Chapter I
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Introduction

1.1. Statement of the Problem

Agriculture is the largest sector of economic activity and plays a crucial role in India's economic development by providing food and raw materials and employment to a large proportion of the population. Food grains play a major role in agricultural production, which constitutes 65 per cent (CMIE, Dec, 2004) of the gross cropped area of the country. Rice and wheat among the cereals and maize among the millets take a large share in the country's agricultural economy. Pulses are also grown in different quantities in different regions of the country.

Importance of development of agriculture in India to strengthen the rural economy of the country has been emphasized by scholars, administrators since the beginning of the twentieth century. Indian agriculture in the pre-independence period was usually described as a gamble in monsoons. There had been a great deal of
uncertainty about crop prospects, as monsoons played a decisive role in determining agricultural output and their failures resulted in widespread famine and misery. At the time of our independence, the country had to depend on imports to meet the demand for food.

After independence, particularly since 1951, the Planning Commission has initiated various programmes for development of agriculture and the sector was given highest priority so that the country can produce enough food to meet the growing requirements of its burgeoning population. In spite of the fact that agriculture was given the topmost priority on almost every Five Year Plan, the first two decades after independence witnessed a slow pace in the growth of agricultural production. From a base of 50 million tonnes in 1950–51, the food grain production had risen only to 75 million tonnes by the mid sixties (Mander & Sharma, 1995) and till then the country had to depend on imports of food, which led to crisis of foreign exchange reserves and Balance of Payments.
The introduction of new technology during the Fourth Plan has changed the shape of Indian agriculture. The Green Revolution had emerged as a big hope from the cropping session of 1966–67 and consequently India's production of food grains especially that of wheat and rice increased sharply. The total food grains production in 1950–51 was 51 million tonnes, which increased to 82 million tonnes in 1960–61, 108 million tonnes in 1970–71, 130 million tonnes in 1980–81, 175 million tonnes in 1990–91, 195 million tonnes in 2000–01. This shows that the country has definitely achieved considerable improvement in agricultural production.

But the new technology did not bring about a breakthrough uniformly in agricultural production in all the states of the country. Progress made by some states in this field has been better as compared to others. Such variations in production are also found in different districts of a particular state. However, in a vast country like India with marked regional diversities in agro-climatic environment, resource endowment and population density is likely to be characterized by uneven development among regions.
The performance of agricultural sector of eastern India, which is characterized by rain fed agriculture, had remained somewhat dismal. Uttar Pradesh and West Bengal have shown a strong growth particularly in rice and wheat since the early 1980s. Even Bihar and Orissa, which had relatively low productivity, recorded a rice yield of more than 2 per cent per annum during 1982 – 97. Growth rate in rice area, production and productivity in Assam during 1982 – 97 was only 0.78 per cent, 2.59 per cent and 1.81 per cent respectively whereas it was 1.11 per cent, 4.92 per cent and 3.81 per cent in West Bengal and 0.43 per cent, 4.37 per cent and 3.93 per cent in Uttar Pradesh in that period (Pandey and Pal, 1998).

Assam is the easternmost state of the Indian union and is located between 24°08' and 27°58'N latitudes and 89°42'E and 96°01'E longitudes. The economy of the state is predominantly agricultural with a total cultivable area of 39 lakh hectares (1998 – 99), which constitutes 50.2 per cent of the total geographical area. Net sown area is about 27.01 lakh hectares, which is about 68.5 per cent of
the cultivable area. The cropping intensity of the State is 145 per cent (1998 – 99) (Govt. of Assam, 2003).

Agriculture in the state continues to face various challenges. Most of the farmers are small and marginal and being poverty stricken; they find it difficult to accept any risks and hence are less responsive to any change in technology. Consumption of fertilizer is extremely low in Assam. The fertilizer consumption figures for Assam and India for 1999 – 2000 are 27.94 and 93.81 kg/hectares respectively (CMIE, Dec, 2002). The state is far behind in terms of irrigated area as it has covered only 33 per cent of irrigable area against the national average of about 80 per cent (Govt. of Assam, 2000 – 2001). Most of the crops in the state are grown under rain fed conditions.

Rice is the most important crop of the state occupying about 70 per cent of the gross cropped area and more than 90 per cent of the total area under food grains. In spite of the importance of rice in the economy of Assam, the average productivity of food grains in general and rice in particular is one of the lowest in Assam.
amongst Indian states. As a result, the state has to import food grains till today from the neighbouring states to meet the growing requirements of her population.

Further, agriculture in Assam faces year after year, either excessive rains and floods and sometimes drought here and there, together with pest attack on standing crops. A normal crop year is rare in the state. The State Government has failed to tackle the above problem of flood and drought despite tremendous expenditures that have been made on this account. As a result, there has always been instability in the growth of agricultural production.

It is in the light of problem discussed above, the present study is an attempt to make an analysis on the growth and instability of food grains production in Assam during the plan period. The study period is for 1951 – 52 to 1999 – 2000. The study is made for the entire period and also for two sub-periods, namely Sub-period I (1951 – 52 to 1966 – 67) and Sub-period II (1967 – 68 to 1999 – 2000). To study the growth pattern and instability in the production of food grains during the post-Green Revolution period, the Sub-

1.2. Objectives

The following are the major objectives of the study:

1. To estimate the compound growth rates for food grains during the pre and post Green Revolution period in terms of area, production and productivity.

2. To examine the inter-district variations in cropping pattern during the above-mentioned period of time across the state.

3. To examine the nature and extent of instability in the food grains production in Assam.

4. To identify and assess the factors influencing growth and instability.
1.3. **Hypothesis**

For realizing the above objectives the following hypotheses have been made:

1. There is no significant change in the growth performance of food grains in different districts during the study period.
2. There is no marked change in inter-district cropping pattern.
3. The instability in agriculture continues to exist even in the post Green Revolution period.

1.4. **Data sources**

The study covers a period of 50 years starting from 1951 – 52 and terminating at 1999 – 2000. The information is collected for all crops across the state’s ten districts (now 23) for the proposed period, during which many a districts had taken birth. To lend comparability and academic ease, this study has used ten districts, which were found in 1971. The creation of new districts from time to time has been executed normally by transferring some Tehsils from one district to form a new district. The study has taken care to reduce all the districts into ten districts by grouping of relevant

Though the study has been made for food grains, all other crops have also been considered for studying the cropping pattern of the state.

1.5. Methodology

Growth rates are expressed in two forms “linear” and “compound”. In this study, compound growth rates have been estimated for area, production and productivity by fitting a semi logarithmic trend function of the following form:

\[ Y = e^{a+bt} \]

Where, \( y = \text{Area/Production/Yield} \)

\( a = \text{Constant} \)

\( b = \text{Growth rate} \)

\( t = \text{time} \)
In order to measure instability, co-efficient of variation and standard deviation have been estimated for different period using the following formulae.

(i) C.V. = Standard Deviation/Mean

(ii) S.D. = \[\frac{\sum (X_i - X)^2}{N}\]^{\frac{1}{2}}

Where,
- \(N\) is the total number of observations
- \(X_i\) is the area, production or productivity
- \(X\) is the mean of the distribution

In order to examine the sources of instability, the area and yield data for each crop and district are detrended (Hazell, 1982) using linear relation of the following form:

\[Z_t = a + bt + e_t\].................................(i)

Where,
- \(Z_t\) = detrended variable (area or yield)
- \(t\) = Time
- \(e_t\) = random residual with zero mean and variance \(\delta^2\)
After detrending, the residuals are centered on the mean area or yield for each period $z$, resulting in detrended time series data of the form:

$$Z = e_t + z$$

Time series data on detrended production for each crop and district are then calculated as the product of the detrended areas and yields.

Further, variance of production is decomposed into its constituent sources viz. area variance, yield variance, area-yield co-variance and higher order interaction between area and yield to examine the source of instability.

Let $Q$ denote production, $A$ the area sown and $Y$, yield. Then for each crop and district

$$Q = AY$$

The variance of production $V(Q)$ can be expressed as

$$V(Q) = \bar{A}^2 V(Y) + \bar{Y}^2 V(A) + 2 \bar{A}\bar{Y} COV(A,Y) - COV(A,Y)^2 + R$$

$$..........(iii)$$
Where  \( \bar{X} \) = Mean area
\[ \bar{Y} = \text{Mean yield} \]
\[ R = \text{Residual term (which is expected to be small)} \]

The above equation is not only a function of variances of yields and areas sown, but also the mean area and yield and of co-variance between areas and yields. Clearly, a change in any one of these components would lead to a change in \( V(\nu) \) between two periods of time.

The change in variance of production \( \Delta V(Q) \) can be decomposed into ten components as shown in the following table:
## Components of change in variance of production

<table>
<thead>
<tr>
<th>Sources of change</th>
<th>Description</th>
<th>Symbol</th>
<th>Components of change</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Change in mean yield</td>
<td>$\Delta \bar{Y}$</td>
<td>$2\bar{Y}_1\Delta \bar{Y} \text{Cov}(Y_1A_1) + (2\bar{Y}_1\Delta \bar{Y} + (\Delta \bar{Y})^2) \bar{V}(A_1)$</td>
</tr>
<tr>
<td></td>
<td>Change in mean area</td>
<td>$\Delta \bar{A}$</td>
<td>$2\bar{Y}_1\Delta \bar{A} \text{Cov}(Y_1A_1) + 2\bar{A}_1\Delta \bar{A} + (\Delta \bar{A})^2 \bar{V}(Y_1)$</td>
</tr>
<tr>
<td></td>
<td>Change in yield variance</td>
<td>$\Delta \bar{V}(Y)$</td>
<td>$(\bar{A}_1)^2 \Delta \bar{V}(Y)$</td>
</tr>
<tr>
<td></td>
<td>Change in area variance</td>
<td>$\Delta \bar{V}(A)$</td>
<td>$(\bar{Y}_1)^2 \Delta \bar{V}(A)$</td>
</tr>
<tr>
<td></td>
<td>Interaction between changes in mean yield and mean area</td>
<td>$\Delta \bar{Y} \Delta \bar{A}$</td>
<td>$2\Delta \bar{Y}\Delta \bar{A} \text{Cov}(Y_1A_1)$</td>
</tr>
<tr>
<td></td>
<td>Change in area yield covariance</td>
<td>$\Delta \text{Cov}(Y,A)$</td>
<td>$[2\bar{A}_1\bar{Y}_1 - 2 \text{Cov}(Y_1A_1)] \Delta \text{Cov}(Y,A) - [\Delta \text{Cov}(Y,A)]^2$</td>
</tr>
<tr>
<td></td>
<td>Interaction between changes in mean area and yield variance</td>
<td>$\Delta \bar{A} \Delta \bar{V}(Y)$</td>
<td>$[2\bar{A}_1\Delta \bar{A} + (\Delta \bar{A})^2] \Delta \bar{V}(Y)$</td>
</tr>
<tr>
<td></td>
<td>Interaction between changes in mean yield and area variance.</td>
<td>$\Delta \bar{Y} \Delta \bar{V}(A)$</td>
<td>$[2\bar{Y}_1\Delta \bar{Y} + (\Delta \bar{Y})^2] \Delta \bar{V}(A)$</td>
</tr>
<tr>
<td></td>
<td>Interaction between changes in mean area and yield and changes in area yield covariance</td>
<td>$\Delta \text{Cov}(Y,A)$</td>
<td>$[2\bar{Y}_1\Delta \bar{A} + 2\bar{A}_1\Delta \bar{Y} + 2\Delta \bar{A} \Delta \bar{Y}] \Delta \text{Cov}(Y,A)$</td>
</tr>
<tr>
<td></td>
<td>Change in residual</td>
<td>$\Delta R$</td>
<td>$\Delta V(AY) - \text{sum of other components}$</td>
</tr>
</tbody>
</table>

*Note*: 'A' denotes Area Sown, 'Y' Yield and 'V' variance.
In order to study inter-district variation in cropping pattern, percentages of area under principal crops across the state’s district at five different points of time are calculated. To minimize the influence of seasonal factors triennial averages of the area of principal crop/crop categories are calculated. Percentage change of area under different crops has been worked out.

In order to identify and assess the factors influencing instability the linear multiple regression function of the following form is fitted to the data relating to the period under study.

\[ y = a + b_1x_1 + b_2x_2 + b_3x_3 + b_4x_4 + b_5x_5 + b_6x_6 + b_7x_7 + b_8x_8 + u_t \]

Where, \( y \) = Variability in productivity

\( x_1 \) = Annual rainfall

\( x_2 \) = Fertilizer consumption

\( x_3 \) = Irrigated area under food grains

\( x_4 \) = Area under HYV food grains

\( x_5 \) = Total area under food grains

\( x_6 \) = Flood affected area.
1.6. Significance of the study

Agriculture occupies a very important place in the economy of Assam. About 69 per cent of the state’s population is being engaged in agriculture and allied activities. The share of this sector in Net State Domestic product (NSDP) of Assam at current prices was 37.8 per cent in 1999-2000. Keeping in view the importance of this sector, various agricultural programmes have always been assigned high priority to each successive Five Year plan. But compared with other states in the country, the pace of development of this sector has not been up to the expectation.

Assam produces both food crops and cash crops. Main food crops in Assam include Rice, Wheat, Pulses, Potato, Maize etc. Tea, Jute, Oil seeds, Sugarcane etc. are the principal cash crops. Among the food crops, rice occupies nearly (70) per cent of the total cropped area.
Since the inception of planning in 1951, stress has been laid on the state for attainment of self-sufficiency in the production of food grains. But till today the state is importing huge amount of food grains from neighbouring states to meet the demand of its growing population in spite of the fact that it has immense potentiality for increasing agricultural production with suitable climatic condition, rich and fertile soil and enough water resources. During the last fifty year period from 1951 – 52 to 1999 – 2000, the production of food grains in Assam has increased from 1.4 million tonnes to 4.0 million tonnes while for India, the increase is from 50 million tonnes to 208.8 million tonnes during the same period. But during this period, growth rate of population in the state was much higher than the corresponding growth rate for the country as a whole. Due to this the state is gradually turning into a food deficit state in the post independence period though it had surplus before.

Another notable feature of food grains production in the state is that none of the crops has shown increasing trend over the years. Such fluctuation is mainly due to various institutional, organizational, technological and climatic factors. The regular
occurrence of flood and droughts is also important factor contributing to such fluctuation. In such a situation it is urgently needed to make a study about the various factors for slow growth rate and instability in production in Assam so that some measures can be suggested to improve agricultural productivity in the State at stabilized rate.

Every possible steps have been taken to make the study comprehensive. Till now, though some studies have been done about the trend in agricultural production in the state, no scientific study has been undertaken on the growth and instability in food grains production in Assam for the period from 1951 – 52 to 1999 – 2000. The study will also throw light on the impact of Green Revolution on the Assam’s agricultural sector.

1.7. Chapter Plan

Chapter II has been exclusively devoted for the study of reviews and finding of different researchers on the growth and instability of agricultural production. The factors influencing such growth and instability have also been discussed in this chapter.
The present state of agricultural economy of Assam has been highlighted in the chapter III. The climate, rainfall, quality of soil in the different agro-climatic zones, nature of cropping pattern, land holding system, land-use pattern have been examined in this chapter. A comparative study of agricultural production of the state with that of some of the major agricultural state of the country has also been made in this chapter.

In chapter IV, inter-district variation in cropping pattern under the principal crops across the state’s district has been discussed by using appropriate statistical technique.

In chapter V, growth performance of area, production and productivity of major food grain crop in different district of the state have been examined with appropriate statistical analysis as stated in the methodology section.

Chapter VI deals with the instability in production to examine the nature and extent of instability in food production in Assam during the period under study. A discussion on factors, which affect
growth in food grain production, has been examined in Chapter VII.

The concluding chapter (Chapter VIII) summarizes the findings of the study. A discussion on policy measure for stepping up agricultural productivity in Assam has been discussed in this chapter.

At the end, selected bibliography have been given.