1977-78	147	165	112	121	166	135	1575	4742	302
1978-79	127	125	99	102	137	134	2255	6794	302
1979-80	114	117	102	113	132	117	1295	3657	284
1980-81	112	127	113	118	170	144	1768	4652	264
1981-82	127	147	116	118	124	105	1526	4071	268
1982-83	116	125	108	109	91	91	1750	4772	274
1983-84	131	153	117	116	167	144	2655	7152	270
1984-85	115	145	126	115	174	151	2402	6828	285

Source: Same as for table A-2.5

TABLE : A-2.9

INDICES OF AREA, PRODUCTION AND YIELD OF SELECTED FOOD CROPS OF WEST BENGAL (1952-53=100)

Years	INDICES OF GROWTH								
	Wheat			Barley			Maize		
	Area	Prod	Yield	Area	Prod	Yield	Area	Prod	yield
1952-53	100	100	100	100	100	100	100	100	100
1953-54	126	109	87	170	142	83	102	106	105
1954-55	132	127	96	146	131	89	103	96	93
1955-56	145	123	85	149	120	80	11	107	97
1956-57	189	72	38	238	119	50	112	108	97
1957-58	79	55	69	126	61	49	117	111	95
1958-59	82	168	83	148	119	80	118	105	89
1959-60	112	89	79	219	110	50	123	133	109
1960-61	80	72	89	131	79	60	123	101	83
1961-62	106	96	90	207	173	183	114	85	75
1962-63	113	85	75	165	117	71	120	101	85
1963-64	127	91	71	134	96	72	119	101	85
1964-65	95	78	82	107	74	69	119	110	93
1965-66	96	95	99	117	121	103	110	121	110
1966-67	129	121	99	183	146	80	107	113	105
1967-68	183	198	108	178	138	77	112	130	118
1968-69	297	747	251	217	196	90	99	111	113

Table Continued

TABLE : A-2.9(Continued)

INDICES OF AREA, PRODUCTION AND YIELD OF SELECTED FOOD CROPS OF WEST BENGAL
(1952-53=100)

Years	INDICES OF GROWTH								
	Wheat			Barley			Maize		
	Area	Prod.	Yield	Area	Prod.	Yield	Area	Prod.	Yield
1969-70	480	1342	280	222	197	88	110	129	118
1970-71	836	2418	289	210	171	81	111	137	124
1971-72	980	2566	262	275	244	89	98	108	110
1972-73	854	1916	224	212	144	68	102	109	107
1973-74	766	1752	229	224	190	85	95	126	133
1974-75	979	2331	238	171	145	85	100	149	149
1975-76	1312	3307	252	164	166	101	115	172	150
1976-77	1195	2928	245	128	108	84	102	152	188
1977-78	1124	2887	257	127	135	106	85	145	170
1978-79	1208	2781	230	120	113	95	102	161	159
1979-80	1178	2139	183	105	120	113	102	159	157
1980-81	657	1318	201	120	126	105	115	158	138
1981-82	497	1084	218	107	108	106	112	166	149
1982-83	618	1686	273	103	105	102	112	169	152
1983-84	764	2379	312	82	97	118	132	227	172
1984-85	779	2262	291	65	74	114	125	267	214

Source: Same as for table : A-2.5

TABLE : A-2.10

INDICES OF GROWTH OF AREA, PRODUCTION AND YIELD OF SELECTED CROPS OF WEST BENGAL (1952-53=100)

INDICES OF GROWTH

Years	Jute			Sugarcane		
	Area	Production	Yield	Area	Production	Yield
1951-52	100	100	100	100	100	100
1953-54	65	63	97	90	63	70
1954-55	67	63	94	109	115	106
1955-56	95	83	87	116	124	107
1956-57	82	57	70	108	107	99
1957-58	93	77	84	111	82	73
1958-59	107	110	103	126	113	90
1959-60	100	92	92	154	123	80
1960-61	81	93	96	189	195	103
1961-62	140	158	102	162	172	106
1962-63	131	146	101	147	128	87
1963-64	134	154	103	154	146	
1964-65	138	170	111	194	180	93
1965-66	122	105	77	185	170	91
1966-67	128	134	95	139	123	88
1967-68	150	180	108	126	112	89
1968-69	81	62	69	147	168	114

Table Continued

TABLE : A-2.10 (Continued)

INDICES OF GROWTH OF AREA, PRODUCTION AND YIELD OF SELECTED CROPS OF WEST BENGAL (1952-53=100)

INDICES OF GROWTH

Years	Jute			Sugarcane		
	Area	Production	Yield	Area	Production	Yield
1969-70	132	159	108	185	214	116
1970-71	123	125	92	187	197	109
1971-72	139	162	105	160	157	98
1972-73	111	127	103	153	156	102
1973-74	126	171	123	145	154	106
1974-75	112	122	98	137	159	116
1975-76	101	125	112	138	162	117
1976-77	133	162	110	139	172	123
1977-78	144	162	108	148	181	122
1978-79	162	192	107	151	179	118
1979-80	152	176	105	138	136	98
1980-81	184	207	101	67	82	122
1981-82	153	209	123	109	134	123
1982-83	133	176	120	148	152	103
1983-84	140	186	120	96	97	101
1984-85	161	202	114	63	73	115

Source: Same as for table : A-2.5

TABLE : A-2.11

INDICES OF GROWTH OF AREA, PRODUCTION AND YIELD OF SELECTED CROPS OF WEST BENGAL

(1952-53=100)

INDICES OF GROWTH

Years	Rape & Mustard			Potato			Tobaco		
	Area	Prod.	Yield	Area	Prod	Yield	Area	Prod.	Yield
1952-53	100	100	100	100	100	100	100	100	100
1953-54	84	64	76	103	98	95	95	85	102
1954-55	91	79	86	105	89	85	98	92	96
1955-56	99	79	79	115	92	80	95	87	94
1956-57	78	56	71	116	73	63	94	72	81
1957-58	89	64	72	122	93	76	100	83	85
1958-59	106	96	91	122	107	87	96	77	81
1959-60	119	62	52	142	157	110	93	81	89
1960-61	97	79	81	144	135	94	107	109	104
1961-62	126	76	61	142	171	122	101	100	101
1962-63	104	84	81	163	187	115	93	85	93
1963-64	95	86	67	162	125	77	91	84	94
1964-65	113	81	72	175	186	107	98	98	102
1965-66	108	93	86	202	29	99	98	105	111
1966-67	117	99	84	187	150	80	99	107	110
1967-68	122	79	65	193	150	77	71	78	112
1968-69	130	135	104	175	200	115	84	85	103

Table Continued

TABLE : A-2.11 (Continued)

INDICES OF GROWTH OF AREA, PRODUCTION AND YIELD OF SELECTED CROPS OF WEST BENGAL

(1952-53=100)

Years	INDICES OF GROWTH								
	Rape & Mustard			Potato			Tobaco		
	Area	Prod.	Yield	Area	Prod.	Yield	Area	Prod.	Yield
1969-70	114	98	86	147	142	97	85	99	118
1970-71	118	80	68	160	217	136	62	59	98
1971-72	117	78	67	179	248	138	74	66	91
1972-73	104	96	92	187	222	119	80	77	98
1973-74	134	99	74	198	226	114	87	81	96
1974-75	112	89	79	212	317	150	73	69	96
1975-76	104	88	85	278	378	136	72	81	115
1976-77	79	57	73	283	387	137	91	115	129
1977-78	106	96	91	311	447	144	91	112	125
1978-79	127	105	87	398	571	144	81	98	123
1979-80	126	120	95	367	466	175	178	89	116
1980-81	143	178	124	285	461	162	116	134	118
1981-82	179	212	119	296	464	157	87	102	121
1982-83	187	204	109	286	542	190	99	122	126
1983-84	207	250	123	359	716	200	93	119	132
1984-85	267	368	137	366	733	200	96	127	135

Source : Same as table : A-2.5.

TABLE : A-2.12

PATTERN OF GROWTH OF AREA, PRODUCTION AND YIELD OF TOTAL RICE IN WEST BENGAL-COMPOUND ANNUAL GROWTH RATES

(in Percent)

S.No.	Districts	1950-53 to 1960-63			1960-63 to 1970-73			1970-73 to 1980-83			1950-53 to 1980-83		
		Area	Production	Yield	Area	Production	Yield	Area	Production	Yield	Area	Production	Yield
1.	Burdwan	0.6	2.9	2.3	0.8	-0.8	0.9	0.01	3.3	0.7	0.5	1.8	1.3
2.	Birbhum	0.1	1.1	1.0	0.6	2.0	1.4	0.2	-0.9	-1.1	0.3	0.7	0.4
3.	Bankura	-0.1	0.7	1.1	1.5	2.5	0.8	-0.6	-1.6	-1.1	0.2	0.4	0.2
4.	Midnapore	-0.1	2.1	0.3	0.9	2.4	1.5	-0.2	-4.3	-1.0	0.2	-0.6	0.3
5.	Howrah	-0.5	1.0	1.6	-0.3	0.5	0.6	0.6	0.7	0.1	-0.02	0.7	0.8
6.	Hooghly	0.3	2.0	1.7	1.9	4.8	2.8	0.4	0.7	0.3	0.9	2.5	1.6
7.	24-Parganas	0.6	2.8	2.1	0.3	0.7	0.3	0.5	1.0	0.6	0.5	1.5	1.0
8.	Nadia	2.4	4.3	1.7	-0.2	-2.9	1.7	0.9	8.4	2.8	1.0	3.1	2.1
9.	Murshidabad	0.3	1.8	1.5	-0.3	0.7	0.8	1.1	2.5	0.9	0.4	1.7	1.1
10.	W. Dinajpur	3.3	7.1	1.8	1.9	2.9	0.9	-0.1	-0.9	-0.9	2.4	2.0	0.9
11.	Malda	0.2	0.1	-0.1	1.4	3.9	2.5	0.6	-1.5	1.5	0.7	0.8	1.3
12.	Jalpaiguri	1.0	3.0	2.0	2.9	3.6	0.6	0.3	-2.1	-2.4	1.4	1.4	0.03
13.	Darjeeling	2.0	1.5	-0.6	2.2	1.8	-0.4	0.2	0.2	0.04	1.5	1.1	-0.3
14.	Cooch-Behar	1.0	2.2	1.2	3.1	5.1	1.9	0.8	0.3	-1.1	1.6	2.5	0.7
15.	Purulia	-	-	-	1.6	3.0	1.4	-1.1	-2.3	-1.3	-	-	-
16.	WEST BENGAL	1.2	2.4	1.2	1.1	2.3	1.2	0.2	-0.1	-0.3	0.8	1.5	0.7

Source: Calculated from Statistical Abstract, West Bengal, 1955, 1965, 1975, 1977-78 and unpublished data, Bureau of Applied Economics and Statistics, Government of West Bengal.

TABLE : A-2.13

PATTERN OF GROWTH OF AREA, PRODUCTION AND YIELD OF TOTAL FOODGRAINS IN WEST BENGAL-COMPOUND ANNUAL GROWTH RATES

(in Percent)

S.No	Districts	1960-63 to 1970-73			1970-73 to 1980-83			1960-63 to 1980-83		
		Area	Production	Yield	Area	Production	Yield	Area	Production	Yield
1.	Burdwan	0.9	2.3	1.5	-0.5	0.07	0.6	0.2	1.2	1.0
2.	Birbhum	1.7	8.2	2.5	-0.4	-2.6	-1.3	0.2	2.7	0.6
3.	Bankura	1.5	2.5	1.1	-0.7	-1.7	-1.2	0.4	0.4	-0.1
4.	Midnapore	0.6	2.5	1.9	-0.4	-1.4	-1.1	0.1	0.5	0.4
5.	Howrah	-1.2	0.5	1.7	0.4	0.3	09.2	-0.4	0.4	0.8
6.	Hooghly	1.5	5.8	4.2	-0.4	-0.3	0.1	0.5	2.7	2.1
7.	24-Parganas	0.2	1.1	0.9	0.1	0.6	0.5	0.2	0.9	0.7
8.	Nadia	0.06	4.2	4.2	-0.6	0.5	1.1	0.3	2.3	2.6
9.	Murshidabad	1.3	4.7	3.4	-0.3	-1.6	-0.3	0.5	1.5	1.5
10.	W. Dinajpur	2.5	4.0	1.5	0.2	-0.4	-0.6	1.3	1.8	0.4
11.	Malda	2.2	5.0	1.4	-1.5	0.6	2.1	0.3	2.8	1.2
12.	Jalpaiguri	2.8	3.5	-2.1	0.7	-1.4	0.7	1.7	1.0	-0.5
13.	Darjeeling	0.6	2.8	2.3	1.1	2.2	1.1	0.8	2.5	1.7
14.	Cooch-Behar	3.2	5.3	1.9	0.7	-0.1	-0.6	2.0	2.6	0.6
15.	Purulia	1.5	3.1	1.5	-1.4	-2.5	1.2	0.04	0.3	0.1
16.	WEST BENGAL	1.3	3.3	2.0	-0.4	-0.7	-0.3	0.4	1.3	0.8

Source: Calculated from Statistical Abstract, West Bengal, 1965, 1975, 1977-78 and unpublished data, Bureau of Applied Economics and Statistics, Government of West Bengal.

TABLE : A-2.14

PATTERN OF GROWTH OF AREA, PRODUCTION AND YIELD OF GRAM IN WEST BENGAL-COMPOUND ANNUAL GROWTH RATES

(in Percent)

S.No.	Districts	1950-53 to 1960-63			1960-63 to 1970-73			1970-73 to 1980-83			1950-53 to 1980-83		
		Area	Prod-duction	Yield	Area	Pro-duction	Yield	Area	Pro-duction	Yield	Area	Pro-duction	Yield
1.	Burdwan	- 1.4	-4.9	-3.3	-4.3	-6.5	-2.0	-12.0	-8.7	3.6	-8.0	-6.7	-0.6
2.	Birbhum	1.0	-6.3	-7.2	-3.3	-2.7	0.4	0.2	3.9	3.9	-0.7	-1.8	-1.1
3.	Bankura	- 1.1	-5.6	-3.1	-5.0	-9.6	-4.6	-11.1	-8.5	3.5	-5.8	-7.2	-1.5
4.	Midnapore	-10.6	-12.0	-1.6	-4.0	-6.7	-2.8	-	-	-	-	-	-
5.	Howrah	0.5	-3.0	-2.9	-8.2	-6.7	-2.0	-	-	-	-	-	-
6.	Hooghly	- 5.6	-9.5	-3.0	-11.6	-10.4	0.6	- 6.1	-8.0	3.0	-11.5	-7.6	0.2
7.	24-Parganas	1.7	-1.0	-2.7	- 1.8	1.6	-0.1	-15.0	-23.3	-1.9	-5.3	-8.3	-1.6
8.	Nadia	0.2	-4.8	-5.0	-0.3	1.2	1.2	- 8.5	-12.1	-3.5	-2.9	-5.4	-2.5
9.	Murshidabad	- 2.2	-6.4	-4.2	-2.7	-0.3	2.5	-7.6	- 2.2	-2.2	-3.4	-4.8	-1.6
10.	W. Dinajpur	- 0.5	-1.0	-1.9	2.9	3.9	-0.8	1.7	2.8	0.9	1.4	1.9	-1.1
11.	Malda	5.1	0.4	-4.7	-1.5	3.3	4.8	-1.0	2.9	3.5	0.9	2.2	0.1
12.	Jalpaiguri	-	-	-	-	-	-	-	-	-	-	-	-
13.	Darjeeling	-	-	-	-	-	-	-	-	-	-	-	-
14.	Cooch-Behar	-	-	-	-	-	-	-	-	-	-	-	-
15.	Purulia	-	-	-	1.2	1.6	-1.1	-13.9	-7.2	3.5	-	-	-
16.	WEST BENGAL	- 0.3	-4.8	-4.3	-4.6	0.1	1.7	- 9.4	-1.1	0.12	-2.5	-1.9	-0.85

Source : Same as for table : A-2.12

TABLE : A-2.15

PATTERN OF GROWTH OF AREA, PRODUCTION AND YIELD OF RAPE AND MUSTARD IN WEST BENGAL-COMPOUND ANNUAL GROWTH RATES

(in Percent)

S.No	Districts	1950-53 to 1960-63			1960-63 to 1970-73			1970-73 to 1980-83			1950-53 to 1980-83		
		Area	Pro-duction	Yield	Area	Pro-duction	Yield	Area	Pro-duction	Yield	Area	Pro-duction	Yield
1.	Burdwan	9.3	8.8	0.03	0.4	1.2	0.8	21.8	33.3	9.1	10.1	13.7	3.3
2.	Birbhum	-1.0	-4.3	-3.4	14.5	12.2	-1.3	22.6	28.9	5.6	11.1	11.4	0.2
3.	Bankura	3.5	2.3	-1.3	0.9	-0.9	-5.1	8.4	17.6	12.4	4.2	6.1	1.8
4.	Midnapore	-1.5	0	2.5	-0.8	-0.3	0.6	- 0.3	-2.8	-2.4	-0.9	-1.0	0.2
5.	Howrah	-6.0	0	1.4	4.4	0	0	0	2.7	3.7	-0.6	0.9	1.7
6.	Hooghly	4.7	0	-4.4	7.8	9.7	1.8	6.4	13.7	6.8	6;3	7.6	1.3
7.	24-Parganas	3.8	2.3	-2.1	6.9	10.1	2.8	4.1	6.4	7.1	4.9	6.2	2.5
8.	Nadia	7.5	8.3	-2.9	3.4	3.2	0.1	5.2	12.1	6.1	6.0	7.1	1.0
9.	Murshidabad	3.2	-4.6	-7.8	0.6	2.3	1.6	5.6	9.6	3.0	3.1	2.3	-0.9
10.	W. Dinajpur	2.0	3.4	1.9	-2.4	-2.9	-0.9	0.2	-0.8	-1.2	-0.04	-0.1	-0.1
11.	Malda	1.7	-2.7	-3.4	-1.3	-2.1	-0.7	-5.6	-1.4	4.5	-1.8	-1.8	0.1
12.	Jalpaiguri	-6.4	-12.3	-6.1	2.1	0.6	-1.9	-0.3	6.0	6.9	-1.6	-2.2	-0.5
13.	Darjeeling	-4.5	-7.2	-2.5	-4.5	-6.7	-1.8	-2.6	0	1.7	-3.9	-4.7	-0.9
14.	Cooch-Behar	3.7	-9.9	-5.1	-1.7	3.1	4.0	-1.1	-1.5	-0.5	-2.1	-2.9	-0.6
15.	Purulia	-	-	-	4.0	7.7	2.4	-13.6	-7.2	6.3	-	-	-
16.	WEST BENGAL	1.1	-1.7	-2.6	0.4	0.6	0.2	4.1	8.9	4.5	1.8	2.5	0.7

Source: Same as for Table : A-2.12.

TABLE A - 2.16

CROPPING PATTERN OF WEST BENGAL

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S.No	Districts	1951-52		1961-62		1971-72		1981-82	
		No. of Crops	Cropping Pattern	No. of Crops	Cropping Pattern	No. of Crops	Cropping Pattern	No. of Crops	Cropping Pattern
1.	Burdwan	1	Am	1	Am	1	Am	1	Am
2.	Birbhum	1	Am	1	Am	2	AmW	1	Am
3	Bankura	1	Am	1	Am	1	Am	1	Am
4.	Midnapore	1	Am	1	Am	1	Am	1	Am
5.	Howrah	1	Am	1	Am	2	AmB	1	Am
6.	Hooghly	2	AmJ	2	AmJ	2	AmB	2	AmB
7.	24-Parganas	1	Am	1	Am	1	Am	1	Am
8.	Nadia	4	A Am GJ	5	A Am JGMe	5	AJWAmG	5	Am JABW
9.	Murshidabad	4	Am GAJ	4	Am JAG	6	Am WJAGBa	4	Am AJW
10.	W. Dinajpur	1	Am	3	Am JA	2	Am A	3	Am AJ
11.	Malda	5	Am AJBaG	6	AmABaTR&MG	8	Am ABaWJBGR&M	6	AmAJBGH
12.	Jalpaiguri	2	Am T	2	Am T	4	Am ATJ	3	Am AT
13.	Darjeeling	3	M Am T	3	Am TM	3	Am TM	NA	NA
14.	Cooch Behar	3	Am AJ	3	AmJA	2	AmA	3	Am AJ
15.	Purulia	-		1	Am	1	Am	1	Am

Source: Calculated from same source as table A-2.5

Note : Am-Aman, A-Aus, B-Boro, W-Wheat, Ba-Barley, M-Maize, G-Gram, R&M-Rape & Mustard, J-Jute, T-Tea, Me-Mesta

NA indicates data not available.

TABLE : A-3.2

EXTENSION OF AREA UNDER HYV: VARIATION IN WEST BENGAL

	Percentage of Area Under HYV to Area Under Crop				
Years	Aus	Aman	Boro	Total Rice	Wheat
1972-73	11.23	8.67	84.10	12.99	92.66
1973-74	13.06	9.11	87.73	14.65	96.55
1974-75	16.22	9.84	90.95	16.08	97.38
1975-76	21.93	13.23	94.04	19.39	99.36
1976-77	30.33	17.23	95.17	22.85	99.75
1977-78	31.33	19.50	97.08	25.68	99.94
1978-79	34.38	23.97	97.18	32.28	99.92
1979-80	29.24	20.57	96.49	25.61	99.94
1980-81	35.75	22.91	100.00	29.60	100.00
1981-82	33.37	25.05	100.00	30.46	100.00
1982-83	35.25	30.00	100.00	35.58	100.00
1983-84	34.93	29.97	99.94	37.41	100.00
1984-85	35.00	30.00	100.00	36.94	100.00
1985-86	37.88	31.98	99.94	39.40	100.00

Source: Calculated from Economic Review 1970-75, 1986-87 and Statistical Abstract 1975, Bureau of Applied Economics and Statistics Government of West Bengal.

TABLE : A-3.1

THE RATIO OF DIESEL TO ELECTRIC PUMPSETS IN WEST BENGAL

1951	1961	1971	1981
1: 0.95	1:0.07	1:0.39	1:0.06

Source : Statistical Abstract, 1965, 1977 and Unpublished data Bureau of Applied Economics and Statistics, Government of West Bengal.

TABLE : A-3.3.

AVAILABLITY OF CREDIT IN WEST BENGAL

S.NO	Types of Credit Sources	1960-61	1970-71	1982-83
1.	State and Central Banks			
	(i) No. of Societies	30	22	18
	(ii) No. of Members	15	16	27
	(iii) Working Capital	1,370	4,287	30,673
	(iv) Loans Advanced	680	1,451	11,283
2.	Land Mortgage Banks*			
	(i) No. of Societies	13	22	25
	(ii) No. of Members	6	34	171
	(iii) Working Capital	68	1,180	12,448
	(iv) Loans Advanced	21	248	1,324
3.	Agricultural Credit Societies			
	(i) No. of Societies	12,768	11,905	7,580
	(ii) No. of Members	661	1,120	2,428
	(iii) Working Capital	518	2,256	15,796
	(iv) Loans Advanced	331	573	3,804

Source: Economic Review (Statistical Appendix) 1986-87, BAES, Government of West Bengal

Note : 1) Number of members is in thousands

2) Working capital and loan figures are in Rs. Lakhs

* Land Mortgage Banks were renamed as Land Development Banks since 1975-76

TABLE : A-3.4.

PROPORTION OF CULTIVATORS & AGRICULTURAL LABOURERS TO AGRICULTURAL WORKERS (MALES) IN WEST BENGAL

(in Percent)

S.NO	Districts	Cultivators				Agricultural Labourers			
		1951	1961	1971	1981	1951	1961	1971	1981
1.	Burdwan	65.6	65.2	48.6	48.6	34.4	34.8	51.4	51.9
2.	Birbhum	59.6	62,0	49.2	42.9	40.3	38.0	50.8	47.1
3.	Bankura	70.0	72.6	57.7	60.7	30.0	27.4	42.3	39.3
4.	Midnapore	79.2	77.0	61.6	63.0	20.8	23.0	38.4	37.0
5.	Howrah	57.5	59.6	37.0	41.6	42.5	40.4	63.0	58.4
6.	Hooghly	69.7	65.8	49.8	52.5	30.3	34.2	50.2	47.5
7.	24-Parganas	67.3	64.1	47.1	50.0	32.7	35.9	52.9	50.0
8.	Nadia	72.5	73.4	58.5	53.3	27.5	26.6	41.5	46.7
9.	Murshidabad	69.2	69.5	52.6	52.0	30.8	30.5	47.4	48.0
10.	W. Dinajpur	84.3	76.3	68.8	61.1	15.7	23.7	31.2	38.9
11.	Malda	77.3	79.5	59.6	57.1	22.7	20.5	40.4	42.9
12.	Jalpaiguri	96.2	93.1	80.4	69.2	3.8	6.9	19.6	30.8
13.	Darjeeling	91.6	91.8	76.8	72.6	8.4	8.2	23.2	27.4
14.	Cooch-Behar	88.6	91.0	91.9	67.1	11.6	9.0	18.1	32.9
15.	Purulia	--	84.4	64.2	72.4	--	15.6	35.8	27.6
16.	WEST BENGAL	72.4	72.9	57.3	57.0	27.6	27.1	42.7	43.0

Source : Census of India, 1951, 1961, 1971 & 1981, Government of India.

TABLE : A-3.5

GROWTH OF PROPORTION OF CULTIVATORS AND AGRICULTURAL LABOURERS TO TOTAL AGRICULTURAL WORKERS IN WEST BENGAL

S.No	Districts	Growth Rate, 1951-1981, in Percent	
		Cultivators	Agricultural Labourers
1.	Burdwan	-0.99	1·35
2.	Birbhum	-0.64	0.52
3.	Bankura	-0.47	0.90
4.	Midnapore	-0.76	1.94
5.	Howrah	-0.07	1.07
6.	Hooghly	-0.94	1.51
7.	24-Parganas	-0.99	1.43
8.	Nadia	-1.02	1.78
9.	Murshidabad	-0.95	1.49
10.	W. Dinajpur	-1.07	3.07
11.	Malda	-1.00	2.14
12.	Jalpaiguri	-1.09	7.22
13.	Darjeeling	-0.77	4.02
14.	Cooch-Behar	-0.92	3.54
15.	Purulia	-0.76*	2.89*
16.	WEST BENGAL	-0.79	1.49

Source: Calculated from Census of India, 1951 and 1981, Government of India.

* For 1961 to 1981 only

TABLE : A-3.6

PROPORTION OF AGRICULTURAL WORKERS IN TOTAL WORK FORCE OF WEST BENGAL

(in Percent)

S.NO	Districts	1951	1961	1971	1981
1.	Burdwan	53.52	545.70	53.23	51.96
2.	Birbhum	70.79	75.78	79.46	76.48
3.	Bankura	78.38	76.76	79.95	73.86
4.	Midnapore	78.16	76.64	80.17	73.63
5.	Howrah	24.34	24.31	32.89	25.55
6.	Hooghly	51.34	49.19	53.37	49.89
7.	24-Parganas	44.35	50.01	52.75	44.86
8.	Nadia	56.50	62.32	66.36	62.13
9.	Murshidabad	65.75	80.83	77.52	73.30
10.	W. Dinajpur	80.01	83.58	85.63	82.09
11.	Malda	66.03	67.73	80.41	76.39
12.	Jalpaiguri	38.08	50.64	56.93	55.40
13.	Darjeeling	23.10	36.54	39.06	34.70
14.	Cooch-Behar	79.94	82.11	84.38	80.87
15.	Purulia	--	78.01	76.93	71.57
16.	WEST BENGAL	47.65	53.17	58.58	55.09

Source: Calculated from Census of India, 1951, 1961,1971,1981, Government of India.