Chapter 6

SUMMARY AND CONCLUSIONS

In this study we tried to examine the performance of agriculture in four States in Eastern India, viz., Assam, Bihar, Orissa and West Bengal and to assess the contributions of various factors, such as area, yield and crop pattern to the overall growth rates of crop output in these States. We also tried to measure the effect of the relative price and the relative yield of the crops, rainfall and irrigation on the acreage under some important cereal and cash crops. The role of fertilizer was also analysed in this study. A district-wise study of the contributions of these factors was carried out whenever it was possible. We tried to highlight the limitations of data, particularly data on water supply and use of fertilizer. Because of these limitations, the role of these factors could not be assessed properly.

In chapter 2 we examined statistically whether there was acceleration, deceleration or stagnancy of growth rates in crop output (except in the output of plantation crops) in Assam, Bihar, Orissa and West Bengal. Next, we tried to ascertain the nature and extent of instability in foodgrains production and total crop production in these States. In this chapter, we also examined the impact of the so-called Green Revolution on the instability of foodgrains production in the States.
For assessing the nature of the growth rates of crop output in these States, we fitted various trend lines to the production index numbers and statistical tests were used to choose the best trend lines. The nature of growth was ascertained on the basis of the chosen trend line. However, in some cases the trend line method did not help us to choose any particular trend line in preference to other trend lines. We used a non-parametric test, Kendall's T, to resolve this dilemma.

Our analysis reveals that the growth rates of total crop production remained constant in Assam, Orissa and West Bengal, at 1.58%, 2.3% and 2.07% per annum respectively during 1950-51 to 1973-74. In Bihar, on the other hand, the annual growth rates of total crop output declined during the same period. For example, the point rates of growth on the straight line fit were 2.79% in 1951-52, 2.45% in 1955-56, 2.18% in 1960-61, 1.82% in 1969-70 and 1.70% in 1973-74.

The nature and extent of instability (periodic fluctuations) in both total crop output and foodgrains production were ascertained by (1) fitting trend lines through the peak points and trough points of production indices (2) examining the estimated average rates of growth on these trend lines, and (3) carrying out the statistical test of the stability of these estimated trend coefficients. The number of declines in production from the previous peak points, the range of percentage declines and the average periodicity of the declines were also used to corroborate the results obtained from statistical analysis.
Our analysis reveals that in Assam, Bihar and Orissa, there was increasing instability and in West Bengal, the instability in the foodgrains production showed a declining trend. In other words, this means that while the fluctuations in foodgrains production in Assam, Bihar and Orissa showed a tendency to widen over time during 1950-51 to 1973-74, they showed a tendency to get damped in West Bengal during the same period, indicating the growth with less instability in foodgrains production in this State.

The fluctuations in the total crop production showed almost the same trend for these States. For instance, in Assam, Bihar and Orissa, instability in crop production showed a tendency to perpetuate itself, while in West Bengal, production tended to be stable around an annual average growth rate of 2.74%.

The impact of the Green Revolution (supposed to have taken place from 1967-68 onwards) on the trend in fluctuations in foodgrains production was assessed by comparing the nature of fluctuations observed during the entire period from 1950-51 to 1973-74 with that observed during 1950-51 to 1965-66. The direct comparison of the nature of fluctuations observed during the post-Green Revolution period with that observed during the previous sub-period could not be carried out because of a small number of peak points and trough points reached during the post-Green Revolution period of seven years only (1967-68 to 1973-74).

The results show that in Assam, the impact of the Green Revolution was negative in the sense that the state of convergence observed during the pre-Green Revolution turned into a state of
diverging fluctuations. In Bihar and Orissa, there was no discernible change. In West Bengal, on the other hand, the tendency of foodgrains production to become stable was more prominent during the post-Green Revolution period than during 1950-51 to 1965-66.

We next tried to measure the relative contributions of different component elements such as area, yield and crop pattern to the overall growth rates of crop output in these States as well as in the districts in these States (chapter 3) over two sub-periods - 1954-57 to 1962-65 and 1962-65 to 1973-74.

The 4-component decomposition scheme of Minhas and Vaidyanathan was used for this purpose.

Our analysis reveals that in Bihar, during the pre-Green Revolution period, the area and yield made significant contributions to the growth rates in most of the districts in the State. The contribution of cropping pattern was negligible in many of the districts in the State.

On the other hand, during the period from 1962-65 to 1971-74, the cropping pattern made more significant contribution to the growth rates of crop output in 9 out of 17 districts in the State. It is further observed that the contribution of yield was negative in some districts in this later sub-period, and the overall contribution of yield to the growth rate for the State as a whole was negligible.

In many of the districts in Orissa, the increase in yield during the pre-Green Revolution period and the increase in area
during the later sub-period were the principal contributors to the growth rates achieved during these periods. The contribution of crop pattern was negligible in both the sub-periods in most of the districts in Orissa.

In the districts of West Bengal, the changes in area and yield taking place during the first sub-period contributed significantly to the overall growth rates of crop output. In the later sub-period, though the contribution of yield was significant in some districts, it was the changes in area that made more significant contribution to the overall growth rate of crop output in almost all the districts in the State. Though the contribution of crop pattern to the overall growth rate of the State as a whole was negative in the later sub-period, it was significantly high in some districts in the same period.

It should further be noted that the wheat revolution resulted in the concentration of a few crops in many districts in Bihar and West Bengal. The high-yielding varieties of rice and wheat elbowed out many of the important crops such as pulses, oilseeds and jute that used to be produced on relatively large areas in these States in the pre-Green Revolution period.

The contribution of the interaction term which represents the joint effect of change in proportion of area under crops and the change in yield per acre was positive in many districts in Bihar and West Bengal during the post-Green Revolution period. In the previous sub-period (1954-57 to 1962-65) its contribution was negligible in most of the districts in these States. This means that in the late

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In these States, the farmers in these States appeared to have adjusted the acreage in favour of the more profitable crops. In Orissa, however, the contribution of this term was negligible in either sub-period.

In chapter 4 we made an attempt to examine how the farmers in the districts in these States planned the allocation of their cultivable land to various crops in response to changes in relative yield and relative price of the crops, irrigation and rainfall. We also examined the relative importance of these factors in influencing the allocation decision of the farmers. This analysis may be useful for framing suitable policies for increasing the growth rate of crop output in these districts. This may further enrich our knowledge about the responsiveness of supply of crop output to changes in the relative prices of the crops in an underdeveloped agriculture, over which there is some controversy among economists.

To carry out this analysis we used (1) traditional regression model, (2) Nerlovian Adjustment model, (3) Nerlovian Expectation model and (4) Combined Adjustment-Expectation model. The choice of the model is based on a number of statistical criteria and a priori restrictions on the parameters.

Our analysis reveals that for winter rice in Bihar, rainfall was the most important variable influencing the farmers' decision about the allocation of land to various crops. The other variables, such as relative yield and relative price of the crop were of minor importance to the farmers.
For wheat in Bihar, irrigation was the most important factor. Rainfall, of course, played an important role in some districts. Relative price was of little importance to the farmers so far as their allocation decision was concerned. In some districts, however, relative yield played a significant role.

For both winter rice and wheat in West Bengal, relative yield of the crops was the major factor determining the cropping pattern in most of the districts in the State. On the other hand, for jute and autumn rice, relative price of the crops was the principal factor and rainfall was also seen to have a positive influence on the changes in area under these crops.

For sugarcane and jute in Bihar (two districts for each crop, Saharsa and Purnea for jute, and Saran and Champaran for sugarcane), relative price was the principal factor determining acreage under these crops.

For winter rice in Orissa, both relative price and relative yield of the crop appeared to be the major factors determining the allocation (of land) decision of the farmers. (The behaviour of the farmers in Orissa was analysed for three districts only owing to the non-availability of data for other districts).

To sum up, the supply of the crops that did not have profitable substitutes such as winter rice and wheat was seen to be insensitive to changes in relative prices. The supply of these crops depended more on weather and, to a certain extent, on yield than on price. On the other hand, the supply of the crops that had profitable substitutes,
such as autumn rice, jute and sugarcane, was seen to have responded positively and significantly to the changes in their relative prices. In chapter 5 an attempt has been made to measure the contribution of fertilizer to yield per acre. In Section 5.1 we have discussed (1) the interrelation between the use of fertilizers and water supply and (2) how this interrelationship affects yield per acre. We noted in this section that a) in the condition of mild water stress, fertilizers, nitrogenous fertilizers in particular, may serve as substitutes for water and can thereby compensate for the loss in yield owing to water stress. Even in this condition, yield per acre can be increased by applying additional doses of fertilizers. b) If the water stress is severe, the application of additional doses of fertilizers may have negligible marginal effect on yield. c) But if there is additional watering during the period of water stress, particularly during the period between floral initiation and maturity of grain, the marginal effect of additional watering may be exceptionally high. d) At the higher levels of fertilizer-use the marginal effect of additional watering may be less.

Thus, if the desired water status is maintained throughout the life of the crop by adequate rainfall or by additional watering by artificial means if rainfall is inadequate and unevenly distributed the marginal contribution of both additional doses of fertilizers and additional watering to yield per acre will be expected to be high. The marginal effect of additional watering may be less for heavily fertilized crops.

In Section 5.2 the limitations of our study have been discussed.
In section 3.0, the distribution of factor intensities among the districts in Bihar and West Bengal. In section 5.6, the regression results are analyzed. The regression results show that in Bihar, the marginal effect of fertilizer is positive (11.5 Kgs per acre) and statistically significant for only 1971-72. This may be attributed to high water status of the districts in this year. The annual rainfall in this year ranged from 1.1 m to 1.9 m. (Only in Darbhanga the annual rainfall was only 0.8 m). In the subsequent years, i.e., 1972-73, 73-74 and 74-75, the marginal effect of fertilizers is seen to have declined steadily from 11.5 Kgs in 1971-72 to only 3.8 Kgs per acre in 1974-75. Low rainfall in these years may be one of the reasons for this steady decline. With small amount of water-supply, the marginal effect of fertilizers at lower levels of fertilizer consumption can not be expected to be high. Lack of information on the amount of water supplied and the time of additional watering makes the problem of identifying the factors responsible for this decline more difficult.

In West Bengal, the marginal effect of fertilizers is seen to be very high in 1968-69, 1969-70 and 1970-71 in relation to that in the subsequent years. The high annual rainfall in these years, ranging between 1.1 m to 2.0 m in the low rainfall areas and between 2.6 m to 3.2 m in the high rainfall areas, might have created a condition in which the use of additional fertilizer had exceptional marginal effect on yield per acre.

In 1971-72, the marginal effect of fertilizer was negligible. From 1971-72 onwards it, however, showed distinctly rising tendency.
which may be attributed to the use of additional doses of fertilizer in these years. Additional watering may be another factor that might have contributed to this rising tendency. However, nothing can be said conclusively because of inadequacy of data on the amount and time of water supply.