Agricultural Development : A Study of **Inter-Crop and Inter-Regional Variations In North-East India**

A

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C E R T I F I C A T E

Certified that Ms. Tarujyoti Buragohain has worked under my supervision for her M.Phil Dissertation entitled "Agricultural Development - A Study of Inter-crop and Inter-Regional Variations in North-East India" and no part of it has been submitted elsewhere for the award of any other degree. The dissertation, in my opinion, is worthy of awarding the said degree.

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Dedicated to

My

Parents

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CONTENTS

Chapter - I

Introduction

Development and Growth

The term 'economic development' is used interchangeably with such terms as economic growth and economic progress. But the economists draw technical distinctions among these three concepts. However, all the three terms have one common parameter and that is 'change'. Change can also be of two types: desirable and undesirable. Expansion in the values of a large variety of variables such as output, employment, etc. is generally considered to be desirable, while a decrease in their values is regarded as undesirable. Naturally, progress, development and growth all are related to the desirable changes in such variables as income, consumption, ive investment, employment, etc.. But the values of the variables like output and income depend upon the quality and the quantity of the factor inputs and the techniques that are used in the production processes.

The growth of output may occur through a variety of processes: the growth process may be of factor multiplication variety or it may be of factor transformation type.[1] Under the factor multiplication process, increases in output may result from the increases in the quantities of the factor inputs of the given quality used in the production processes based on the prevalent techniques of

production. Obviously, the output per unit of factor inputs does not change, and the number and nature of inputs used also remain invariant through time. Such growth processes tend to be constrained by the upper bounds of resource supplies, especially the sources of non-renewable and natural variety. This we may call economic progress. As this process is constrained by supply bottlenecks, the scope of rise in output is limited, and the growth process may not be sustained over long periods. In the first process, quantitative expansion in both the inputs and the outputs takes place without altering the organisational and institutional set up and the technological inter-relations between inputs and output. As against this, under the factor transformation process, output may be raised by using the same quantity of given inputs of superior quality. Use of better techniques of production often leads to an improvement in the quality of factor inputs and their productivities. Technological changes may also warrant the use of new factor inputs which may lead to the quantitative augmentation and qualitative transformation of the conventional inputs hitherto used in the production processes. In all these cases, output per unit of factor inputs used in the production process tends to rise. As against the first process, the second process is associated with the qualitative transformation of the

factor inputs as a result of which the given inputs yield more output per unit of factor inputs used in the production process.

The developing economies have the advantage that the superior techniques they need have already been developed and exploited commercially by the developed economies of the West. So the developing economies may choose one or more techniques from the available stock which are more efficient and superior to the ones that are being currently used. The borrowed techniques have, however, to be adopted and adapted to the local conditions. Besides, the induction of such techniques and new products often necessitate changes in the institutional, organisational and even social structure. Consequently, the resultant changes tend to be all embracing and all pervading. Such expansion in output/income may be defined as economic development.[2] However, the developed countries have no such advantage. The superior technique has to be first developed by them through their own R and D and then it has to be adopted for commercial exploitation. But the induction of new technology does not require introduction of all pervasive and comprehensive changes in their socio-economic structures. This problems may be defined as economic growth. We have used the terms growth and development in the second sense. But the actual growth

process may not be of a pure variety, it may be a mixture of various processes.

Importance of Agricultural Sector

The primary sector occupies the central place in the developing economies and their regional units in which it generates the highest proportion of output and absorbs the greatest proportion of the labour force. The explosive growth of population and the relatively limited size of the secondary and tertiary sectors of these economies dictate that either the non-agricultural sectors should grow at such high rates as are warranted by the growth of the labour force or the ever growing numbers of job seekers flocking to the labour markets will continue to be accomodated and absorbed in the primary sector in general and agriculture in particular. But the modern secondary and tertiary sectors of these economies are relatively capital intensive whereas the primary sector in general and the agriculture in particular is relatively labour intensive which enables the primary sector to generate relatively more employment per unit of invested capital. It may be noted that irrigation and cropping intensity have got a very high employment potential.[3] Due to the predominance of agriculture in the economy, the growth of such an economy hinges mainly upon the growth performance of its agricultural sector. The

growth of agriculture and the economy as a whole are so closely related that the rapid growth of the former accelerates the growth of the entire economy, whereas the sluggish or negative growth or stagnation of the agricultural output makes the entire economy slide down the developmental path.[4] But the agricultural sector of these economies poses difficult problems, as a very large segment of this sector has been entwined in the low income, low wage and low productivity equilibrium trap for long. Only a small part of it is modern and reasonably developed. Besides, like the national economy and its constituent sectors, the agriculture in developing economies is also characterised by a variety of dualisms. The traditional and the less developed segment of agriculture is characterised by the low level primitive technology and low productivity - both per unit of area cultivated and per person employed and hence, low returns to investment. Since the less developed segment of agriculture is relatively predominant in the rural economy, developing economies have also been facing the food shortages. The strategy of development may, therefore, focus mainly on agriculture as the core of the developmental processes. Only an adequately and properly developed agricultural sector may furnish an appropriate base for rapid industrialization. So evolving of an appropriate strategy of

development requires delineating of the current status, problems, bottlenecks and constraints, as well as the factors that are conducive to growth, so as to facilitate the determining of the contours of future potential of development of the national and the regional economies. Besides, the identification and evolution of the contribution of the individual elements of the composite growth process may help in determining the relative strengths and weaknesses of the growth processes in operation so far. It may be facilitated by the decomposition of the overall growth of output into its components. This is especially true for the growth of agricultural output where the induction of new techniques of production lies at the core and base of the Green Revolution in India. Green Revolution technology, in its turn, hinges upon the intensive use of land augmenting inputs like high yielding seed varieties, water, fertilizers, pesticides, etc. and the adoption of modern cultural practices. However, a part of the overall growth of agricultural output in general and foodgrains in particular results also from the growth of area under cultivation. Therefore, the overall growth may be decomposed into two components: due to growth of yield and due to growth of area.

The dual character of agriculture also reflects through the regional inequalities of developmental levels.

Scarcity of resources and productivity of investment have forced decision makers to concentrate developmental efforts at few sectors and regions of the economy. Then, the same factors facilitated the extension of the selectivity approach from industry to agriculture subsequently.[5] Therefore, regional inequalities of agricultural development tended to widen through time.

Therefore, a general belief prevails that the success story of Green Revolution has remained confined to the narrow segment of North-West India and isolated pockets elsewhere. Besides, it is also believed that the successful model may not be easily replicated in other regions, at least in the short run. Empirical evidence may, however, not conform to these propositions nurtured fondly both by economists and some of the decision makers.[6] Empirical testing of these propositions requires that we (i) evaluate the growth performance of the different spatial units during the post-Green Revolution period, (ii) decompose the overall growth of output into its constituent elements, and (iii) assess the relative contributions of the individual components, especially the acreage growth and the growth of yield, the two major sources of agricultural growth. This study has been designed to examine the above aspects of agricultural growth with reference to North-East India from 1972 to 1983.

This study is, however, devoted mainly to evaluate the relative contributions of the growth of area and yield to the growth of output. An algebric algorithm to decompose the growth of output into the components of the growth of yield and the growth of area under the individual crop has been developed. This complements the Minhas and Vaidyanathan (M-V) algorithm of decomposition which is applicable to the macro aggregates of all the agricultural crops taken together.[7] Another alternative algorithm has also been developed in order to decompose growth of output into its growth components due to growth of yield, growth of area and change in price structure. This study attempts to assess and evaluate the growth of the agricultural sector in North-East India. An attempt has been made to determine the relative contribution of the growth of area and the growth of yield to the growth of output, the two factors that generally account for the major proportion of the overall growth of the agricultural output. The cropping pattern and the price structure are the two other important factors that contribute greatly to the growth of the agricultural output as switching from the low to the high yield and high value crops tends to raise the value of output.

The study is divided into five chapters:

The first chapter deals with the sources of data, assumptions and methodology.

The second chapter gives a brief review of the main decomposition algorithms that have been developed and used empirically so far.

The third chapter deals with the analysis of trend growth rates of output, area and yield and their proportionate share in the overall growth.

The fourth deals with the analysis of year to year growth rates and the relative contributions of the growth of area and yield to the growth of output.

The last chapter contains the resume and conclusions of the study.

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Chapter - II

(a) Sources of Data and Assumption
(b) Methodology

(a) Sources of Data and Assumption

Data have been taken from Basic Statistics of North-Eastern Region, North-Eastern Council, Shillong, 1982, and from the Office of the Directorate of Economics and Statistics of Meghalaya and Hand Book of Statistics published by the Directorate of Economics and Statistics of various states of North-East India./

A general belief prevails that the success story of Green Revolution has remained confined to the narrow segment of North-West India and isolated pockets elsewhere. Besides, it is also believed that the successful model may not be easily replicated in other regions, at least in the short-run. Empirical evidence may, however, not conform to these propositions nurtured fondly both by economists and some of the decision makers.[1] Empirical testing of these propositions requires that we

i) evaluate the growth performance of the different spatial units during the post-Green Revolution period,

ii) decompose the overall growth of output into its constituent elements, and

iii) assess the relative contribution of the individual components, especially the acreage growth and

the growth of yield, the two major resources of agricultural growth. This study has been designed to examine the above aspects of agricultural growth with reference to North-East India from 1972 to 1983.

(b) Methodology

Growth rates have been derived from the following growth curve:

Log Y = Log a + bT which has been fitted to the data by the ordinary least squares technique.

Obviously, $\frac{1}{Y} \cdot \frac{dY}{dt} = b$ yield the growth rate, where t stands for time.

Besides, trends growth rates which reflect average growth performance of the economy over the entire period covered by the study, we estimated year to year rates of growth of the variables involves in order to evaluate the relative contribution of yield, area and price to the growth of output and inter-crop temporal variations.

Decomposition of Growth of Output

Decomposition approach was used to study the relative contribution of different components - area,

productivity and price to the aggregate increase in different crops of output. Overall growth of output in physical terms may be decomposed into growth due to area and growth due to yield as follows: Total output of ith crop is given by

$$O_{(i)} = A_{(i)} Y_{(i)} \qquad (1)$$

where O is output, A is area under the crop and Y is yield per unit of area under cultivation.

$$Y_{(i)} = \frac{O_{(i)}}{A_{(i)}} \qquad (2)$$

$$A_{(i)} = \frac{O_{(i)}}{Y_{(i)}} \qquad (3)$$

Differentiating partially (1) we get

$$\frac{\delta O_{(i)}}{\delta A_{(i)}} = Y_{(i)} \text{ and } \frac{\delta O_{(i)}}{\delta Y_{(i)}} = A_{(i)} \qquad (4)$$

Logarithmaic transformation of equation (1) gives $\text{Log } O_{(i)} = \text{Log } A_{(i)} + \text{Log } Y_{(i)}$ (5)

Differentiating with respect to time, we get

$$\frac{1}{O_{(i)}} \cdot \frac{dO_{(i)}}{dt} = \frac{1}{A_{(i)}} \cdot \frac{dA_{(i)}}{dt} + \frac{1}{Y_{(i)}} \cdot \frac{dY_{(i)}}{dt} \quad (6)$$

These leads as

$$\frac{dO_{(i)}}{dt} = \frac{O_{(i)}}{A_{(i)}} \cdot \frac{dA_{(i)}}{dt} + \frac{O_{(i)}}{Y_{(i)}} \cdot \frac{dY_{(i)}}{dt}$$

Substituting from 2, 3 and 4 we get

$$dO_{(i)} = \frac{\delta O_{(i)}}{\delta A_{(i)}} \cdot dA_{(i)} + \frac{\delta O_i}{\delta Y_{(i)}} dY_i \quad (7)$$

This equation is in consonance with the Euler's theorem.

Equation (6) may also be written in the following form :

$$R(O) = R(A) + R(Y) \quad (8)$$

where R denotes growth rate and the subscripts O, A and Y stand for output, area and yield, respectively.

The algorithm has been developed by Prakash and Goel (P-G)[2] and it is different from the one developed by B.S. Minhas and A. Vaidyanathan (M-V)[3]. M-V algorithm has been devised to decompose growth of total agricultural

output into its component parts at a macro level. It cannot be applied to decompose the growth of output of individual crops. As against this, P-G algorithm has been devised to decompose growth of output of individual crops into its component parts. But the algorithm can easily be converted to macro algorithm by aggregating crops. Application of the two algorithms to the aggregative data of Meghalaya has demonstrated that the P-G algorithm gives better results than those yielded by M-V algorithm. But the P-G algorithm has been developed to decompose the growth of output of individual crops in physical terms. This neglects the impact of the changes in prices which are the important determinants of the changes in the cropping pattern. Since the algorithm is applied to the individual crops, it also neglects the changes in the cropping pattern We, therefore, extend the algorithm to incorporate the price effects on growth as follows:

Total value of output of ith crop is given by

$$V_{(i)} = P_{(i)} A_{(i)} Y_{(i)} \qquad (9)$$

Differentiating V_i partially with respect to P(i), A(i) and Y(i), we get

$$\frac{\delta V(i)}{\delta P(i)} = A_{(i)} Y_{(i)} \qquad (10)$$

$$\frac{\delta V(i)}{\delta A(i)} = P_{(i)} Y_{(i)} \qquad (11)$$

$$\frac{\delta V(i)}{\delta Y(i)} = A_{(i)} P_{(i)} \qquad (12)$$

Equations (9) to (12) together lead to the following equations:

$$P_{(i)} A_{(i)} = V_{(i)}/Y_{(i)} = \delta V_{(i)}/\delta Y_{(i)} \qquad (13)$$

$$P_{(i)} Y_{(i)} = V_{(i)}/A_{(i)} = \delta V_{(i)}/\delta A_{(i)} \qquad (14)$$

$$A_{(i)} Y_{(i)} = V_{(i)}/P_{(i)} = \delta V_{(i)}/\delta P_{(i)} \qquad (15)$$

Logorithmic transformation of (9) and then differentiation with respect to t will yield the following equation:

$$\frac{1d\,V(i)}{V_{(i)}dt} = \frac{1d\,P(i)}{P_{(i)}dt} + \frac{1d\,A(i)}{A_{(i)}dt} + \frac{1d\,Y(i)}{Y_{(i)}dt} \quad \text{or}$$

$$d\,V_{(i)} = \frac{V_{(i)}}{P_{(i)}}\,dP(i) + \frac{V_{(i)}d\,A_{(i)}}{A_{(i)}} + \frac{V_{(i)}d\,Y_{(i)}}{Y(i)} \qquad (16)$$

Substituting from (13-15), we get

$$d\,V(i) = A_{(i)} Y_{(i)}\,d\,P_{(i)} + P_{(i)} Y_{(i)}\,d\,A_{(i)} + P_{(i)} A_{(i)}\,d\,Y_{(i)} \qquad (17)$$

$$= \frac{\delta V_i}{\delta P_i}\,d\,P_i + \frac{\delta V_i}{\delta A_i}\,d\,A_i + \frac{\delta V_i}{\delta Y_i}\,d\,Y_i \qquad (18)$$

The first term on the right hand side gives the effect of change in price upon the value of total output, second term measures the effect of change in area upon the value of output per unit of cultivation, and the last term measures the effect of change in the yield upon the value of output: It may, however, be noted that the interaction effects of the three components of changes have been neglected both in equation 17 and 18. Thus, the interaction effects are assumed implicitly to be negligible, which may or may not be the case. Therefore, the algorithm may further be modified to take these interaction effects into account.

Applying difference operator $E = (\Delta+1)$ to equation (9) we get

$$(V_{(i)} + \Delta V_{(i)}) = (P_{(i)} + \Delta P_{(i)})\ (A_{(i)} + \Delta A_{(i)})\ (Y_{(i)} + \Delta Y_{(i)})$$

$$= P_{(i)}A_{(i)}Y_{(i)} + P_{(i)}Y_{(i)}\Delta A_{(i)} + Y_{(i)}A_{(i)}\Delta P_{(i)} + A_{(i)}P_{(i)}\Delta Y_{(i)} + P_{(i)}\Delta A_{(i)}\Delta Y_{(i)} +$$

$$A_{(i)}\Delta P_{(i)}\Delta Y_{(i)} + \Delta A_{(i)}\Delta P_{(i)}Y_{i} + \Delta P_{(i)}\Delta A_{(i)}\Delta Y_{(i)}$$

hence

$$\Delta V_{(i)} = A_{(i)}Y_{(i)}\Delta P_{(i)} + P_{(i)}Y_{(i)}\Delta A_{(i)} + P_{(i)}A_{(i)}\Delta Y_{(i)} + Y_{(i)}\Delta P_{(i)}\Delta A_{(i)} +$$

$$P_{(i)}\Delta A_{(i)}\Delta Y_{(i)} + A_{(i)}\Delta P_{(i)}\Delta Y_{(i)} + \Delta P_{(i)}\Delta A_{(i)}\Delta Y_{(i)} \quad - - - (19)$$

Proceeding to limits As $\Delta V_{(i)} \to dV_{(i)}$, we get

$$d V_{(i)} = A_{(i)} Y_{(i)} d P_{(i)} + P_{(i)} Y_{(i)} d A_{(i)} + P_{(i)} A_{(i)} d Y_{(i)} + Y_{(i)} d P_{(i)} d A_{(i)}$$
$$+ P_{(i)} d A_{(i)} d Y_{(i)} + A_{(i)} d P_{(i)} d Y_{(i)} + d P_{(i)} d A_{(i)} d Y_{(i)} \quad \ldots (20)$$

Dividing both sides by $V_{(i)} = P_{(i)} A_{(i)} Y_{(i)}$

$$\frac{d V_{(i)}}{V_{(i)}} = \frac{d P_{(i)}}{P_{(i)}} + \frac{d A_{(i)}}{A_{(i)}} + \frac{d Y_{(i)}}{Y_{(i)}} + \frac{d P_{(i)}}{P_{(i)}} \cdot \frac{d Y_{(i)}}{Y_{(i)}}$$

$$+ \frac{d A_{(i)}}{A_{(i)}} \cdot \frac{d Y_{(i)}}{Y_{(i)}} + \frac{d P_{(i)}}{P_{(i)}} \cdot \frac{d Y_{(i)}}{Y_{(i)}} + \frac{d P_{(i)}}{P_{(i)}} \cdot$$

$$\frac{d A_{(i)}}{A_{(i)}} \cdot \frac{d Y_{(i)}}{Y_{(i)}} \quad \ldots (21)$$

or

$$R(O) = R(P) + R(A) + R(Y) + R(P) + R(P)\, R(A)$$
$$+ R(P)\, R(Y) + R(A)\, R(Y) + R(P)\, R(A)\, R(Y) \quad \ldots (22)$$

This obviously takes cross interactions of the changes in to factors at a time as well as all three factors at a time.

Adjustment of Data

We have taken 3 years moving averages of the variate values in order to free them from the influences of cyclical fluctuations and random factors in order to estimate the year to year growth rates of output of food-grains, cereals, pulses and five major oil seeds grown in North-East India. The actual growth rates of output, area and yield are derived from the following formula :

$$g(t) = \left[\frac{xt}{x(t-1)} - 1 \right]$$

where g(t) is the rate of growth of variable x during the t-th year and xt denotes the variate value at time t. The rates of growth of output have been estimated jointly from equations (7) and (8).

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Chapter - III

Review of Literature

Agricultural development, like economic development, can be brought about either by factor multiplication or by factor transformation.[1] But in practice, it is a mixture of the two strategies. This is especially true about agriculture where land is a limiting factor of development. One cannot increase the area under cultivation infinitely due to reasons that are obvious. Therefore, the transformation of farm inputs and raising their productivity thereby happens to be the chief source of agricultural development in any country or region.

Agricultural production is generally a function of the farm inputs, adoption of improved cultural practices, governmental programmes of agricultural development and agro-climatic conditions. Of all these the new farm technology has been found to be the single most important factor in the agricultural development in several countries/regions. In fact, it is the new farm technology that has been responsible for taking the agriculture of some developing economies out of the low level equilibrium trap.[2] The strategy of assigning a crucial role to agriculture in the process of development of the national economy and the emphasis put on modern technology as a key factor in agricultural development has got extended from national to state levels. Consequently,

the modern technology has started percolating slowly to the states. The adoption of modern inputs and scientific farm practices, in howsoever small dozes, have already resulted in a distinct break-through in agricultural production and productivity of agricultural crops in general, and foodgrains, cereals, pulses and oil seeds in particular. But, how far this growth of output is due to the increase in area sown, cropping pattern and agricultural productivity changes is an interesting problem to investigate. Therefore, the growth of output can be divided into the growth components that constitute overall growth of aggregate agricultural output. To the best of our knowledge such decomposition of the growth of agricultural output into its components due to different factors was attempted by Minhas and Vaidyanathan. They developed a multiplica- formula for this purpose. Minhas and Vaidyanathan[3] start with the identities

$$P_o = A_o \sum_i W_i C_{io} Y_{io} \qquad \text{(i)}$$

and

$$P_t = A_t \sum_i W_i C_{it} Y_{it} \qquad \text{(ii)}$$

Where P_o and P_t are the total value of agricultural output in the initial and terminal period respectively, A_o and A_t represent the aggregate area sown under different crops at the two time points. W_i stands for the price of the i-th

crop and is kept constant throughout the analysis. C_{io} and C_{it} are the area under i-th crop as a proportion of the total area under cultivation and the area under individual crops under study during the two time periods. Y_{io} and Y_{it} are the yield rates per unit of area during the initial and final years. Substracting the identity (1) from (2) and simplifying the difference in production during a period can be written as

$$P_t - P_o = (A_t - A_o) \sum_i W_i C_{io} Y_{io} \quad (1)$$

$$+ A_t \sum_i W_i C_{io} (Y_{it} - Y_{io}) \quad (2)$$

$$+ A_t \sum_i W_i (C_{it} - C_{io}) Y_{io} \quad (3)$$

$$+ A_t \sum_i W_i (C_{it} - C_{io}) (Y_{it} - Y_{io}) \quad (4)$$

The first term on the right side of the identity is the absolute increase in agricultural output due to the increase in gross cultivated area.

The second term, measures the impact of changes in yield and this may be called yield effect. It includes the absolute effect of increase in productivity along with the interaction effect of area and yield. The third term represents the effects of changes in cropping pattern and

the interaction of cropping pattern and area effects. The last term represents the interaction effect of yield and cropping pattern along with the interaction of all the three absolute effects together.

This basic decomposition has been extended and modified subsequently by the researchers interested in this field of investigation. Vaidyanathan, one of the authors of the original algorithm has himself been engaged in extending the scope and the range of the algorithm, the order to be able to capture the effects of yield raising inputs like fertilizers. Some others, like Chandra Prabha have modified it to study relative rather than absolute changes. We have confined our attention to these two versions as the representatives of the entire spectra of algorithms that have been brought into existence so far.

The M-V formula has been modified by Chandra Prabha[4] by converting the absolute increases to relative increases. The algorithm as modified by her is as follows:

$$\frac{P_t - P_o}{P_o} = \frac{A_t - A_o}{A_o} + \sum_i \frac{Y_{it} - Y_{io}}{Y_o} \frac{P_{io}}{P_o} + \sum_i \frac{C_{it} - C_{io}}{C_{io}} \frac{P_{io}}{P_o}$$

$$+ \frac{A_t - A_o}{A_o} \lesssim_i \frac{Y_{it} - Y_{io}}{Y_{io}} \frac{P_{io}}{P_o} + \frac{A_t - A_o}{A_o} \lesssim_i \frac{C_{it} - C_{io}}{C_{io}}$$

$$\frac{P_{io}}{P_o} + \lesssim_i \frac{Y_{it} - Y_{io}}{Y_{io}} \frac{C_{it} - C_{io}}{C_{io}} \frac{P_{io}}{P_o} + \frac{A_t - A_o}{A_o} \lesssim_i$$

$$\frac{Y_{it} - Y_{io}}{Y_{io}} \frac{C_{it} - C_{io}}{C_{io}} \frac{P_{io}}{P_o}$$

In this scheme, P_{io} denotes the value of output of the i-th crop in the base year '0', and the ratio $\frac{P_{io}}{P_o}$ represents the proportion of the total value of agricultural output contributed by the i-th crop. The rest of the symbols are the same as used in the (M-V) algorithm.

It is obvious that this modification has shifted the emphasis from absolute to relative changes. Therefore, it is more appropriate to analyse the sources of growth than the M-V algorithm is its original form. Thus, like M-V algorithm, also suffers from the limitation that it may be applied to the growth of the agricultural technology associated with high yielding variety seeds has, however, remained confined to a few selected crop groups as substantial gains have not been recorded in case of other crop groups. Such an aggregative analysis tends to conceal part of the impact of the dramatic break-throughs upon yield rates of specific crop groups that

have been brought about by R and D. This may be remedied by undertaking the study of the decomposition of the growth of output of individual crops. Another important flaw in these algorithms is that the price effects have been completely neglected in both the versions of the algorithms. Therefore, this is another direction which has required some attention. This has been remedied by Prakash and Goel. They have developed another mathematical algorithm which we designate (P-G) algorithm and which can be used for decomposing the growth of output of individual crops into its component parts. It can be used for studying the macro aggregates also. The model of decompostion is exact and it does not provide for random errors. All interactions may, however, be postulated to be of residual type, though other versions of the model provide for the interaction terms. This has already been discussed under methodology. P-G algorithm has been devised to decompose growth of output of individual crops into its component parts. But the algorithm can easily be converted to macro algorithm by aggregating crops. Application of the two algorithm to the aggregating data of Meghalaya has demonstrated that P-G algorithm gives better results than those yielded by M-V algorithm.[5]

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Chapter-IV

Trend growth rates of output area and yield and their proportionate share in the over all growth

In this chapter, we will discuss the trend growth rates which have been derived from the estimated growth curves and proportionate share of production, area and yield to the overall growth of output of foodgrains, cereals, pulses and five major oilseeds. The growth curve has been fitted to the data by the method of Ordinary Least Square.

4.0. Empirical Results

The growth curves have been estimated for total foodgrains, cereals, pulses and five major oilseeds that are grown in the region.

Inter-temporal changes in the values of a variable or variables reflect its temporal behaviour pattern. One way to evaluate temporal changes is to compare the changes in the values at two successive points of time. This may be a tedious procedure. The growth rate is a summary measure which overcomes this limitation. The trend growth rate summarises the increases that occur in the values of the given variable over a period of time. The trend grwoth rate can be estimated from the growth curve fitted to the time series data. If, however, the spatial units grow at

differential rates then the nature and the degree of inter and intra regional inequalities will be affected. Under such cases, the relative position of the individual units are not same and hence their rank and order will also change. Consequently, the relative shares of the individual units in the total will tend to change. Therefore, changes in these relative shares may be also used to gauge the behaviour pattern of the inter and intra regional inequalities through time. We have, therefore, fitted the growth curves to the absolute variate values which have been analysed in conjunction with the variate values relative to the national or the regional aggregates.

4.1. Growth of Foodgrains

4.1.2. Growth of Output

The estimated growth curves are reported in table 1. The growth curves fit well only to the output data of India, Arunachal Pradesh, Meghalaya, Mizoram and Nagaland. The proportion of variation of output explained by the curve in these units ranges from 46 per cent for national economy to 84 per cent for Meghalaya.

Output of foodgrains in the national economy has increased at a statistically significant rate of 1.34 per

cent per annum and the growth of output in the regional economy is not only not significant statistically but its growth rate is much lower than the national average. In fact, the output of foodgrains in the North-Eastern Region as a whole has expanded only at a measely rate of 0.22 per cent per annum. Consequently, the proportionate share of the regional production has decreased from 3.06 per cent in 1972-73 to 2.67 per cent in 1979-80 (Table No. 2.A).

The growth of output in the region has been adversely affected by the negative growth of output in Assam and Mizoram. Output in Mizoram has decreased at as high a rate as 6.41 per cent per annum which is statistically significant also. But the decrease in output in Assam is not significant. The proportionate shares of output of Assam and Mizoram in the regional aggregate have declined from 78.43 per cent and 2.396 per cent in 1972 to 69.05 per cent and 0.69 per cent in 1980 respectively. As against this, output of foodgrains in Arunachal Pradesh, Meghalaya and Nagaland has increased at statistically significant and high rates at 5.5, 1.42 and 3.48 per cent per annum respectively. These rates are higher than both the regional (0.22 per cent) and the national averages (1.34 per cent).

The proportionate shares of these units have increased from 1.7, 3.93 and 1.76 per cent in 1972-73 to 3.61, 4.94 and 3.03 per cent 1980 respectively. Output in Manipur and Tripura has also increased but the growth rates are not significant. Tripura's growth rate is 2.04 per cent which is more than the national and the regional averages. But the growth rate of Manipur is more or less the same as the national rate of growth of output. The proportionate shares of these two units have increased from 5.71 and 6-07 per cent in 1972 to 8.27 per cent and 10.41 per cent in 1980 respectively.

4.1.3. Growth of Area and Yield

Growth of output can be accounted mainly either by the growth of factor inputs or by the growth of productivity per unit of factor inputs used or both. Land area constitutes the major resource inputs in agriculture. But the changes in the techniques of production brought about by investment in techniques of cultivation or land augmenting inputs like water, fertilizers, pesticides, insecticides, high yielding variety seeds, etc. and the associated changes in the cultural practices are generaly reflected in the growth of yield per unit of land cultivated and output per person employed in agriculture. Therefore, in order to go behind the factors

underlying the differential growth performance of the constituent units of the regional economy, the growth of area and the yield of each crop group in individual administrative units is analysed separately.

3.3.3.1. Area

The growth curve fits well to the acreage data of Arunachal Pradesh, Meghalaya and Nagaland. The explained proportion of variation ranges from 50 per cent for Arunahcal Pradesh to 84 per cent for Nagaland. For the rest of the units, the curve does not fit well.

Nagaland has recorded negative growth of area under foodgrain crops at a statistically significant rates, while the area has increased at statistically significant rates in Arunachal Pradesh and Meghalaya. However, the rate of growth of area in Assam is not significant. The growth rate of area in these units are 3.42, o.51 and 0.43 per cent respectively. However, these growth rates are more than the growth rates of both the regional and the national economies. The proportionate shares of Arunachal Pradesh, Assam and Meghalaya have increased from 1.92, 74.45 and 3.74 per cent in 1972 to 2.98, 74.57 and 3.99 per cent respectively in 1980. Area under foodgrain crops in the national economy has increased only nominally at an extremely low rate of 0.25 per cent per annum, whereas the average growth in the regional economy as a whole has been at a rate of 0.38 per cent. The proportionate share of acreage of the regional economy in the national total has increased nominally from 2.53 per cent in 1972 to 2.58 per cent in 1980.

The results suggest that the growth of output of foodgrains in Arunachal Pradesh and Meghalaya is, at least, partly accounted by the growth of area, whereas the growth of output in Nagaland has been achieved despite a significant fall in area under the foodgrain crops during the same period. It implies that the rapid growth of yield in Nagaland has not only neutralized the negative growth of area but it has also raised the output level substantially.

It is probable that the land less suitable to the foodgrain crops may have been transferred from the cultivation of foodgrains to other crops in Nagaland. It implies that the remaining acreage is relatively more suitable for agro-climatically to the cultivation of foodgrain crops which might have raise output per acre. It is also probable that the smaller area under these crops have benefitted from the use of improved techniques and the increased use of land augmenting inputs. Rises in the high yielding variety seeds and fertilizers supports this view. Assam shows the reverse pattern where output has registered a fall despite the increase in area under cultivations. Such results can materialise only if the increase in area is more than neutralised by the fall in output per acre. It is probable that the additional area brought under foodgrains in Assam is agro-climatically less suitable to the cultivation of those crops. Now such a change in cropping pattern will be

effected by the farmers only if what they loose in yield due to such shifts is more than compensated by the corresponding rises in the relative prices of the crops.

The negative growth of output in Mizoram is accompanied by the negative growth of area. Therefore, the decline in output may be accounted largely by the negative growth of area. The proportionate share of area in Mizoram has decreased from 2.46 per cent in 1972 to 2.17 per cent in 1980. Negative growth of area also seems to have diluted the impact of the growth of yield upon the growth of output in Manipur. The output of foodgrains in Manipur has recorded positive growth, negative growth of area notwithstanding. It implies that the growth of yield has not been fully neutralized by the fall in area. Same is true about Tripura which has achieved a rate of growth of output of 2.04 per cent despite a decrease in area at a rate of 0.02 per cent per annum. The acreage share of Tripura in the regional total decreases from 9.23 per cent in 1972 to 8.42 per cent in 1980. The north-eastern states have traditionally been the paddy growing areas. Wheat has become popular among the farmers only recently. It is probable that the adoption of new technology associated with these two crops has pursuaded the farmers to reduce the acreage under this crop group. As new technology needs heavy investment in inputs like water,

fertilizers, high yielding variety seeds, etc. in view of scarcity of resources farmers of the region might have found it imparative to reduce the acreage under this crop group and still reap the benefits of higher yields and greater output of these crops. But the growth of output in the regional economy as a whole seems to be the outcome of mainly the growth of area under these crops. A good deal of the acreage growth under these crops in the region seems to have been neutralised by the negative growth of yield in Assam and Mizoram. These inferences are supported by the growth curves fitted to the yield data.

4.1.3.2. Yield

The yield has increased at an annual compound rate of 1.087 in the national economy, and the rate of growth is also significant statistically. Obviously the significant growth of output of foodgrains in the national economy is more or less, completely accounted by the growth of yield, whereas areal growth makes hardly any contribution to the growth of output. As against this, the yield in the regional economy has grown negatively during the same period. Consequently, the regional yield relative to the national average declines from 121.65 in 1972 to 105.8 per cent in 1980. The negative growth of yield in the region is

accounted by its negative growth in Assam and Mizoram. But the yield has grown positively in the rest of the states; which has been completely swamped by the negative growth performance of Mizoram and Assam. It may be noted that Mizoram has been seriously affected by insurgency. In order to cope with this problem villages have been relocated and reorganised from the security view point. This may probably explain the negative growth performance of the state.

The following inferences may be drawn from these results:

1. The gap between the growth of output of food-grains in the regional economy of North-East India and the national economy has tended to decline.

2. Whereas the growth of yield has sustained the growth of national output, the growth of regional output is accounted by the acreage growth. The negative growth of regional yield is, however, the result of its negative growth in Mizoram and Assam.

3. Within the region, all states except Assam and Mizoram have recorded satisfactory growth of output; and the growth may largely be attributed to the productivity growth.

4. Intra-regional inequalities of production of foodgrains have tended to be mitigated in so far as the dominance of the Assamese economy in the region has been diluted.

A heartening feature revealed by these results is that the green revolution process seems to have seeped from the national to even remote and difficult areas like Arunachal Pradesh, Nagaland, Tripura, Meghalaya.

4.2. Total Cereals

The foodgrains consist of cereals and pulses and cereals consist of rice maize, wheat and small millets and pulses consist of gram, tur and other pulses. But the cereals account for the major proportion of foodgrains. Besides, it is the growth of productivity of cereal crops in general and paddy and wheat in particular that has mainly been responsible for the triggering off the green revolution in the country. So the high growth of cereals may be concealed in steady growth of foodgrains. Therefore, the pattern of growth of cereals and pulses has been examined separately.

4.2.1. Growth of Output of Cereals

The fit of the growth curve to the data is good only in case of Arunachal Pradesh, Meghalaya, Mizoram and Nagaland. The explained proportion of variation ranges from 10 per cent of the total for Nagaland to 83 per cent for Arunachal Pradesh.

The national economy has recorded an annual compound growth rate of 3.20 per cent which is roughly three times the rate of growth of output of foodgrains. This growth credence to the view that the green revolution has hinged mainly upon the growth of output of the cereals. However, the rate is not significant statistically which may be due to the short duration of the period covered by the study. The output in the north-eastern region has grown at the rate of only 0.21 per cent which is not different from the rate at which the output of foodgrains has grown during the same period. The result may be expalined by the fact that the pulses have not been a traditionally important crop group in the region and their relative position does not seem to have changed in the cropping pattern of the region during the decade of seventies. The national output has expanded at a rate which is fifteen times the regional rate. Consequently, the regional share in the national output of cereals has

declined from 3.23 in 1973-74 to 2.84 per cent in 1979-80 (Table No.2.B). Obviously, the region, taken as a whole has lagged behind the rest of the country so far as the growth of output of cereals is concerned. This must have enhanced the distance between the national and the regional economies.

The output of cereals has grown negatively both in Assam and Mizoram. Whereas, the decrease in output in Assam is not significant statistically, the rate of decrease of output in Mizoram is significant. All other units have however recorded the positive growth of output. Arunachal Pradesh records a statistically significant rate of growth which is as high as 5.35 per cent. This, in fact, is the highest growth rate recorded by any of the nine units covered by the study. Arunachal Pradesh is followed by Nagaland where the output has grown at a statistically significant rate of 3.45 per cent. The output both in Arunachal Pradesh and Nagaland has increased at a rate which is greater than the national average. Meghalaya has also recorded a significant rate of growth of output. But its growth rate of 1.40 per cent is relatively low. Tripura and Manipur have recorded positive growth of output at the rates of 2.04 and 1.26 per cent respectively. The last two growth rates are, however, not significant statistically.

Interestingly except Assam and Mizoram, all other five units of the region have recorded the growth of output at rates which are much higher than the regional rate of growth. Obviously, the regional performance has been affected adversely by the growth performance of Assam and Mizoram. These differential growth performances of the states much have reduced the extent of intra-regional inequalities. Whereas the share of Arunachal Pradesh and the dominance of Assam in the regional economy in the regional output of cereals has increased from 1.73 per cent in 1972-73 to 3.68 per cent in 1979-80, the Assam's share has declined from 78 to 69 per cent. But the share of Mizoram has declined from 2.44 to 0.69 per cent during the same period. Share of Manipur has increased from 5.81 to 8.35 per cent; share of Meghalaya has been raised from 3.97 to 4.96 per cent. Nagaland has succeeded in raising its share from 1.75 per cent to 3 per cent. Tripura's share has gone up from 6.15 per cent to 10.52 per cent during the period. .Thus, the dominance of Assam in the cereals' economy of the region has been diluted quite a lot by the relatively better growth performance of the other units of the region. Thus, the degree of concentration and the intra-regional inequality must have declined.

4.2.2. Growth of Area and Yield Under Cereals

The growth of output is to be evaluated in terms of the growth of its components, viz. the growth of area and the growth of yield. Both area and yield have increased positively in the national economy, but it is the growth of yield alone which is statistically significants, and it accounts for one third of the total growth of output. As against this, the growth of both area and yield in the regional economy are not significant. Besides, yield has declined over the years, and roughly less than half of the acreage gains have been neutralised by the negative growth of yield. Consequently, the level of the regional yield relative to the national average has declined from 113.66 in 1972-73 to 96.64 per cent in 1979-80.

Thus, the discrepancy between the regional and national average levels of yield of cereals have tended to increase during the period of time covered by the study, which should have further accentuated the inequalities of agricultural development between the regional and national economies. As against this, the regional share in the national acreage under cereals has increased from 1.5 per cent to 2.94 per cent. These growth of acreage in the phase of declining yield may be explained in terms of

greater degree of attraction of relative prices of cereals to the farmers of the region. It is also probable that this growth performance of the region is accounted only by the growth performance some odd units of the regional economy.

4.2.2.1. Area

The growth curve fits well to the acreage data only in case of Arunachal Pradesh and Meghalaya in whose case the explained proportion of variation ranges from 51 to 60 per cent of the total. In the remaining economies of the region, not only the growth rates are not significant but the explained proportion of variation is also low. In fact, it ranges from 5 to 33 per cent of the total variation. Then in as many as four of these seven units namely, Mizoram, Nagaland, Tripura and Manipur, the area under cereals has actually declined at nominal rates. This has got three implications.

i) The positive growth of area under cereals in the regional economy is accounted by its positive growth in the remaining three units namely, Arunachal Pradesh, Assam and Meghalaya. The acreage growth in these economies has been so high as has not only neutralised the negative growth

of area under these crops in Manipur, Nagaland, Mizoram and Tripura but it has also facilitated the nominal positive growth of area in the regional economy as a whole. But the area has increased at the highest rate of 3.4 per cent in Arunachal Pradesh.

ii) Relative shares of Arunachal Pradesh, Assam and Meghalaya in the total area under cereals in the region as a whole must have increased at the cost of four units in which area has declined during the same period. It is supported from the fact that the acreage share of Arunachal Pradesh increases from 1.99 per cent in 1972-73 to 2.76 per cent in 1979-80; the share of Assam has increased from 73.78 in the base year to 74.14 per cent in the terminal year whereas Meghalaya's share has increased from 3.8 to 4.08 per cent of the total area under cereal in the region. Manipur's share has declined negligibly from 5.39 to 5.38 per cent. Share of Mizoram is reduced from 2.55 to 2.22 per cent. In case of Nagaland, the acreage share has declined from 3.02 to 2.81 per cent. Tripura's share has been reduced from 9.46 to 8.6 per cent of the regional acreage. These changes, however, do not seem to have affected substantially the dominance of Assam and Tripura in the regional economy so far as the production of the cereals is concerned.

iii) These results also imply that the positive growth of output in those four units which have recorded a decline in acreage is accounted solely by the growth of yield. However, Assam and Mizoram have recorded a negative growth of output. Whereas the decline in both the area and yield of cereals in Mizoram accounts for the negative growth of output; the negative growth of yield in Assam has completely swamped the acreage growth to make output change negatively. These inferences are supported by the growth of yield.

4.2.2.2. Yield

Out of the seven units of the regional economy the growth curve fits well to the yield data of Arunachal Pradesh, Mizoram, Nagaland and Meghalaya. The explained proportion of variation in these cases ranges from 33 to 85 per cent of the total. Tripura is the only state for which the fit of the curve is not satisfactory. Yield has, however, recorded a negative growth both in case of Assam and Mizoram. Thus, the negative growth of yield of cereals in Assam not only swamps completely the positive growth of area but it makes output grow negative in the state. The consequence of this feature of growth is that the yield of Assam relative to the regional average has declined from

1.06 in the base year to 0.93 in the terminal year. Thus, the yield of the state relative to the regional average has declined by as much as 13 per cent during the period of eight years. The green revolution technology has decidedly not been inducted into Assam in any significant manner. But the attractiveness of relative prices of the cereals might have persuaded the farmers to increase the acreage under these crops in which process either inferior lands might have been brought under cultivation or the cultivation of the cereals might have been taken up in a relatively agro-climatically suitable area or both. Mizoram's case is different as all the three variables have recorded a negative growth. Plausible reasons have already been discussed in case of foodgrains crops.

Arunachal Pradesh records the positive growth of yield at a significant rate of 1.92 per cent per annum. Approximately two fifth of the total growth of output is accounted by the growth of yield and only three fifth is accounted by the growth of area. Consequently, the relative yield of Arunachal Pradesh which was only 87.09 per cent of the regional average in the base year has increased to 133.05 per cent in the terminal year. It is gratifying to note that the process of green revolution has perculated to such a remote and isolated state as Arunachal Pradesh.

The growth of yield in Manipur is positive though the rate of growth of 1.38 per cent is not significant statistically. But it is high enough to have neutralised the negative growth of area and the entire growth of output is accounted by the growth of yield in this case. The impact of growth of yield in Manipur may be gauged from the fact that the index of yield relative to the regional level has increased from 108 in 1973 to 155 in 1980.

Like Arunachal Pradesh, the growth of both area and yield under cereals in Meghalaya is not only positive but statistically significant also. But the major proportion of the growth of output is accounted by the growth of yield. In fact, approximately 67 per cent of the overall growth of output is accounted by the growth of yield, with the result that the productivity index of the state relative to regional average increases from 104 to 121 during the period covered by the study.

Nagaland has recorded the highest growth of yield in the region. The rate of growth is 4.2 per cent which is statistically significant. The highest growth performance has not only swamped the impact of the negative growth of area but it has also facilitated significant growth of output at a high rate of 3.5 per cent per annum. Consequently, index of relative yield which was slightly more than half

of the regional average at 58 has gone up to 106.84 in a period of eight years.

The growth of output in Tripura is also accounted completely by the growth of yield. Tripura has recorded the second highest rate of growth of yield in the region, the value being 2.27 per cent. The relative level of yield has increased from 65 to 122 per cent. Thus, Arunachal Pradesh, Manipur, Meghalaya, Nagaland and Tripura appeared to have joined in the national race for green revolution. Meghalaya and Manipur appeared to have maintained their relative position but Assam and Mizoram have lost its dominance a little bit. These trends highlight the tendency of intra regional inequalities of agricultural development to have declined a bit. In this process the new technology and the movements of relative prices seemed to have played an important role.

4.3. Total Pulses

4.3.1. Growth of Output

The estimated curves do not fit well to the output data of national economy in case of pulses. The explained proportion of the total variation is as low as 0.17 per cent of the total. Output of pulses in the national economy

has grown nominally at a rate of 0.10 per cent per annum. The growth curves do not fit well to the output data of the regional economy as well. The explained proportion of variation of output of the pulses of regional economy is only 1.83 per cent. However, the regional economy has recorded negative growth of output at an annual compound rate of 0.15 per cent. Consequently, the index of regional output relative to the national average in the base year declined from 0.498 in 1972-73 to 0.45 in 1979-80 (Reported in Table 2.C.). The growth curves fit well to the output data of Manipur and Meghalaya alone. Where the explained proportion of variation ranges from 61 to 74 per cent. But the output of pulses in Manipur declines at a significant rate of 2.98 per cent whereas the output has increased at a significant rate of 3.91 per cent in Meghalaya. Besides, Manipur, output has also decreased in Assam at a rate of 0.74 per cent which is not significant. Output of pulses in all other states has increased though the rates of growth are not significant statistically. Thus, the negative growth of output in the regional economy is the consequence of its negative growth in Assam and Manipur. Their negative growth performance has completely swamped the positive growth of output in Meghalaya, Mizoram, Nagaland and Tripura. As a result of these features of growth performance of the

economy of the states, the indices of output of Assam and Manipur relative to that of the region have decreased from 93.93 and 5.09 in the base year to 83.16 and 3.85 per cent respectively in terminal year. But the values of these indices for Meghalaya, Nagaland, Mizoram and Tripura have increased from 1.96, 2.35, 0.09 and 1.76 in base year to respectively 3.85, 4.67, 0.61 and 3.85 per cent in the terminal year.

Interestingly, Mizoram has recorded the positive growth, while Manipur has shown negative growth. Thus, the growth of performance of the two states in field of pulses is in contradistinction to their performances in the field of foodgrains and cereals.

These growth performances may be examined in terms of the components.

4.3.2. Growth of Area and Yield

The growth curve does not fit well to the national data of area and yield. However, the curves fit well to the regional data relatively to both area and yield. The explained proportion of variation is 76 and 54 per cent respectively.

4.3.2.1. **Area**

The area under pulses in national economy has increased at a negligible rate of 0.24 per cent but the yield has declined at an annual compound rate of 0.13 per cent. Thus, roughly one half of the acreage growth has been neutralised by the negative growth of yield. Probably the remarkable gains in productivity of the cereals under the impact of Green Revolution technology and the attractive prices of the cereals on account of the price support policy pursued by the government and the temporal rises there in the cultivation of cereals has become much more attractive than that of the pulses. But the persistence of excess demand over the years has pushed relative prices of pulses also quite a bit. This might have pursuaded the farmers to bring additional area of low quality under pulses. The profitability seem to have been maintained as the probable lost in productivity appears to have been made good by the rapid increases in the relative prices of pulses.

The positive growth of area in the regional economy has been completely neutralized by the negative growth of yield. But the area under pulses in the regional economy has grown much more rapidly than its growth in the national economy. Consequently, the share of North-East India in the total area under pulses in the country has increased from

0.51 to 0.55 per cent during the period covered by the study. But the yield of the pulses in the region has declined more rapidly than the rate at which the yield has declined in the national economy. Consequently the regional yield relative to the national average has declined from 100.66 to 56.57 per cent during the period of eight years.

The growth curves fit well to the acreage data in case of Manipur, Mizoram and Tripura. The explained proportion of total variation ranges from 62 to 82 per cent of the total. But the curves do not fit well to the acreage data of other states. Area under pulses has declined significantly in Manipur at an annual rate of 2.27 per cent. But the positive growth of area in the rest of the states has ensured its positive growth in the regional economy as a whole. Consequently, Manipur's share in the regional acreage total has declined from 6.77 to 4.4 per cent during this period. The share of Assam has also declined from 93.5 to 85.4 per cent. Mizoram has recorded a fantastic growth of acreage under pulses. Its growth rate is as high as 17.697 per cent per annum which is significant statistically. The growth of acreage under pulses has not been neutralised by the negative growth of yield in case of Mizoram. Consequently, output of pulses has

increased in Mizoram also whose share in the regional total has increased from 0.09 in 1974 to 0.83 per cent in 1980.

4.3.2.3. Yield

The growth curves fit well to the yield data in case of Assam, Meghalaya and Mizoram. But the yield in two of these states namely Assam and Mizoram has declined at a significant rate, whereas it has increased significantly at an annual compound rate of 2.66 per cent in Meghalaya. The positive growth of area has been completely swamped by negative growth of yield in Assam. The gains in acreage in Mizoram has been neutralised only to the extent of 15 per cent. But in case of Meghalaya the contribution of productivity gains to the growth of output is roughly two third of the total, the remaining one third is being accounted by the growth of area. But the negative growth of both area and yield makes output of pulses grow negatively at a significant rate of 2.98 per cent in Manipur.

The growth yield in Nagaland contributes positively to the growth of output, the major-share of output growth is accounted by the growth of area under pulses. But in case of Tripura the productivity gains account for one fourth while the remaining three fourth of the total growth of

output is accounted by the growth of area. These results show that Meghalaya, Nagaland and Tripura have recorded substantial growth of yield of pulses during the period covered by the study.

Thus, the agricultural development in North-East has not remained confined to the cereal crops alone. Though the output has declined in the region as a whole. This is accounted by the negative growth performance of Manipur and Assam.

The pulses appear to have emerged as favourite a crop group in the region as is evident from the growth of area under them. Attractive prices seem to have pushed up the profitability of their cultivation, yield declines notwithstanding.

4.4. Five Major Oil seeds

4.4.1. Growth of Output

The growth curve fits poorly to the output data of both the national and the regional economies. However, the growth of output in the regional economy has been more rapid than that in the national economy. Consequently, the regional share in the national output of oilseeds has increased from 1.15 in the base year to 1.46 per cent in the

terminal year (Reported in Table No.2.D).

The fit of the growth curve is satisfactory only in case of Meghalaya, Nagaland and Tripura. The explained proportion of variation ranges from 55 to 84 per cent of the total. But the growth rate of Nagaland has been much greater than the national and regional rates. The output of oil seeds in Nagaland has increased at an annual compound rate of growth 10.29 per cent per annum. The rates for Meghalaya and Tripura are more than twice the regional growth rate. So, the share of Meghalaya in the regional output has increased nominally from 4 to 4.36 per cent of the total. Tripura has succeeded in raising its share in the total from 2.27 to 2.72 per cent whereas Nagaland has improved its share from 1 to 4.67 per cent. The output of oil seeds in Assam has also increased at an annual compound rate of growth 1.44 per cent which, however, is not significant statistically. Obviously the rate of growth of output in Assam is slightly lower than the regional rate. This has reduced Assam's share from 91 to 89 per cent of the regional output. Output of oil seeds both in Manipur and Mizoram has declined though the rate of decline is not significant statistically. The shares of these two states have declined from 1.5 and 1.52 per cent in the base year to 0.76 to 0.88 per cent of the regional total respectively in the terminal year. Thus, the growth

performance of Meghalaya, Nagaland and Tripura has tended to close the regional gap while Manipur and Mizoram have contributed negligible dilution of the domination of Assam in the agricultural economy of the region.

4.4.2. Growth of Area and Yield

The growth curves fit poorly both to the acreage and yield data of the national economy. But the acreage growth accounts only for about one-fifth of the total growth of output, while the remaining four fifths of it is accounted by the gains in yield. Growth curve fits well to the acreage data of the region though its fit to the yield data of the regional economy is poor.

Besides, there growth of yield is hardly visible. Therefore, the contribution of the gains in yield to the growth of output is negligible. Approximately 96 per cent of the growth of output in the region is accounted by the growth of area under the oil seeds crops. The regional share in the total area under oil seeds in the country has increased from 1.28 to 1.6 per cent. This is a manifestation of the increasing popularity of the crops in the region.

4.4.2.1. Area

The growth curve fits well to the acreage data of Assam and Meghalaya and regional economy alone and the explained proportion of variation ranges from 86 to 92 per cent of the total. The growth of area in both these states has been at significant rates of 1.64 and 2.33 per cent these are greater than the regional average of 1.56 per cent. Therefore, the shares of these states in the regional acreage have increased from 90.83 and 2.99 per cent to 92.89 and 3.3 per cent. Besides these two states, Tripura is the only other state where area under oil seeds has recorded a positive growth at a not significant rate of 0.86 per cent. As this rate is lower than the regional average, Tripura's share in the regional acreage has declined from 2.97 to 2.74 per cent. In the rest of the states, area under oil seeds has declined though the rates of decline are not significant. Naturally, the shares of Manipur, Mizoram and Nagaland in the regional total have fallen from 2.16, 0.91 and 1 per cent to 1.16, 0.63 and 0.66 per cent respectively. Thus Assam's dominance appears to have been accentuated by the negative growth performance of these three states.

4.4.2.2. Yield

The growth curve fit well to the yield data of Manipur, Nagaland and Tripura alone. The explained proportion of total variation ranges from 48 to 59 per cent, whereas the yield has declined at a significant annual compound rate of 1.47 per cent in case of Manipur. It has increased significantly at rates of 13.51 per cent and 2.01 per cent in Nagaland and Tripura respectively. These rates are much higher than the regional average. The index of yield relative to the regional average in Manipur has declined from 100.66 to 87.36 and the negative growth of both yield and area has made the output grow negatively in this state though the rate of decline in acreage has been much more rapid than the rate of decrease in the yield. As against this, the index of yield in Nagaland and Tripura has increased from 96.99 and 91.56 respectively to 607.75 and 113.58. Interestingly, the growth of yield has not only neutralised the negative growth of area in Nagaland, but it has made the output grow also at a significant rate. So the entire growth of output is accounted by the growth of yield. But the growth of yield in Tripura accounts for 70 per cent of the total growth of output whereas 30 per cent of its growth is caused by the growth of area. The yield has also grown positively in Meghalaya though the rate is not

significant statistically. The growth of area in Meghalaya, accounts for slightly less than four fifts of the total growth of output whereas, about 22 per cent of the overall growth of output is due to the growth of yield. The yield of oil seeds has however declined at not statistically significant rates both in Assam and Mizoram. Thus, the growth of area has not only been not neutralized by the negative growth of yield but it has also made output growth positive in Assam. Like Nagaland, the growth of output in Assam is, thus, accounted, wholly by the growth in area. But in Mizoram negative growth of both area and yield makes output also grow negative.

Thus, the oilseeds have also gained in popularity and a major proportion of output growth may be accounted by the growth of area.

Notes

Table No.1 is reported the trend growth rates of Production, Area and Yield of foodgrains, cereals, pulses and five major oil seeds; b denotes trend growth rate and P, A, Y, stands for Production, Area and Yield respectively. Table No.2.A, 2.B, 2.C and 2.D, are reported the proportionate share of production, area and yield of foodgrains, cereals, pulses and five major oil seeds over the years.

Chapter-V

Annual growth rates and relative contributions of the growth of area and yield to the growth of Output

We will discuss the annual growth rates in this chapter. The data have first been freed from cyclical and seasonal fluctuations by means of three years moving averages:

$\bar{x}_1 = 1/3\ (x_0 + x_1 + x_3)$, $\bar{x}_2\ 1/3\ (x_1 + x_2 + x_3)$,

$\bar{x}_3 = 1/3\ (x_2 + x_3 + x_4)$, ..., where subscripts denote the year to which a particular x variate refers. Then, these averages have been used for deriving the annual growth rates:

$$\vartheta_t = \left(\frac{\bar{x}_{t+1}}{\bar{x}_t} - 1 \right)$$

where ϑt is the annual rate of growth of x during year t. Estimated growth rates have been derived from the formula outlined in the methodology. The chief objective of this chapter is to test the efficiency and the validity of the decomposition algorithm. Another objective is to examine the relative contributions of the growth of area and yield to the growth of output and their temporal variations.

5.1. Decomposition Algorithm-Validity

Both estimated and actual rates of growth of output for the four major crop groups alongwith their x^2 values

for the differences between the estimated and actual rates are reported in table No. 3.A, 3.B, 3.C, 3.D.

A perusal of the table reveals that the decomposition algorithm fits extremely well to the data as the calculated values of χ^2 are much less than the table values of 12.592 at 5% probability level in all but two cases: Hence, the differences between the estimated and the actual growth rates are not significant statistically. The only exceptions are the rate of growth of output of pulses in Meghalaya and rate of growth of output of five major oil seeds in Nagaland, where the values of χ^2 are as high as 13.464 and 262.72033 which are greater than the table value for the given degrees of freedom.

5.2. Contributions of Yield and Area

The relative shares or contributions of growth of area and yield to the overall growth of output may be derived from the modified form of the equation (8).

$$R(O) = R(A) + R(Y)$$

$$\text{or} \quad 1 \times 100 = \frac{R(A)}{R(O)} \times 100 + \frac{R(Y)}{R(O)} \times 100$$

The results of these calculations are reported in table No.4.A, 4.B, 4.C, and 4.D.

5.2.1. Growth of Output of Foodgrains

5.2.2. National Economy

A careful analysis of this table will reveal both the basic features and the sources of growth of output in the country/region. Three out of seven years show negative growth of output in India. Interestingly, both the yield and area have changed negatively in these years. However, the decrease in yield and area have changed negatively in these years. However, the decrease in yield contributes as much as 7.79, 65 and 81 per cent of the total decline of the rate of growth of output during these years. The residual 92, 35 and 19 per cent of the over-all decline is accounted by the negative growth of area under foodgrains. Thus, the contribution of decreasing yield to the negative rate of growth of output tends to increase through time. As is well known, these years of 1974, 1976 and 1979 have been the years of drought in the country. It is natural that the adverse weather conditions have affected yield much more seriously than the area under the foodgrain crops.

As against this, the years during which the positive growth of output has been recorded the contributions of the growth of area and yield have varied. The contribution of the growth of yield has been approximately

22 per cent of the overall growth in 1972-73 which has progressively increased to 79 per cent in 1976-77. Thereafter, it has declined to 72 per cent in the subsequent years. The both sets of these results suggest that the growth of yield has tended to become the major source of growth of output as the green revolution has tended to mature in the country over the years. The annual rates of growth of output have ranged from 4 to 21 per cent compared to the overall growth performance of the economy as measured by the growth of GNP which is around 3 - 3.5 per cent per annum. Thus, the growth performance of the foodgrains subsector of Indian agriculture is quite heartening.

5.2.3. Regional Economy

The annual rates of growth of output of foodgrains in North-East India, both negative and positive, have been consistently lower than the corresponding national rates of growth. The output of foodgrains in the regional economy has declined in four as against three years in the national economy. But the three years of decline coincide with the three years of national decline. It implies that the adverse growth performance in the regional and national economies has occurred simultaneously. Similarly the years of good performance in the two economies also coincide.

It implies that the adverse or favourable weather conditions have tended to spread widely over the country rather than having been locally or regionally confined. In the later case, the disaster management is relatively easy and less complicated.

In all the four years of negative growth performance of the regional economy, the contribution of both area and yield to output has been negative. The negative contribution of yield has been consistently higher than the negative contribution of the area. But the relative negative share of yield has tended to decline through time. In two out of the three years of positive growth of output, the contribution of areal growth has also been negative. In these years, the growth of yield has completely swamped the impact of decline of area under foodgrains upon their output though the rate of growth of output has been pulled down by the negative areal growth. Only in one year the growth of both yield and area have contributed positively to the growth of output and their relative shares have also been, more or less equal But on the whole, the growth process has been dominated by the changes in the productivity of land in the North-Eastern Region. Or the rate of growth of yield has tended to increase in magnitude through time, notwithstanding its negative or positive direction of change. Obviously, like

the Indian economy, the growth of output of foodgrain in North-East India has hinged mainly upon the growth of yield.

5.2.4. Arunachal Pradesh

Within North-East, the performance of constituent state economies has been quite varied. The growth of output in Arunachal Pradesh has been negative in two of the seven years. Two of the five years of postive growth are the years when both the regional and national economies have recorded negative growth. Thus, in these two years the state economy has performed contrary to the regional and national trends. The positive growth, however, does not show systematic trend in so far as the acceleration and decelaration of the rates have tended to alternate consistently. The positive growth rate has ranged from 4.5 to 25.4 per cent. Three of these five years are actually the years of high performance. The contributions of acreage growth and yield growth have also tended to vary. In same years, acreage growth has dominated the growth of output whereas the yield growth has dominated it in the rest of the years. In 1972-73, the acreage growth has been swamped by the negative growth of yield, whereas positive growth of area has swamped the negative growth of yield in 1974-75. But in 1978-79 even 20 per cent growth of yield has been completely swamped by negative growth of

area. But on the whole, it seems that the contribution of growth of area has tended to fall through time. In fact, its contribution of 26.31 per cent in 1973 has come down to 0.19 per cent in 1978 whereas the contribution of yield to the growth of output has tended to rise from 10 per cent to 82 per cent during the same period. Besides the contribution of the growth of yield in Arunachal Pradesh is higher than its contribution in the regional economy. It is heartening to note that a relatively remote and inaccessible state like Arunachal Pradesh, has joined the national quest of agricultural development in right earnest.

5.2.5. Assam

The growth performance of Assam seems to have pulled down the regional average. Its performance also seems to be contrary to both the regional and national trends. It has recorded negative growth of output in five out of seven years. In three of these five years, both the yield and acreage have grown negatively. In other two years, the negative growth of yield has swamped the positive acreage growth. But in 1977, negative growth of area has diluted the impact of positive growth of yield upon the growth of output. On the whole, the negative growth of yield appears

to have dominated the negative growth of output. The contribution of yield to negative growth of output ranges from 67 to 100 per cent except in 1978 when it's contribution is only 8 per cent. However, there is no definite trend as positive growth of output is accounted largely by the growth of area in 1975 and solely by the growth of yield in 1977.

5.2.6. Manipur

The economy of Manipur also records negative growth of output in three years. The positive growth of output in 1975 is nominal while in other years are the years of high performance. Negative growth of output has been caused by the negative growth of both area and yield. In two years of negative growth of output, as much as 72 to 86 per cent of overall growth is accounted by the negative growth of yield. But in 1978, its contribution is only 21 per cent of the overall negative growth of output. The growth of yield in 1975 has swamped the negative growth of area though negative acreage growth has reduced the rate of growth of output to half of the growth of yield. In all other years, the output has benefitted from the growth of both acreage and yield. During the years of positive growth of output, the contribution of yield to the growth

of output has ranged from 54 to more than 100 per cent. Thus, the growth of output has consistently been dominated by the growth of yield and its share has tended to rise over the years. Like Arunachal Pradesh, Manipur also seems to have benefited from trickle down effects of the green revolution.

5.2.7. Meghalaya

Meghalaya records negative growth of output in two years. In the last year both area and yield have grown negatively and 70 per cent of the overall negative growth is accounted by the negative growth of area. But in 1974, the negative growth of output is accounted solely by the negative growth of yield which has swamped by positive acreage growth completely. In 1973, the positive acreage growth has, however, been swamped by negative growth of yield. In the rest of the years, both the positive growth of yield and area have contributed positively to the growth of output. The positive growth of yield has contributed as much as 67 to 85 per cent of the overall growth of output. Thus, the green revolution appears to have reached the portals of Meghalayan economy also. The contribution of growth of yield to the growth of output has been increasing through time.

5.2.8. Mizoram

1976 is the only year of positive growth in Mizoram economy. It is, however, the positive acreage growth which has not only neutralised the negative growth of yield but it has also made output grow positive at a high rate of 40.8 per cent. In the rest of the years, the output has grown negatively. In two of these years, both area and yield have grown negatively. In four out of seven years, the growth performance has been dominated by the growth of yield, while the growth of area has dominated it in other years. Thus, negative growth of Assam and Mizoram together accounts for the relatively low growth performance of the regional economy.

5.2.9. Nagaland

Nagaland shows negative growth of output only in 1977 when the negative acreage growth has swamped the positive growth of yield. In 1973, the positive growth of area has swamped the nominal decline in the yield, whereas in 1977 the negative growth of area has been swamped by the positive growth of yield. In the rest of the years, both area and yield have contributed positively to the growth of output. But the contribution of growth of yield has

consistently been larger than the corresponding contribution of the growth of area. The growth of yield accounts for 56 to more than 100 per cent of the total growth of output during these years.

5.3.0. Tripura

Output has grown negatively in Tripura in three years. In 1979 the negative contribution of both area and yield makes output grow negative, though 70 per cent of it is accounted by the negative contribution of acreage growth. As against this, the negative growth of output in 1974 and 1976 is due to the negative growth of yield which has also swamped the postive acreage growth. But in 1977 and 1978, the yield growth has swamped the negative acreage growth. On the whole, the growth of yield has dominated the growth process. Its contribution to growth of output ranges from 88 per cent to more than 100 per cent of the overall positive rate of growth of output. Thus, except Assam and Mizoram, all the states of the region have recorded impressive gains in the yield of foodgrains. Mizoram and Assam together have pulled down the region below the national average. Thus these results furnish empirical evidence to support the view that the green revolution process has perculated to the North-Eastern Region.

5.3.1. Total Cereals

Foodgrain is a composite crop group which consists of cereals and pulses. It is important to see the growth performance of these crops as a composite whole as well as its individual components. It is because of the fact that the major break-through in yield has been achieved mainly in the case of wheat and paddy. In case of other crop groups either high yielding variety seeds have not been evolved so far or evolved varieties have not been as susccessful as those of wheat and paddy. These coupled with the changes in the relative prices that have occurred under the combined impact of market forces and the agricultural price policies pursued by the government have made the cultivation of the cereals relatively attractive. Grouping of the cereals with the pulses under foodgrains may, therefore, conceal the extent of success achieved in case of cereals. Therefore, we have analysed the growth performance of cereals and pulses separately.

5.3.2. India

The output of cereals has changed negatively in four of the seven years. In three of these years, namely, 1974, 1976, 1979, negative contributions of both yield and

area have made output grow negatively. Whereas the negative contribution of yield to negative growth of output in 1974 is only 23 per cent of the total, it rises to 71 and 84 per cent in 1976 and 1979, respectively. But in 1973, the negative growth of area has not only neutralised the positive growth of yield but it has also made the output decline at as high a rate as 46 per cent. Thus the contribution of area to negative growth of output is more than 100 per cent in 1973 and 76 per cent in 1974. Thus, the negative growth of output has been dominated by the negative contributions of areal growth. But in the subsequent years the contributions of changes in yield have tended to acquire greater weight. In 1978, the output has grown at a rate of 4.62 per cent while the output grown has occurred at as high a rate as 14.7 per cent in 1977 and 20.25 per cent in 1975. The contribution of the growth of yield has been many times more than that of areal growth. In fact, 71 to 80 per cent of the rate of growth of output is explained by the rate of growth of yield. Thus on the whole the growth process seems to have been dominated by changes in yield which has tended to acquire greater weight through time.

5.3.3. North-East India

In two of the four years namely 1974 and 1976 of negative growth of output, the positive areal growth has been subsumed by the negative growth of yield, whereas in the other two years namely 1978 and 1979 the negative growth of both area and yield have made output grow negatively, though in these years also the contribution of yield is much greater than that of area. Thus in all these four years the dominant proportion of the negative growth of output is accounted by the negative growth of yield. As against this, the positive growth of yield has completely swamped the negative growth of area in 1973 and 1977. But in 1975, the contributions of yield and areal to positive growth of output are almost equal. Thus, in six out of seven years both the magnitude and the direction of the growth of output are determined decisively by the magnitude and the direction of the growth of yield in the regional economy of North-East India.

5.3.4. Arunachal Pradesh

The output of cereals has changed negatively only in 1979 in Arunachal Pradesh, which is due to negative growth of area, though the two third of the negative areal

growth has been neutralised by the positive growth of yield. It is only in 1978 that the growth of output is dominated by the growth of yield which accounts for 82 per cent of overall growth. In 1977, the contribution of yield to overall growth is only 49 per cent. But in all other years the growth of area has dominated the growth process, which accounts for 85 per cent to more than 100 per cent of overall growth of output. Thus, the process of green revolution on this evidence of the growth of yield appears to have gathered momentum in Arunachal Pradesh since 1976-77.

5.3.5. Assam

As against this, the output in Assam has grown positively only in 1975 and 1977. In 1975 only 37 per cent of the growth of output is accounted by the growth of yield, whereas the yield accounts for the entire overall growth of output, as it has also neutralised the negative growth of area in 1977. In 1973, 1978, 1979 both area and yield have grown negatively though the contribution of yield to the negative growth of output is much more than that of area. In 1974 and 1976 the negative growth of yield not only neutralises positive areal growth but it also makes output grow negatively.

Thus, in Assam both the magnitude and direction of the growth performance have been determined by the changes in yield which has been falling almost consistantly. It needs an indepth study to find the causes of the negative growth of yield. The plausible reason may be that the continuous rises in the relative prices of cereals must have raised the profitability of the cultivation of these crops which might have induced farmers to switch area from other cereal crops even though the agro-climatic conditions might have not suited the crops like wheat and/ or the additional acreage might have been of extremely poor quality which may account for consistent falls in the yield. But the decreases in yields must have been more than compensated by relative price differentials.

5.3.6. Manipur

Like the national economy the Manipur economy has also recorded negative growth in 1976, 1978 and 1979 and this is the consequence of the negative growth of both yield and area. In two of these three namely 1976 and 1979 the decline in yield contributes 71 to 86 per cent of the total fall in output, whereas in 1978 its contribution is only 21 per cent. In 1975 the positive growth of yield not only neutralised negative growth of area but it makes

output grow positively. In 1974, the contributions of the growth of both yield and area are almost equal, 48.91 and 48.4 per cent respectively, while in 1973 and 1977 the growth of yield contributes from 70 to 78 per cent of the total growth of output. Thus, on the whole, both the magnitudes and the directions of the growth process are dominated by the growth of yield in Manipur.

5.3.7. Meghalaya

Output of cereals in Meghalaya has changed negatively only in 1974 and 1979. In the last year, the negative growth of output is accounted by the negative growth of both yield and area, but the fall in yield accounts for only 25 per cent decline in output. As against this in 1974, the negative growth of yield has not only neutralised the positive growth of area but it has also made output grow negatively. In the years of positive growth performance it is the areal growth in 1973 which has not only neutralised the negative growth of yield but it has also made output grow positively. In the remaining years from 1975 to 1978 the positive growth performance is due to the positive growth of both yield and area. But the contributions of yield to the growth of output rangesfrom 55 to 86 per cent. However, the changes in the relative shares of yield in output growth

does not show any definite trend as it tends to increase from 77 to 86 per cent then, it falls in the next year and increases again in the subsequent year. But like Arunachal Pradesh and Manipur, Meghalaya, also seems to have joined the national race for agricultural growth.

5.3.8. Mizoram

The growth performance of Mizoram is negative in all but one year. In 1974 and 1978 both area and yield contribute negatively to the negative growth performance, while in 1973 and 1979 the negative changes in yield have swamped the positive areal growth completely. But in 1975 and 1977 the negative growth of area has made output grow negatively. The only year in which output has grown positively is 1976, when areal growth at nearly a rate of 82 per cent has completely swamped the negative growth of yield. Though it is difficult to derive any regular temporal pattern yet it seems that the drastic decreases in the yield have been mainly responsible for the negative growth performance of the state. It is interesting to note that the output has grown positively in 1976 when the regional and the national economies have performed negatively.

5.3.9. Nagaland

Nagaland shows negative growth in 1977 which is entirely due to the negative growth of area. The area has decreased at a rate which is more than twice the rate of increase of yield. As against this, in 1973 the growth of output is accounted entirely by the areal growth which has swamped the negative growth of yield. But in 1974 it is just the reverse. The entire growth of output is accounted solely by the growth of yield while area does not contribute at all. In all other years the growth of yield has dominated the growth process by and large. The contribution of yield to growth ranges from 32 to 94 per cent of the total.

5.4.0. Tripura

The negative growth of output in 1974 and 1976 is accounted entirely by the negative growth of yield; whereas in the last year the negative changes both in area and yield make output grow negatively in Tripura. In the rest of the years, output has grown positively and the growth process has been dominated by the growth of yield whose contributions range from 89 to 100 per cent of the total.

These results lend strong empirical evidence to support the view that Tripura, Nagaland and Arunachal Pradesh have been encompassed and engulfed by the green revolution wave originating from the North-West India. Manipur and Meghalaya have not been left untouched. Another interesting point to be noted is that the regional economy and its constituent units, except Mizoram and Assam, have been adversely affected in the same years by droughts and floods simultaneously with the other sub-component of the national economy. But Assam and Mizoram have shown the growth performances which are contrary to the national as well as the regional trends.

5.4.1. Total Pulses

5.4.2. India

The output of pulses has changed negatively in 1976 and 1979 and the decreases both in area and yield account for it, though the relative contribution of yield is larger than that of area. In all the years except one of positive growth performance, the growth of output has been dominated by the growth of yield, its contribution ranges from 57 to 79 per cent of the total growth. These results are at variance with the popular belief that the breakthrough in yield is confined to the cereal crops alone.

However, the rates of growth of yield are relatively moderate.

5.4.3. North-Eastern Region

The North-Eastern Region records negative growth in 1974, 1975 and 1979. In 1975 and 1979 both area and yield contribute negatively to the negative growth of output. But in 1974 positive growth of area is completely swamped by the negative growth of yield. However, the acreage growth emerges as the major source of the growth of output. Its contribution ranges from 62 to almost 100 per cent. The farmers of the region may have been induced to switch area from other crops to pulses by the relatively attractive prices. Under the impact of relative shortages, the prices of pulses might have grown more rapidly than the prices of cereals during the post-green revolution period. This must have enabled the national and the regional economy to bridge some of the gap arising from the slower growth of yield of pulses in the country through changes to the acreage under this crop group. Output has grown positively only in 1976, 1977 and 1978 and in two of these years, the growth process has been dominated by the growth of yield whose contribution to the growth of output ranges from 36 to 70 percent. During the years of negative growth

performances also, it is the negative growth of yield which has swamped the acreage growth. Thus, the regional growth process in case of pulses has been dominated by the changes in the yield.

5.4.4. Assam

The output of pulses in Assam has increased only in 1976, 1972 and 1978, and the contributions of yield range from 11 to 70 per cent of the total growth of output. But in 1977 the output growth is accounted solely by the areal growth. The negative growth performance has also been dominated by the declines in yield.

5.4.5. Manipur

The output of pulses in Manipur has grown positively only in 1974 and 1977 and the contributions of the yield ranges from 55 to more than 100 per cent. Greater proportions of the negative growth of output are, however, accounted by the negative growth of area.

5.4.6. Meghalaya

Meghalaya shows the positive growth of output in four years. In two of these years the changes in yield

account for the entire growth of output, whereas in one of these years, its contribution is as high as 70 per cent. But in 1979 yield contributes negatively to the growth of output. In 1976 entire negative growth is accounted by the negative contribution of yield, whereas the contribution of yield to the total decline in output in 1973 is only 40 per cent of the total.

5.4.7. Mizoram

In Mizoram, the output has increased in 1975 and 1978 and it has decreased in one year. But in 1975 and 1976 changes in output are accounted solely by the change in yield. But the growth of yield accounts only for 10 per cent of overall growth of output in 1978.

5.4.8. Nagaland

Nagaland shows positive growth in three out of four years and the acreage growth contributes the major proportion of total growth of output. Its contribution ranges from 45 to 89 per cent. But the decline in 1977 is entirely due to a fall in the yield. It may be noted that the pulses appear to have gained popularity among the farmers of Meghalaya, Mizoram and Nagaland only in recent years. But the cultivation does not seem to be an annual affair regularly as these crops have not

been cultivated in quite a few years of the period covered by the study. This is especially so in case of Nagaland and Mizoram

5.4.9. Tripura

Tripura shows positive growth of output in first four years of the study.

In 1974 and 1976 productivity growth contributes from 53 to more than 100 per cent of the total growth of output. In the other two years, the growth of output is dominated by the areal growth whose contribution ranges from 67 to more than 100 per cent. The negative growth process has also been dominated by the declines in the yield in two of these three years.

Thus, it is not correct to suppose that the productivities of the pulses have remained stagnant during the post-green revolution period. The North-Eastern Region and its constituent units except Assam have also recorded productivity gains to some extent in the cultivation of pulses also.

5.5.0. Five Major Oil Seeds

Like pulses, oilseeds are also supposed to have suffered in terms of popularity and profitability in the post-green revolution period; due to non-evolution of high yielding variety seeds comparable to the high yielding variety seeds of cereals. But the consequent shortages have brought their importance to the fore and the movements of the relative prices appear to have restored the parity in their terms of trade. These aspects may, however, be looked into greater details only if a detailed study is taken up.

5.5.1. India

The Indian economy shows positive growth in four out of the seven years. Interestingly, in three of these four years, the growth of output has been based only on the growth of yield which accounts for 73 to 100 per cent of the total growth of output. But its contribution in 1978 is only 13 per cent of the total. Even in the years of negative growth of output, the major share is accounted by the declines in the yield.

5.5.2. North-Eastern Economy

The regional economy has also recorded positive growth of output in four out of seven years; and in three of these years, the growth has been dominated by the growth of yield. It accounts for 58 to 79 per cent of the total growth whereas in the last year, its share is only 3 per cent of the total growth of output. In the years of negative growth performance, major share is only accounted mainly by the negative changes in the yields of the oil seeds.

5.5.3. Assam

Assam's growth peformance in the field of oil seeds is similar to that of the regional economy. In three of the four years of positive growth, the major proportion is accounted by the growth of yield which ranges from 48 to 85 per cent of the total, whereas in the last year, its share declines to only 35 per cent. The negative growth of output is also accounted mainly by the falls in productivity of land. However, Assam's growth performance in this field is not inferior to that of the regional economy.

5.5.4. Manipur

Manipur shows positive growth only in two out of five years in which oil seeds have been cultivated, and in both the years, the contribution of yield is relatively small which ranges from 4.6 to 25 per cent of the total growth. The negative growth is also dominated by the declines in acreages. Thus, Manipur's performance is at variance with the national and regional economies. Changes in acreages under oil seeds might have been caused by the movements of the relative prices and/or inpropriateness of the available technology to agro-climatic conditions of the state or both.

5.5.5. Meghalaya

Meghalaya shows negative growth in one out of six years in which oil seeds have been grown. One of these five years is the year of zero growth, acreage growth has been neutralised by the decline in productivity. In the remaining two years, however, the declines in yield have been swamped by the areal growth. It is only in 1976 that the growth of output is accounted entirely by the growth of yield. Thus, like Assam, the output growth of oil seeds in Meghalaya has also been based on the growth of area under them.

Attractiveness of the relative prices might have persuaded the farmers to take up the cultivation of oil seeds.

5.5.6. Mizoram

In Mizoram, the cultivation of the oil seeds has been given up in the later half of the period covered by the study. In the first half of the period, the last year is the year of zero growth which has been preceeded by a year of high growth which is accounted entirely by the growth of yield. In the years of negative growth, the declines in yield have contributed the major proportion of the growth of output. This may be due to inappropriateness of or unsuitability of agro-climatic conditions.

5.5.7. Nagaland

In 1975 and 1976 of the four years (1974, 1975, 1976, 1979) in which the crop have been grown are zero growth years in both the years negative growth of yield has neutralised the areal growth. Out of three years of the positive growth, the yield has swamped the negative growth of area in 1978 whereas in 1977 area contributes 82 per cent to the growth of output. In 1972-73 both yield and area contributes almost equally to the growth of output.

These results do not mark any definite pattern. It seems that the state is still in experimental stage.

5.5.8. Tripura

Tripura has, however, recorded positive growth in five out of seven years. The growth rate is zero in 1976 when productivity growth has been neutralised by the decreases in area. In three of these four years, the growth rate has been dominated by the growth of area whose contribution ranges from 61 to more than 100 per cent. Only in 1974 and 1977 growth of output is affected mainly by the growth of yield, when its contributions range from 72 to more than 100 per cent. Tripura seems to have recorded the best growth performance in the region.

5.5.9. Conclusion

These results show that the green revolution process has perculated to all the states of North-East India except Mizoram and Assam. The major thrust to the growth of output is provided by the growth of yield of foodgrain cereals and pulses. But the growth of output of oil seeds has been based mainly on the growth of area. The relative profitability of these crops might have persuaded the

farmers of the region except Arunachal Pradesh, namely Assam, Tripura, Manipur, Meghalaya, Mizoram and Nagaland to adopt the cultivation of oil seeds, but either the inappropriateness of the technology to these states or the unsuitability of agro-climatic conditions appear to have hampered the expansion of cultivation of these crops.

The years of negative growth are easily identifiable with the adversed weather conditions in the national as well as the regional economy which have naturally made productivity decline sharply. An interesting trend that appears in the regional economy is the movement of the green revolution process towards maturity in so far as the growth of output has been sustained more by the productivity growth than by increases in area and the contribution of yield has tended to rise through time. But the validation of this inference requires the study of a much longer period than that covered by the study. Once the data for eighty's become available, testing of this hypothesis may become feasible.

Notes

Table No.3.A, 3.B, 3.C and 3.D are reported the actual and estimated growth rates and their χ^2 values of foodgrains, cereals, pulses and five major oil seeds respectively.

Table No.4.A, 4.B, 4.C, and 4.D are reported the relative shares or contributions of area and yield to the overall growth of output of above four major crop groups, respectively.

Table No.5.A, 5.B, 5.C, 5.D, report the annual growth rates of production, area and yield of foodgrains, cereals, pulses and five major oil seeds.

Shri Prakash has found that the price flexibility has succeeded in maintaining the parity between the prices of foodgrains and non-foodgrain crops in the Indian economy which has obviated the need of adjustments in the allocation of area between these two broad crop groups over as long a period as three decades. The area allocated to two crop groups has all along remained in the ratio of 4:1. See Prakash, S. "Econometric Modelling of Price Formation Processes In Indian Economy : A Study of Flex-Fix Price Dichotomy in Input-Output Framework, Eight International Conference on Input-Output Techniques, August, 1986. Japan.

Chapter-VI

Resume and Conclusions

The present study has been taken up to test the following hypotheses about the agricultural development experience of north-eastern economy.

1. The green revolution process has been diffused widely through space and the north-eastern economy has also been benefitted from this process of diffusion.

2. The inter-regional inequalities of agricultural development have declined temporarily.

3. Inter-regional inequalities have also fallen in the process of the diffusion and percolation of the developmental process from more to less developed areas.

All the above three hypotheses have been tested by means of the evaluation of the growth of yield and area and their respective shares in the overall growth of output.

The major findings of the study are as follows:

1. The gap between the growth of output of foodgrains in the regional economy of North-East India and the national economy has tended to increase. The growth of output of foodgrains in the regional economy has been sustained by the growth of output in Arunachal Pradesh,

Manipur, Meghalaya, Nagaland and Tripura. But the negative growth of output in Assam and Mizram has pulled the regional average below the national average. The dominance of Assam in the region has been deluted by the differential growth performances.

2. Whereas the growth of yield has sustained the growth of national output, the growth of regional output has been sustained mainly by the acreage growth, despite the fact that rates of growth of yield in Arunachal Pradesh, Manipur, Nagaland and Tripura have been greater than the rate of growth of yield in the national economy. The sluggish performance of the regional yield is, however, the consequence of its negative growth of yield in Mizoram and Assam. This has pushed the regional growth below the national average.

3. Within the region, all the states, except Mizoram and Assam, have recorded satisfactory growth of output though there are considerable inter-regional inequalities in their growth performances. The growth of output may, however, be attributed largely to the growth of the productivity of land.

4. Intra-regional inequalities of production of foodgrains have tended to be mitigated in so far as the dominance of the Assamese economy in the region has been diluted.

A heartening feature revealed by these results is that the green revolution process seems to have seeped from the national to the regional economy and within the region even to remote and difficult areas like Arunachal Pradesh, Nagaland, Manipur and Tripura. The growth performance of these states is much better than that of the national economy despite the negative growth of area under these crops in Manipur, Nagaland and Tripura.

The North-Eastern region, taken as a whole, has lagged behind the national economy in the growth of output and yield in case of cereals. But the negative growth pefformances of Assam and Mizoram have pulled down the regional peformance level. This has enhanced the clevage between the regional and the national economies.

However, the differential growth performances of the states have reduced the intra-regional inequalities and the dominance of Assam and Tripura has been reduced to some extent.

The growth of yield has played the significant role in the growth process of all the states of North-Eastern region except Assam and Mizoram.

The movements of relative prices in favour of cereals might have facilitated the change in the cropping patterns in favour of the cereals.

The pulses appear to have emerged as a favourite crop group in the region as is evident from the growth of area under them. Attractive prices seem to have pushed up the profitability of their cultivation, yield declines notwithstanding. The negative growth of output of pulses, in the regional economy, is accounted by the negative growth of yield of Assam, Manipur and Mizoram. But in case of pulses, Mizoram's growth performance is not bad. The growth of output of Mizoram is accounted solely by the growth of area.

The oilseeds have also gained in populatity and a major proportion of output growth may be accounted by the growth of area. The relative profitability of these crops might have persuaded the farmers of the region, except Arunachal Pradesh, to adopt the cultivation of oilseeds, but either the impropriateness of the technology to these states or the unsuitability of agro-climatic conditions

appear to have hampered the expansion of cultivation of these crops.

These results show that the green revolution process has perculated to all the states of North-East India except Assam and Mizoram. The negative growth of output in Mizoram is accompanied by the negative growth of both area and yield. But the negative growth of Assam is accounted solely by the negative growth of yield. To understand these results all that one can say is that the Assam's area is less fertile than that of other states, or the area is agro-climatically less suitable for these crops or modern technology has not moved to Assam. But in our view, more plausible interpretation will be that the attractiveness of the relative prices of these crop groups might have persuaded the farmers to bring additional area under these crops though either the agro-climatic conditions may not suit their cultivation or the transferred acreage may be less fertile. But the falling yield is more than compensated by rising relatively prices./

Statistical Tables

Table 1 : Trend Rate for Production, Area and Yield for Different Crop Groups (in percentage)

	Trend Growth Rate Total Foodgrains			Trend Growth Rate Total Cereals			Trend Growth Rate Total Pulses			Trend Growth Rate Five Major Oil Seeds		
	b			b			b			b		
	P	A	Y	P	A	Y	P	A	Y	P	A	Y
India	1.34	0.25	1.08	3.20	2.28	1.19*	0.10	0.24	-0.13	0.69	0.14	0.56
N.E. India	0.22	0.38	-0.16	0.21	0.36	-0.15	-0.15	0.80*	-0.96*	1.63	1.56*	0.07
Andhra Pradesh	5.499*	3.42*	2.07*	5.35*	3.43*	1.92*	-	-	-	-	-	-
Assam	-0.3	0.43	-0.73	-0.29	0.43	-0.73	-0.74	0.45	-1.19	1.44	1.64*	-.196
Manipur	1.27	-0.04	1.31	1.26	-0.36	1.38	-2.98*	-2.27*	-0.68	-2.399	-2.13	-1.48
Meghalaya	1.42*	0.51*	0.91*	3.40*	0.50*	.90*	3.91*	1.15	2.66	3.00*	2.33*	0.67
Mizoram	-6.41*	-0.18	-6.23*	-6.49*	-0.28	-6.22*	8.33	17.697	-9.37	-4.68	-1.98	-2.55
Nagaland	3.48*	-0.52*	4.00*	3.45*	-0.75	4.2*	3.24	3.04	0.197	10.29	-3.22	13.51
Tripura	2.04	-0.20	2.24	2.04	-0.25	2.27	5.34	3.67	1.21	2.88	0.86	2.01

N.B.: P, A, Y stands for Production, Area and Yield, respectively.

Table 2.A : Proportionate Share of Proudction (P), Area (A) and Yield (Y) of Foodgrains

States		1972-73	1973-74	1974-75	1975-76	1976-77	1977-78	1978-79	1979-80
N.E. India	P	0.03055	0.02966	0.03058	0.02847	0.02959	0.02812	0.02536	0.02669
	A	0.02530	0.02438	0.02567	0.02722	0.02743	0.02652	0.02578	0.02585
	Y	1.2165	1.21645	1.19175	1.10487	1.07829	1.06605	0.98434	1.05809
Arunachal Pradesh	P	0.01702	0.01672	0.02588	0.02659	0.02909	0.03376	0.03761	0.03614
	A	0.01919	0.02019	0.02751	0.03094	0.03116	0.03501	0.03592	0.02977
	Y	0.88675	0.82803	0.94297	0.85906	0.93361	0.96384	1.04672	1.36060
Assam	P	0.78428	0.69948	0.69279	0.69979	0.68564	0.68982	0.68812	0.69051
	A	0.74449	0.72504	0.72125	0.73260	0.72407	0.72637	0.73488	0.74567
	Y	1.05359	0.96521	0.96029	0.95494	0.94709	0.94957	0.93638	0.92573
Manipur	P	0.05708	0.08650	0.09844	0.08797	0.08706	0.09036	0.08164	0.08269
	A	0.05857	0.06051	0.06309	0.05882	0.05652	0.05843	0.05219	0.05476
	Y	1.09606	1,42942	1.56008	1.49569	1.54149	1.54615	1.56362	1.54467
Meghalaya	P	0.03934	0.04024	0.04072	0.03927	0.04332	0.04178	0.04502	0.04937
	A	0.03736	0.03932	0.03960	0.03796	0.03703	0.03803	0.03881	0.03991
	Y	1.05359	1.02386	1.02851	1.03452	1.17013	1.09895	1.15905	1.23681
Mizoram	P	0.02396	0.02052	0.01474	0.01303	0.01921	0.01483	0.00834	0.00689
	A	0.02461	0.02512	0.01949	0.01626	0.02853	0.02342	0.01933	0.02167
	Y	0.97371	0.81709	0.75662	0.80153	0.67427	0.63273	0.43141	0.31755
Nagaland	P	0.01758	0.01829	0.01982	0.02572	0.02842	0.02399	0.02631	0.03032
	A	0.02995	0.03183	0.3178	0.03051	0.03026	0.02670	0.02676	0.02849
	Y	0.58746	0.57455	0.62322	0.84276	0.93983	0.89914	0.89264	1.06459
Tripura	P	0.06074	0.11724	0.10761	0.10829	0.10725	0.10547	0.11303	0.10408
	A	0.09230	0.09798	0.09735	0.09291	0.09243	0.09203	0.09211	0.08418
	Y	0.65824	1.19682	1.10591	1.16587	1.16079	1.14653	1.22664	1.23681

Table 2.B : Proportionate Share of Production (P), Area (A) and Yield (Y) of total Cereals

States		1972-73	1973-74	1974-75	1975-76	1976-77	1977-78	1978-79	1979-80
N.E. India	P	0.01709	0.03225	0.03347	0.031506	0.03134	0.03064	0.02752	0.02839
	A	0.015042	0.02885	0.03025	0.03082	0.032157	0.03134	0.03043	0.02940
	Y	1.13657	1.11764	1.10584	1.02209	0.97462	0.97818	0.90493	0.96643
Arunachal Pradesh	P	0.01731	0.01802	0.02628	0.02692	0.03059	0.03422	0.03818	0.036766
	A	0.01985	0.020946	0.02847	0.03197	0.03261	0.03632	0.037286	0.02763
	Y	0.87090	0.860624	0.92323	0.84211	0.9375	0.94145	1.02432	1.33053
Assam	P	0.78165	0.69657	0.69041	0.69813	0.70592	0.68844	0.68577	0.68807
	A	0.73778	0.72014	0.71593	0.72874	0.72894	0.72282	0.73024	0.74135
	Y	1.05958	0.96784	0.96510	0.95865	0.97292	0.95167	0.93876	0.92842
Manipur	P	0.05805	0.08710	0.09897	0.08840	0.09085	0.09095	0.0823	0.083450
	A	0.053925	0.06025	0.06325	0.05900	0.0574	0.05884	0.05249	0.05382
	Y	1.07646	1.44639	1.5653	1.49906	1.58229	1.54554	1.56712	1.54842
Meghalaya	P	0.03968	0.04062	0.041019	0.08947	0.04527	0.04206	0.04519	0.04956
	A	0.03814	0.04028	0.040586	0.03876	0.03828	0.03896	0.03977	0.04081
	Y	1.03972	1.00877	1.01097	1.01879	1.18229	1.07899	1.13619	1.21368
Mizoram	P	0.02457	0.02087	0.01494	0.01314	0.02017	0.01500	0.00838	0.00690
	A	0.02547	0.02606	0.02019	0.01667	0.02973	0.02417	0.01975	0.02220
	Y	0.95631	0.801169	0.73978	0.78853	0.67813	0.62082	0.42412	0.31053
Nagaland	P	0.017479	0.0179834	0.0134617	0.0254518	0.0289952	0.0230144	0.0260106	0.03004
	A	0.0301629	0.031739	0.0315076	0.0303144	0.0302472	0.0248803	0.0263272	0.02809
	Y	0.578947	0.5672514	0.6141575	0.8402255	0.958333	0.9247211	0.987354	1.06842
Tripura	P	0.06148	0.11834	0.108886	0.10916	0.111953	0.10632	0.11415	0.10522
	A	0.09464	0.10059	0.09993	0.09451	0.09501	0.09399	0.09414	0.08602
	Y	0.64945	1.18226	1.08973	1.15507	1.17813	1.13104	1.21206	1.22316

Table 2.C : Proportionate share of Production (P), Area (A) and Yield (Y) of total Pulses

		1972-73	1973-74	1974-75	1975-76	1976-77	1977-78	1978-79	1979-80
N.E. India	P	0.00498	0.00511	0.00468	0.00328	0.00403	0.00983	0.00415	0.00448
	A	0.00511	0.00473	0.00509	0.00436	0.00485	0.00499	0.00502	0.00553
	Y	1.00664	1.07963	0.91868	0.75235	0.83198	0.76817	0.81359	0,56567
Assam	P	0.93934	0.87476	0.84435	0.83178	0.81223	0.83007	0.83794	0.83164
	A	0.93518	0.85740	0.86378	0.84831	0.84022	0.85349	0.85821	0.85358
	Y	1.00411	1.02169	0.97608	0.98005	0.96594	0.97187	0.97852	0.97561
Manipur	P	-	0.05088	0.06397	0.05374	0.04804	0.05011	0.03755	0.03854
	A	-	0.06769	0.05877	0.05337	0.05117	0.04940	0.04395	0.04409
	Y	-	0.75271	1.10766	1.00748	0.93917	1.01279	0.85442	0.87317
Meghalaya	P	0.01957	0.01761	0.21322	0.02336	0.01965	0.02179	0.03359	0.03854
	A	0.01525	0.01354	0.01336	0.01404	0.01346	0.01278	0.01327	0.01747
	Y	1.28337	1.30152	1.59569	1.66334	1.45985	1.59847	2.53699	2.20732
Nagaland	P	0.02348	0.03718	0.04264	0.04673	0.06114	0.05011	0.04545	0.04665
	A	0.02383	0.03439	0.03473	0.03652	0.04129	0.03918	0.03814	0.03827
	Y	0.98563	1.08459	1.22727	1.27930	1.48175	1.27877	1.19332	1.21951
Mizoram	P	-	-	0.00085	0.00467	0.00218	0.00218	0.00593	0.00609
	A	-	-	0.00089	0.00375	0.00359	0.00341	0.00829	0.00832
	Y	-	-	0.23923	0.37407	0.60827	0.63939	0.71599	0.73171
Tripura	P	0.01761	0.02153	0.02559	0.03972	0.05677	0.04575	0.03953	0.03854
	A	0.02574	0.02798	0.02849	0.04401	0.05027	0.04089	0.03812	0.03827
	Y	0.68378	0.77007	1.00239	0.90274	1.12895	1.11765	1.03819	1.00734

Table 2.D : Proportionate share of Production (P), Area (A) and Yield (Y) of Five Major Oil Seeds

States		1972-73	1973-74	1974-75	1975-76	1976-77	1977-78	1978-79	1979-80
N.E. India	P	0.01153	0.01187	0.00971	0.00815	0.01019	0.01013	0.01148	0.01458
	A	0.01285	0.01274	0.01312	0.01318	0.01399	0.01422	0.01459	0.01630
	Y	0.86039	0.93194	0.74128	0.61905	0.72917	0.71282	0.78571	0.89474
Assam	P	0.91035	0.92674	0.86111	0.87376	0.85839	0.88486	0.87978	0.88964
	A	0.90832	0.91514	0.88694	0.89232	0.89494	0.90905	0.92546	0.92886
	Y	0.98349	1.01311	0.97029	0.97767	0.95844	0.97362	0.95022	0.95798
Manipur	P	-	0.01522	0.04589	0.02104	0.02632	0.01535	0.00839	0.00764
	A	-	0.02157	0.03509	0.02094	0.02361	0.01599	0.00991	0.01159
	Y	-	1.00661	1.30693	1.00463	1.11429	0.95923	0.84632	0.87363
Meghalaya	P	0.04167	0.02759	0.03986	0.04455	0.05388	0.05044	0.04287	0.04365
	A	0.02988	0.02846	0.03216	0.03539	0.03539	0.03473	0.03318	0.03294
	Y	1.44103	0.97004	1.23762	1.25806	1.57403	1.45084	1.29221	1.25420
Nagaland	P	0.01010	0.00856	0.01087	0.01114	0.01128	0.01097	0.04939	0.04669
	A	0.01002	0.01016	0.00975	0.01047	0.01060	0.01097	0.00474	0.00659
	Y	0.96986	0.84269	1.11386	1.06458	1.06234	1.04149	3.74604	6.07749
Mizoram	P	0.01515	0.00666	0.00604	0.00866	0.00877	-	-	-
	A	0.00909	0.00609	0.00634	0.00648	0.00627	-	-	-
	Y	1.66509	1.09176	0.95297	1.38462	1.39740	-	-	-
Tripura	P	0.02273	0.02379	0.03623	0.04084	0.04135	0.03838	0.02891	0.02717
	A	0.02971	0.03201	0.02972	0.01047	0.01060	0.01099	0.02671	0.02735
	Y	0.91557	0.74345	1.21782	1.18610	1.36104	1.25695	1.08225	1.13579

Table 3.A : Estimated and Actual Rates of Growth of Out-put in total Foodgrains and their χ^2-Values

States		1972-73	1973-74	1974-75	1975-76	1976-77	1977-78	1978-79	χ^2
All India	RE	7.8088	-4.6795	20.4319	-8.2811	13.3906	4.3001	-18.0456	0.0203378
	RA	7.8723	-4.6227	21.2450	-8.1527	13.7091	4.3472	-17.4765	
N.E. India	RE	1.6056	-1.6305	12.4785	-4.3139	8.1630	-5.9140	-13.7297	-0.0152288
	RA	1.5906	-1.6527	12.8607	-4.5221	8.0620	-5.8936	-13.2339	
Arunachal Pradesh	RE	0.0419	48.4032	16.2925	4.4581	23.9385	4.8778	-10.5050	-2.613124
	RA	-0.1923077	52.2158	15.9494	4.4760	25.3919	4.8333	-16.6137	
Assam	RE	-9.5361	-2.6556	13.5597	-6.2754	8.7634	-6.0916	-13.4012	-0.0089552
	RA	-9.4748	-2.5930	14.0007	-6.4538	8.7213	-6.1254	-12.9328	
Manipur	RE	48.6916	11.5717	0.9098	-5.5156	11.8436	-15.3457	-12.4596	0.5707756
	RA	53.9564	11.9181	0.8652	-5.5097	12.1508	-14.9751	-12.1201	
Meghalaya	RE	3.9611	-0.4578	8.7001	5.2589	4.9461	1.3412	-4.8662	0.1169137
	RA	3.9101	-0.4804	8.8496	5.3215	4.2105	1.4141	-4.8473	
Mizoram	RE	-12.668	-31.4172	1.1307	58.943	-16.2946	-53.5499	-26.74	6.2010013
	RA	-12.9781	-29.3564	-0.2222	40.7572	-16.6139	-47.0588	-28.3154	
Nagaland	RE	5.6458	6.4934	45.6518	5.4527	-8.1954	3.2165	0	0.135662
	RA	5.7728	6.5741	46.4463	5.5305	-8.7701	3.1653	0	
Tripura	RE	90.9782	-9.7015	13.3975	-5.24	6.3851	0.8642	-21.0527	0.2387383
	RA	96.0668	-9.7279	13.5769	-5.4409	6.2642	0.8536	-20.1005	

N.B.: RE stands for Estimated Growth Rate; RA for Actual Growth Rate.

Table 3.B : Estimated and Actual Rates of Growth of Out-Put in total Cereals and their χ^2-values

States		1972-73	1973-74	1974-75	1975-76	1976-77	1977-78	1978-79	χ^2
All India	RE	-44.4071	-5.136	19.4951	-7.6494	14.2847	4.5563	-16.502	-0.0425047
	RA	-46.1708	-5.1185	20.2453	-7.5830	14.6574	4.6181	-16.0712	
N.E. India	RE	1.5684	-1.5088	12.7705	-7.7941	12.0772	-6.1115	-13.8792	-0.00117081
	RA	1.6144	-1.5363	13.1941	-8.0647	12.0968	-6.0374	-13.4029	
Arunachal Pradesh	RE	5.7432	41.7879	16.5727	4.4581	23.9385	4.8778	-10.5059	-3.3568347
	RA	5.7692	43.6364	15.9494	4.4760	25.3919	4.8333	-16.6137	
Assam	RE	-9.6381	-2.3729	13.9686	-6.4223	8.7901	-6.4026	-13.4664	-0.0020911
	RA	-9.4451	-2.4077	14.4606	-6.6178	8.82698	-6.4002	-13.1135	
Manipur	RE	48.2739	11.5429	1.1174	-5.5602	11.9919	-15.3792	-12.493	0.3061061
	RA	52.4656	11.8842	1.1092	-5.5186	12.2097	-14.3792	-12.2050	
Meghalaya	RE	4.1263	-0.5265	8.7948	5.4312	4.0535	0.9966	-5.1273	0.003276
	RA	4.0268	-0.6545	8.9213	5.4356	4.1667	0.9492	-5.0370	
Mizoram	RE	-12.668	-31.6679	1.172	59.3935	-16.0677	-54.4006	-26.983	4.9018347
	RA	-12.9781	-29.5133	-0.4454	41.1633	-16.6403	-47.5285	-28.6232	
Nagaland	RE	4.7174	5.8419	47.7782	4.6627	-9.5963	6.0792	0	-0.1159725
	RA	4.5714	6.5574	48.0342	4.7344	-11.0254	6.1958	0	
Tripura	RE	91.423	-9.826	13.378	-5.4956	6.5383	0.8816	-21.122	0.2314324
	RA	96.48078	-9.810	13.4739	-5.7081	6.4535	0.8852	-20.1808	

N.B.: RE stands for Estimated Growth Rate; RA for Actual Growth Rate.

Table 3.C : Estimated and Actual Rates of Growth of Out-Put in total Pulses and their χ^2-values

States		1972-73	1973-74	1974-75	1975-76	1976-77	1977-78	1978-79	χ^2
All India	RE	2.0915	0.5723	28.1729	-13.3305	5.275	1.8567	-33.3038	2.0141545
	RA	0.2906	0.06695	30.2111	-12.8708	5.3788	1.7582	-31.2857	
N.E. India	RE	0.2856	-7.9737	-8.9646	6.8009	0.5198	9.8868	-2.4797	0.4631729
	RA	0	-8.2192	-8.7420	7.0093	0.2183	10.2397	-2.5692	
Assam	RE	-6.841	-11.2705	-9.7842	3.8176	2.7692	11.1881	-3.3086	0.1528786
	RA	-6.875	-11.4094	-10.1010	4.4944	2.4194	11.2861	-3.3019	
Manipur	RE	-	21.4294	-26.3794	-4.4554	4.3451	-18.2167	0	-0.4228371
	RA	-	19.23077	-25.80645	-4.3478	4.5455	-17.3913	0	
Meghalaya	RE	-10.25	11.1667	0	-10.045	4.1667	76.7467	16.3864	13.464431*
	RA	-10.00	11.1111	0	-10.000	11.1111	70.00	11.7647	
Mizoram	RE	-	-	400	-50.000	0	170	0	5.2941176
	RA	-	-	400	-50.000	0	200	0	
Nagaland	RE	56.16667	5.2316	0	36.6622	-17.8982	0	0	0.387554
	RA	58.3333	5.2632	0	40	-17.8571	0	0	
Tripura	RE	21.4214	21.254	33.2712	47.3257	-20.1047	-4.6244	-5.0375	1.2859061
	RA	22.2222	18.1818	30.76923	52.9418	-19.2308	-4.7619	-5.00	

N.B.: RE stands for Estimated Growth Rate; RA for Actual Growth Rate.

Table 3.D : Estimated and Actual Rates of Growth of Out-Put of Five Major Oil Seeds and their χ^2 values

States		1972-73	1973-74	1974-75	1975-76	1976-77	1977-78	1978-79	χ^2
All India	RE	27.9854	-3.675	16.8041	-21.45695	14.5159	3.8794	-14.11	0.0437462
	RA	29.0932	-3.6663	16.1965	-20.9497	14.8937	3.8425	-13.5756	
N.E. India	RE	31.184	-20.0763	-2.4892	-1.0288	13.7575	16.87	9.6223	0.0229598
	RA	32.7020	-21.2175	-2.4155	-1.2376	14.2857	17.65	9.6756	
Assam	RE	33.8945	-26.4866	-1.1382	-2.6022	17.1353	16.1221	10.8556	0.0381339
	RA	35.0902	-26.7967	-0.9818	-2.9745	17.8102	16.9765	11.0169	
Manipur	RE	-	370.5475	-64.9622	22.5926	-35.3313	-36.5357	0	12.569819*
	RA	-	442.8571	-55.2632	23.5294	-33.3333	-35.7143	0	
Meghalaya	RE	-11.5172	14.3822	8.9758	19.5266	6.8773	-0.0065	0	0.0107873
	RA	-12.1212	13.7931	9.0909	19.4444	6.9767	0	0	
Mizoram	RE	-46.8333	-25.629	44.9351	-3.5840	-	-	-	-3.9500997
	RA	-41.6667	-28.5714	40.00	0	-	-	-	
Nagaland	RE	12.1515	0	.333	.1	11.05	783.24	0	262.72033*
	RA	12.5	0	0	0	11.1111	330.00	0	
Tripura	RE	34.4233	20.7549	10.2693	0.9277	5.9766	-11.7173	3.2387	1.5356401
	RA	38.8889	20.00	10.00	0	6.0605	-11.4286	3.2258	

N.B.: RE stands for Estimated Growth Rate; RA for Actual Growth Rate.

Table 4.A : Relative shares of Growth of Area (A) and Yield (Y) to the Overall Growth of Output of Total Foodgrains

States		1972-73	1973-74	1974-75	1975-76	1976-77	1977-78	1978-79
India	A	0.77382	-0.93939	0.27624	-0.36564	0.18527	0.26897	-0.22654
	Y	0.21855	-0.07792	0.68518	-0.65031	0.79139	0.71540	-0.806064
N.E. India	A	-0.07107	-0.46061	0.48756	-0.72124	-0.10669	-0.27674	-0.45956
	Y	1.8176	-1.44848	0.48289	-1.67478	1.11911	-0.72666	-0.57823
Arunachal Pradesh	A	-26.31999	0.713194	1.22445	0.89509	0.44803	0.19255	-1.83865
	Y	-26.10308	0.21373	-0.20313	0.10045	0.49449	0.81781	-1.20650
Assam	A	-0.28722	-0.03880	0.56714	-0.31938	-0.06307	-0.91667	-0.36349
	Y	-0.71911	-1.11197	0.40143	-1.29148	1.06766	-0.07843	-0.67285
Manipur	A	0.29707	0.42198	-1.0575	-0.13975	0.20494	-0.81108	-0.30446
	Y	0.60508	0.54866	2.10345	-0.86025	0.76955	-0.21369	-0.72359
Meghalaya	A	1.30691	-3.08333	0.21297	0.13534	0.43230	0.276596	-0.70309
	Y	-0.29412	-4.04166	0.77175	0.85338	0.74347	0.67376	-0.301031
Mizoram	A	-0.15179	-0.74285	-51.7727	1.991904	-1.119807	-0.39970	-0.186794
	Y	-1.12789	-0.32455	-56.90909	0.54588	-0.139073	-0.738207	-1.131003
Nagaland	A	1.06759	0.093703	0.04349	0.43038	-1.42531	-0.455696	0
	Y	-0.09012	0.90323	0.939289	0.55515	0.490308	1.47469	0
Tripura	A	0.06277	-0.01028	0.10457	-0.50368	-0.20767	-1.81176	-0.70448
	Y	0.88425	1.00719	0.88144	1.33445	1.22843	2.83529	-0.34279

Table 4.B : Relative shares of Growth of Area (A) and Yield (Y) to the Overall Growth of Output of Total Cereals

States		1972-73	1973-74	1974-75	1975-76	1976-77	1977-78	1978-79
India	A	-1.04073	-0.75915	0.23297	-0.29947	0.17804	0.27706	-0.18855
	Y	-0.07824	-0.23121	0.72902	-0.70976	0.79564	0.70779	-0.83821
N.E. India	A	-0.19876	-0.47403	0.50720	-0.24566	-0.00083	-0.27318	-0.46940
	Y	1.17391	-1.45455	0.46096	-1.212159	0.99835	-0.73841	-0.56642
Arunachal Pradesh	A	0.87695	0.84601	1.24201	0.89509	0.448208	0.19255	-1.84865
	Y	0.11785	0.111595	-0.203135	0.10045	0.49468	0.817805	-1.20650
Assam	A	-0.28571	-0.05809	0.59474	-0.30211	-0.096263	-0.1	-0.37147
	Y	-0.73439	-1.04564	0.37137	-1.25529	1.09173	-0.9	-0.65599
Manipur	A	0.216695	0.484007	-0.42342	-0.14674	0.20557	-0.81885	-0.31122
	Y	0.70326	0.489057	1.43243	-0.862319	0.776413	-0.20923	-0.711712
Meghalaya	A	1.30769	-2.67857	0.211883	0.13419	0.42206	0.410526	-0.761905
	Y	-0.28536	-3.62500	0.77354	0.86397	0.54916	0.631579	-0.25397
Mizoram	A	-0.151772	-0.74348	-25.86957	1.98737	-1.122596	-0.413844	-0.18763
	Y	-1.12789	-0.32972	-28.41304	-0.54440	-0.156831	-0.730696	-1.129959
Nagaland	A	1.070022	0	0.055174	0.369979	-1.60925	0.655395	0
	Y	-0.037197	0.890244	0.939621	0.615222	-0.73889	0.323672	0
Tripura	A	0.061671	-0.007143	0.069785	-0.43433	-0.16589	-1.6854	-0.71259
	Y	0.88588	-1.009184	0.923534	-1.395797	1.17829	2.67416	-0.33399

Table 4.C : Relative shares of growth of Area (A) and Yield (Y) to the Overall Growth of Output of Total Pulses

States		1972-73	1973-74	1974-75	1975-76	1976-77	1977-78	1978-79
India	A	41.32829	-85.57143	0.365111	-0.466977	0.416357	0.368364	-0.25759
	Y	-34.1363	79.42857	0.567362	-0.568765	0.565056	0.670455	-0.80665
N.E. India	A	5.624	-0.164034	-0.56064	0.614836	24.5000	0.26660	-0.128405
	Y	-5.339	-1.133657	-0.46568	0.355207	-22.13636	0.69922	0.836576
Assam	A	-0.45930	-0.18493	-0.65347	0.73794	2.913223	0.291408	-0.263636
	Y	-0.53482	-1.17266	0.315842	0.113586	-1.76859	0.698849	-0.739394
Manipur	A	-	-0.780234	-4.096096	0	0.38462	-0.495687	0
	Y	-	2.173602	-3.82583	-1.0258	0.569231	0.552041	0
Meghalaya	A	-0.625	0	0	0	0	0.095286	2.657313
	Y	-0.400	1.0054	0	-1.004	0.37534	1.001143	-1.263605
Mizoram	A	-	-	0	0	0.75	0	0
	Y	-	-	1	-1	0.10	0	0
Nagaland	A	0.8914795	0.5000	0	0.44876	0	0	0
	Y	0.0714897	0.494297	0	0.46775	-1.002396	0	0
Tripura	A	0.66652	0.35534	1.12303	0.361730	-0.743109	-0.87605	0
	Y	0.29748	1.983498	-0.32637	0.53230	-0.30265	0.096639	-1.012

Table 4.D : Relative shares of Growth of Area (A) and Yield (Y) to the Overall Growth of Five Major Oil Seeds

States		1972-73	1973-74	1974-75	1975-76	1976-77	1977-78	1978-79
India	A	0.16363	-0.32970	-0.122196	-0.16358	0.24983	0.877604	-0.337997
	Y	0.798556	-1.33243	0.901671	1.20062	0.72532	0.132813	-0.7010309
N.E. India	A	0.160245	-0.20123	-0.92562	-2.774194	0.381386	0.344476	0.673136
	Y	0.793272	-1.14703	-0.103306	-3.6048387	0.581516	0.611331	0.309599
Assam	A	0.118552	-0.039179	-1.683674	-1.25926	0.39924	0.470554	0.63394
	Y	0.84725	-1.027612	-0.52000	-2.13805	0.56261	0.47821	0.351179
Manipur	A	-	0.790317	-0.759072	0.708457	-0.857186	-0.960235	0
	Y	-	0.046503	-0.421643	0.252019	-0.20282	-0.06301	0
Meghalaya	A	-0.305281	1.29514	0.83388	0	1.00896	1.32	0
	Y	-1.25578	-0.251632	0.154015	1.00463	-0.02439	-1.32	0
Nagaland	A	0.4208	0	0.5	4.76	0.8181818	-0.1642	0
	Y	0.5512	0	-4.6700	-4.66	0.17642	2.53761	0
Mizoram	A	-0.7058	-0.29156	0	0	-	-	-
	Y	-0.41805	-1.18866	1.1235	-3.58	-	-	-
Tripura	A	0.60504	-0.1585	1.311	-8.70	0.26237	-0.27384	1.49845
	Y	0.28002	1.1965	-0.285	9.62	0.72442	-0.75153	-0.4944

Table 5.A : Annual Growth Rates of Production (P), Yield (Y) and Area (A) of Foodgrains in Percentage

States		1972-73	1973-74	1974-75	1975-76	1976-77	1977-78	1978-79
India	P	7.8723	-4.6227	21.2450	-8.1527	13.7091	4.3472	-17.4765
	Y	1.7220	-0.3628	14.5631	-5.2960	10.8501	3.1282	-14.0900
	A	6.0868	-4.3167	5.8688	-2.9845	2.5405	1.1719	-3.9556
N.E. India	P	1.5906	-1.6527	12.8607	-4.5221	8.0620	-5.8936	-13.2339
	Y	1.7890	-2.3857	6.2118	-7.5743	9.0249	-4.2816	-7.6541
	A	-0.1133	0.7552	6.2667	3.2604	-0.8619	-1.6324	-6.0756
Arunachal Pradesh	P	-0.1923	52.2156	15.9494	4.4760	25.3919	4.8333	-16.6137
	Y	-5.0171	11.1645	-3.2397	0.4464	12.5556	3.9487	20.0379
	A	5.0590	37.2392	19.5322	4.0118	11.3829	0.9291	-30.5439
Assam	P	-3.4748	-2.5930	14.0007	-6.4538	8.7213	-6.1254	-12.9328
	Y	-6,8138	-2.8836	5.6204	-8.3333	9.3099	-5.6112	-8.7049
	A	-2.7223	0.2279	7.9393	2.0579	-0.5466	-0.4804	-4.6963
Manipur	P	53.9564	11.9181	0.8652	-5.5097	12.1508	-14.9751	-12.1201
	Y	32.6568	6.5369	1.8277	-4.7436	9.3539	-3.2000	-8.7730
	A	16.0348	5.0348	-0.9179	-0.7720	2.4896	-12.1457	-3.6866
Meghalaya	P	3.9101	-0.4803	8.8496	5.3215	4.2105	1.4141	-4.8473
	Y	-1.1516	-1.9417	6.8317	4.5412	3.1250	0.9524	-1.4579
	A	5.1127	1.4839	1.8684	0.7177	1.8211	0.3888	-3.4082
Mizoram	P	-12.9781	-29.3564	-0.2222	40.7572	-16.6139	-47.0588	-28.3154
	Y	-14.6417	-9.6107	12.5168	-22.2488	2.3077	-34.7368	-32.0277
	A	1.9737	-21.8065	-11.3861	81.1918	-18.6023	-18.8131	5.2877
Nagaland	P	5.7728	6.5141	46.3363	5.3050	-8.7701	3.1653	0
	Y	-0.5164	5.8824	43.6275	3.0717	4.3046	4.6561	0
	A	6.1622	0.6109	2.0243	2.3809	-12.5000	-1.4396	0
Tripura	P	96.0668	-9.7279	13.5769	-5.4409	6.2642	0.8536	-20.1005
	Y	84.9462	-9.8007	11.9705	-7.9769	7.6854	2.4066	-6.8882
	A	6.0319	0.0992	1.4210	2.7370	-1,3003	-1.5424	-14.1645

Table 5.B : Annual Growth Rates of Production (P), Yield (Y) and Area (A) of Total Cereals in Percentage

States		1972-73	1973-74	1974-75	1975-76	1976-77	1977-78	1978-79
India	P	-46.1408	-5.1185	20.2453	-7.5829	14.6574	4.6181	-16.0712
	Y	3.6117	-1.1983	14.7739	-5.3794	11.6751	3.2727	-13.4683
	A	-48.0188	-3.9377	4.7242	-2.2703	2.6096	1.2836	-3.0337
N.E. India	P	1.6144	-1.5363	13.1941	-8.0647	12.0968	-6.0374	-13.4029
	Y	1.8868	-2.2417	6.0818	-9.7744	12.0833	-4.4609	-7.5875
	A	-0.3184	0.7329	6.6887	1.9803	-0.0061	-1.6505	-6.2917
Arunachal Pradesh	P	5.7692	43.6364	15.9494	4.4759	25.3919	4.8333	-16.6137
	Y	0.6842	4.8698	-3.2397	0.4464	12.5556	3.9487	20.0379
	A	5.0590	36.9181	19.8124	4.0117	11.3829	0.9291	-30.5439
Assam	P	-9.4451	-2.4077	14.4606	-6.6178	8.8269	-6.4002	-13.1135
	Y	-6.9353	-2.5176	5.3719	-8.4314	9.6359	-5.7617	-8.6010
	A	-2.7028	0.1447	8.5967	2.0091	-0.8459	-0.6409	-4.8654
Manipur	P	52.4656	11.8842	1.1092	-5.5186	12.2097	-14.9577	-12.2050
	Y	36.9004	5.7951	1.5924	-4.7649	9.4799	-3.1269	-8.6903
	A	11.3735	5.7478	-0.4749	-0.7953	2.5120	-12.2523	-3.8027
Meghalaya	P	4.0268	-0.5645	8.9213	5.4356	4.1667	0.9492	-5.0369
	Y	-1.1461	-2.0289	6.9033	4.7048	2.2907	0.6029	-1.2842
	A	5.2724	1.5025	1.8914	0.7264	1.7628	0.3937	-3.8431
Mizoram	P	-12.9781	-29.5133	-0.4454	41.1633	-16.6403	-47.5285	-28.6232
	Y	-14.6417	-9.7324	13.0728	-22.4076	2.6114	-34.7305	-32.3395
	A	1.9737	-21.9355	-11.9008	81.8011	-18.6791	-19.6701	5.3712
Nagaland	P	4.5714	6.5574	48.0342	4.7344	-11.0254	6.1958	0
	Y	-0.1715	5.8419	45.1299	2.9083	8.1522	2.1001	0
	A	4.8889	0	2.6483	1.7544	-17.7485	4.0691	0
Tripura	P	96.4808	-9.8099	13.4739	-5.7081	6.4535	0.8852	-20.1808
	Y	85.4740	-9.8928	12.4428	-7.9739	7.6039	2.3829	-6.7416
	A	5.9490	0.0668	0.9352	2.4818	-1.0655	-1.5013	-14.3804

Table 5.C : Annual Growth Rates of Production (P), Yield (Y) and Area (A) of Total Pulses in Percentage

States		1972-73	1973-74	1974-75	1975-76	1976-77	1977-78	1978-79
India	P	0.2906	0.0669	30.2111	-12.8708	5.3739	1.7582	-31.2857
	Y	-9.9156	6.5574	17.1429	-7.3171	3.0364	1.1788	-25.2427
	A	12.0071	-5.9851	11.0300	-6.0138	2.2386	0.6779	-8.0611
N.E. India	P	0	-8.2192	-8.7420	7.0093	0.2183	10.2397	-2.5692
	Y	-5.3388	-9.3275	-4.0669	2.4938	-4.8662	7.1611	-2.1479
	A	5.6244	1.3538	-4.8976	4.3071	5.3859	2.7257	0.3317
Assam	P	-6.8750	-11.4094	-10.1010	4.4944	2.4194	11.2861	-3.3019
	Y	-3.6809	-13.3758	-3.1863	0.5063	-4.2821	7.8947	-2.4390
	A	-3.1600	2.1053	-6.5979	3.3113	7.0513	3.2934	-0.8696
Manipur	P	-	19.2308	-25.8065	-4.3478	4.5455	-17.3913	0
	Y	-	33.4294	-12.7429	-4.4554	2.5907	-9.5959	0
	A	-	-12.0000	-13.6364	0	1.7544	-8.6207	0
Meghalaya	P	-10.0000	11.1111	0	-10.0000	11.1111	70.0000	11.7647
	Y	-4.0000	11.1667	0	-10.0450	4.1667	70.0800	-14.8636
	A	-6.2500	0	0	0	0	6.6670	31.2500
Mizoram	P	-	-	400	-50	0	200	0
	Y	-	-	400	-50	0	20	0
	A	-	-	0	0	0	150	0
Nagaland	P	58.3333	5.2632	0	40.0000	-17.8571	0	0
	Y	4.1667	2.6000	0	18.7135	-17.8982	0	0
	A	52.0000	2.6316	0	17.9487	0	0	0
Tripura	P	22.2222	18.1818	30.7696	52.9412	-19.2308	-4.7619	-5.00
	Y	6.6066	18.0282	-13.6038	28.1768	-5.8189	-0.4576	-5.0575
	A	14.8148	3.2258	46.8750	19.1489	-14.2857	-4.1667	0

Table 5.D : Annual Growth Rates of Production (P), Yield (Y) and Area (A) of five Major Oil Seeds, in percentage

States		1972-73	1973-74	1974-75	1975-76	1976-77	1977-78	1978-79
India	P	29.0932	-3.6663	16.1965	-20.9457	14.8937	3.8429	-13.5756
	Y	23.2258	-4.8866	19.4495	-18.8940	10.7955	0.5128	-9.5238
	A	4.5796	1.2116	-2.6453	-2.5629	3.7204	3.3666	-4.5862
N.E. India	P	32.7020	-21.2179	-2.4155	-1.2376	14.2857	17.6535	9.7856
	Y	25.9433	-24.3446	-0.2475	-4.4665	8.3117	10.7914	3.0303
	A	5.2406	4.2683	-2.2417	3.4397	5.4458	6.0786	6.5919
Assam	P	35.0902	-26.7967	-0.9818	-2.9745	17.8102	16.9765	11.0169
	Y	29.7302	-27.5416	0.5102	-6.3452	10.0271	8.1281	3.8724
	A	4.1643	1.0549	-1.6484	3.7430	7.1082	7.9939	6.9832
Manipur	P	-	442.8572	-55.2632	23.5294	-33.3333	-35.7143	0
	Y	-	20.5479	-23.2555	5.9259	-6.7599	-2.2500	0
	A	-	350.0000	-41.6667	16.6667	-28.5714	-34.2857	0
Meghalaya	P	-12.1212	13.7931	9.0909	19.4444	6.9767	0	0
	Y	-15.2209	-3.4749	1.4000	19,5266	-0.1650	-1.3223	0
	A	3.7037	17.8571	7.5758	0	7.0423	1.3158	0
Mizoram	P	-41.6667	-28.5714	40.0000	0	-	-	-
	Y	-17.4221	-33.9623	44.9351	-3.5842	-	-	-
	A	-29.4118	8.3333	0	0	-	-	-
Nagaland	P	12.5000	0	0	0	11.1111	330.0000	0
	Y	6.8884	0	-4.6700	-4.6600	1.9600	837.4100	0
	A	5.2632	0	5	4.7600	9.0900	-54.1667	0
Tripura	P	39.8889	20.0000	10.0000	0	6.0605	-11.4286	3.2258
	Y	10.8939	23.9295	-2.8495	9.6234	4.3893	-8.5923	-1.6000
	A	23.5294	-3.1746	13.1148	-8.6957	1.5873	-8.1250	4.8387

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