CHAPTER III

REVIEW OF LITERATURE

3.1 Introduction

This chapter presents the review of literature with a view to examine how the problem has been analyzed by different researchers from time to time. The review is classified into four parts as under:

1. Studies focused on agricultural growth
2. Studies focused on growth and instability in agriculture.
3. Studies focused on the decomposition of sources of instability.
4. Other related studies.

3.2 Studies Focused on Agricultural Growth

Haffis et al., (1992)\(^1\) worked out the growth patterns on food grains economy of India. This study employed secondary data of 40 years time series from 1949-50 to 1988-89. The net results emerged than the study that though the productivity of food grain crops has increased during the last 40 years, nut this increase in productivity has failed to boost up the area under the production of these crops due to the shifting of a portion of land. The contribution of yield effect increased from 53.42 per cent in the first decade to 104.06 per cent in the fourth decade. Finally, the study concludes at a low growth rate or present level of area, our country has achieved self-sufficiency in food grains production recently. Some implications of the policy are given in the study.

Singh and Kaur (1992)\(^2\) studied the growth in agricultural productivity in Punjab. It had been increasing at a growth rate of little above 4 per cent during the seventies and eighties. The average productivity per hectare increased from Rs. 3294 per hectare in


1970-71 to Rs. 4914 in 1980-81 and further to Rs. 6544 per hectare in 1988-89. The growth in productivity was leveling off in various districts. During the seventies, as many as 4 districts had growth rate higher than 5 per cent but during the eighties only 2 districts had this much growth.

Verma (1992)\(^3\) reviewed the contribution of agriculture as growth component can be analyzed and examined in terms of (i) product contribution; (ii) factor contribution and (iii) market contribution. It would be interesting to discuss how Indian agriculture had behaved on these fronts in recent past and particularly during 80’s.

Sinha and Thakur (1993)\(^4\) analyzed the growth performance of major food crops in Bihar. The study highlights the remarkable increase in area, production and productivity of the wheat followed by rice and maize throughout the study period. The variability analysis revealed that the yield for all these three crops was found to be more stable in the post-green revolution period as compared to the pre-green revolution period. Further, the Chow’s test also supported the fact that the new production technology had a significant impact in production process of Wheat and Maize during the Green Revolution period. In case of rice, technological progress was observed over the time, though it has no significant impact on the production of rice during the period of Green Revolution.

Bastine and Palanisami (1994)\(^5\) analyzed the trends in growth rates over the period 1965-66 to 1989-90 and the decadal changes in growth rates of area, production and productivity of major crops of Kerala. Despite the fact that the value of the agricultural product per unit of land in Kerala is one of the highest in the country because of diverse crop combination.


Bhatnagar and Nandal (1994)\(^6\) addressed about the growth of wheat in Haryana. The result suggested that the growth rates of wheat for a period of 25 years (1966-67 to 1990-91) were found highly significant. Interaction between area and yield had played a significant role in increasing the production of wheat. Further, the production has increased to a larger extent by adoption of high yielding varieties of wheat, good irrigation facilities, good consumption of fertilizers, adoption of proper technology and also good harvesting price of wheat. Thus, wheat being a relatively much less risky crop as compared to other Rabi crops impetus the farmers to increase the area under wheat.

Naidu et al., (1994)\(^7\) points out the trends in area, production and productivity of major crops in Andhra Pradesh. They found that the time series analysis from 1980-81 to 1989-90 indicated high productivity of rice per unit of area in Srikakulam district and increase in area under groundnut in all the three districts viz., Srikakulam, Vizianagaram and Visakhapatnam. They also concluded that ragi and bajra based cropping system was slowly fading away and in its place the more remunerative commercial crops like groundnut and sugarcane were creeping in. Though the sesamum and mesta were other important crops of this area, better deal to be given to these crops for better production and productivity. Setting up of a full-fledged groundnut research station may be highly helpful to the oilseed farmer of this tract.

Singh and Singh (1994)\(^8\) estimated the growth of agriculture in Punjab. The paper shows that Punjab had made a remarkable progress in agriculture. The need of the day was to sustain agricultural productivity. Over-exploitation of underground water was a matter of great concern to agricultural scientists and the Government. Area under protective food crops like pulses had declined. There was a need to increase area under leguminous crops so that they may enrich the soil with nitrogen. Besides chemical fertilizers use of organic manures should also be encouraged.


Ghosh and Neogi (1995)\textsuperscript{9} carried out the supply response of foodgrains and policy actions. They made an attempt to study the growth of per capita production of rice, wheat and foodgrains as a whole and to find out the possible connection between different policy actions of the government, on the one hand, and production and marker prices, on the other.

Mander and Sharma (1995)\textsuperscript{10} dealt with production performance of cereal crops in India. The data for the study were obtained from statistical Abstracts of India for the years 1966-67 through 1988-89. The growth rates of production, area and yield of important cereal crops such as rice, jowar, maize, bajra and wheat for different States were worked out by making use of an exponential function.

Sharma and Joshi (1995)\textsuperscript{11} discussed about the performance of rice production and factors affecting acreage under rice in regions of India. For the purpose of this study, secondary data on acreage, production and yield of rice in different traditional coastal and non-traditional rice growing regions were collected from different published sources for the periods 1970-71 to 1988-89. Compound growth rates of acreage, production and yield of rice were worked out by fitting exponential functions.

Maheshwari (1996)\textsuperscript{12} assessed the agricultural growth in Karnataka. She used the kinked exponential estimates of rates of growth to arrive at more complete picture of trends, it was found that in Karnataka the yield increased brought about by HYV seeds were not really revolutionary. These findings pointed out the importance of water management in a semi-dry area like Karnataka in maintaining growth in the agricultural sector.


Misra and Panda (1996)\textsuperscript{13} analyzed the development of agriculture in Orissa during eighties and indicate the strategy that need to be followed in the nineties. They found that the growth rate of agricultural production had shown no significant increase during 1969-70 to 1981-82. However, the recent development in production is not so unsatisfactory. The growth rate of production and yield of all the crops was found quite significant.

Prasad et al., (1996)\textsuperscript{14} assessed the growth pattern in area, production and productivity of rice crop and also found out the causes for disparities in rice yield in Karimnagar district of Andhra Pradesh. In order to find out the growth pattern they collected secondary data from season and crop reports and computed compound growth rates with help of exponential function. They also collected the primary data to prove the yield discrepancies. They found that the co-efficient of variation of area, production and productivity were found to be by and large stable in the study area. They also found that the soil type, soil fertility and irrigation sources were the reasons for yield disparities in the sample area.

Singh et al., (1996)\textsuperscript{15} analyzed the growth behaviour of agriculture in the State of Madhya Pradesh. They also used the exponential form of the function. Their study covers two short-run and one long-run period to analyze the growth behaviour. They found that the growth rates of area, production and productivity of most of the crops were statistically significant during short-run. Their analysis revealed that there was a need to minimize acreage fluctuations via expanding irrigational network.

Tripathy (1996)\textsuperscript{16} made an attempt to find the growth and trends in area, yield and production of rice in Orissa. The results of the present study indicated that the output of


rice during the post-green revolution period grew at an annual rate of 1.43 per cent and this was contributed solely by per-hectare yield. Area under rice experienced deceleration due to diversion of area to oilseeds and pulses.

Bhalla and Singh (1997)\textsuperscript{17} highlighted the results of an analysis of state level data on area and output of 43 crops for the years from 1962-65 to 1992-95. It revealed that there was a marked acceleration in the growth rate of agriculture output in India during 1980-83 to 1992-95 as compared with the earlier periods. Furthermore, Agricultural growth had become regionally much more diversified.

Dhindsa and Sharma (1997)\textsuperscript{18} attempted to analyze the growth behaviour and factors influencing the supply of various pulse crops in Punjab. The specific objectives of the study were (a) to study the growth of area, production and yield of various pulse crops in Punjab during 1966-67 to 1991-92, (b) to examine the acreage response of various factors determining the decisions regarding allocation of land among different pulse crops in Punjab and its various sub-regions, (c) to estimate the short-run elasticities of acreage under various pulse crops with respect to various price and non-price factors and (d) to suggest measures to increase the production of pulse crops in the state.

Kalirajan and Shand (1997)\textsuperscript{19} studied the sources of output growth in Indian agriculture. They observed that TFP growth in the pre-reform period was negative in four out of 15 states and that, by the end of the decade, it was small for those states where the contribution of TFP growth was positive. The contribution of technology (in its two components) to output growth declined substantially, particularly from 1988 to 1990.

Sawant (1997)\textsuperscript{20} presented an update of growth performance of India’s agricultural sector for the green revolution period. He focused on the national and state


level analysis of aggregate growth performance, i.e., of crop and livestock sub-sectors combined, elaborates evaluation of growth in the crop sector and emerging regional patterns of growth and diversification.

Shiyani and Pandya (1998)\textsuperscript{21} measured the diversification of agriculture in Gujarat. They concluded from the results presented in this study that there existed wide spatiotemporal disparity in the acreage allocation under different crops. In general, the farmers had shifted their cropping pattern from the subsistence crops to the commercial crops. On an average, relatively higher growth rate of acreage under tur, castor, rapeseed-mustard, sugarcane, maize and wheat were found in different agro-climatic sub-zones of Gujarat, whereas negative compound growth rates of acreage under pearl millet, jowar and cotton were noticed in most of the zones.

Srivastava (1998)\textsuperscript{22} examined the agricultural development in Bihar in the context of performance of agriculture during the period 1970-71 to 1991-92; potential generated and constraints inhibiting agricultural development and strategy for agricultural development. He found that there was a decline in the net area sown during the latter parts of his study.

Brothakur and Bhattacharyya (1999)\textsuperscript{23} used compound growth rates which computed for area, production and productivity of rice based on the exponential function for three periods [viz., pre-green revolution period (1951-52 to 1970-71), post-green revolution period (1971-72 to 1993-94) and the total period (1951-52 to 1993-94)]. Although, the high yielding varieties were introduced in the State of Assam during 1965-66, its impact was felt only after 1971-72. Hence, the period 1951-52 to 1970-71 was considered as the pre-green revolution period.


Chugh and Satyapal (1999)\textsuperscript{24} evaluated that the data had been indexed on base year (Triennium ending 1974-75). Use had been made of linear and exponential models for the estimation of growth rates. Comparison had also been made on the growth rates of production, between the States and within the period of his study.

Chattopadhyay and Das (2000)\textsuperscript{25} estimated of growth rate in West Bengal agriculture. They found that the rainfall did not have any significant effect on agricultural production and, the recent developments in West Bengal agriculture was lopsided. Only a few crops had dominated the field of the farmers by elbowing out other crops, like high protein pulses, wheat etc., and the locational base had also not been widened.

Dashora et al., (2000)\textsuperscript{26} enquired about growth in production of important pulse crops in Rajasthan. They found that the output growth in aggregate pulse crops was positive but non-significant in the overall period. The contribution of area in the aggregate pulse crops output was 53 per cent while that of yield was 22 per cent.

Joshi et al., (2001)\textsuperscript{27} focused about the agricultural performance in semi-arid tropics of India. This study concluded that the performance of superior crops, like rice and wheat, was remarkable, while that of inferior crops, like pearl millet and sorghum, was quite dismal. Pearl millet-sorghum, cotton-sorghum, and sorghum based cropping systems proved to be the systems of low-income and higher risk in comparison to rice, and rice-wheat based cropping systems.

Pillai (2001)\textsuperscript{28} highlighted paddy productivity growth in West Bengal and Orissa. She found that input productivity had indeed played an important role in the growth performance in the 1980s and early 1990s in this region. While growth in inputs and total


factor productivity had contributed significantly to the output growth in both the states, the performance of West Bengal had been better than Orissa. This improvement in input productivity in West Bengal had been brought about both by efficiency and technology in the presence of variations across seasons and seed varieties. Improvements in production technology were apparent between 1986-87 and 1990-91. Although use of inputs and technical efficiency increased over time, it had not been as dramatic as the improvement in the state of production technology.

Singh and Chandra (2001)\(^{29}\) analyzed the growth trends in area, yield and production of food grains in Uttar Pradesh. They found that the state of Uttar Pradesh had registered a considerable change in agricultural development during different phases of the green revolution. Introduction of High Yield Varieties of major crops in the State in the mid-seventies paved the way to significant rise in foodgrains production. The growth rate in production was low during the green-revolution period compared to post-green revolution era.

Singh and Chandra (2001)\(^{30}\) studied the agricultural productivity in Madhya Pradesh. The authors found that the food grains production in the state increased from 5.896 to 17.41 million tones during 1951-52 to 1996-97 achieving an annual growth of 2.38 per cent. Although, the yield during this period increased from 461 to 1105 kg/ha but this is still very low compared to all-India average of 1614 kg/ha. The low yield was found due to lower use of agricultural inputs mainly fertilizer and irrigation water. The analysis has revealed that fertilizer consumption in the state increased. Yearly growth of fertilizer use in the state has been erratic and low compared to all-India growth trend.

Ramasamy and Selvaraj (2002)\(^{31}\) observed the reasons for the slow growth of pulses, oilseeds and coarse cereals. The paper showed that the growth in pulses and oilseeds production had not kept pace with the population growth, resulting in an overall decline in per capita availability and generally higher prices for pulses and edible oils.


Sarkar and Chakraborty (2002)\textsuperscript{32} examined the growth crisis of food grain production in West Bengal. The study concluded that the growth in the food grain area, production and yield trends in the State of West Bengal had decreased significantly during Reform Period and Overall period. This was mainly due to the significant decrease of the growth in rice production and yield trends and pulse area, production and yield trends, during reform period compared to the Pre-reform period, although production and yield growth of pulse crop were negative during Pre-reform period.

Singh and Kumar (2002)\textsuperscript{33} addressed to India had made impressive strides on the agricultural front during the last three decades. Much of the credit for this success should go to the several million small farming families that formed the backbone of Indian agriculture and economy. Policy support, production strategies, public investment in infrastructure, research and extension for crop, livestock and fisheries had significantly helped to increase food production and its availability.

Bharti et al., (2003)\textsuperscript{34} reported the growth of pulses in India. They declared that India was a major player in the world pulses market. It was not only the largest producer of pulses, but also biggest consumer. Though there was greater importance of pulses for Indian consumers, its performance had been dismal in the last five decades due to a number of constraints like their cultivation on rainfed and marginal lands, high susceptibility to insect, pests and diseases, weather aberrations, lack of genetic break through, diversion of pulses area to other more remunerative crops, etc. there was a wide gap between the demand for and supply of pulses in India.

Haridoss (2003)\textsuperscript{35} examined the inter-district variations in foodgrains production in Tamil Nadu. He concluded that Thanjavur had no model district. In foodgrains production, Pudukkotai alone had reached more than potential target apart from

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\textsuperscript{32} Sarkar, Bebnarayan and Sanjukta Chakraborty, (2002), “Growth Crisis of Foodgrains in West Bengal”, \textit{Agricultural Situation in India}, Vol. LVIII, No.11, pp: 511-516.

\textsuperscript{33} Singh R. B., and Praduman Kumar, (2002), “Acceleration of India’s Agricultural Growth during the Tenth Five Year Plan and Beyond”, \textit{Agricultural Situation in India}, Vol. LIX, No. 5, pp: 259-266.

\textsuperscript{34} Bharti, D. K., L. S. Gangwar, Ashwani Kumar and Sandeep Kumar, (2003), “Analysis of Growth of Pulses in India – Last Five Decades”, \textit{Agricultural Situation in India}, Vol. LX, No. 6, pp: 511-516.

\textsuperscript{35} Haridoss, R., (2003), “Inter-District Variations in Foodgrains Production in Tamil Nadu”, \textit{Agricultural Situation in India}, Vol. LIX, No. 11, pp: 673-684.
Thanjavur district. In the case of area under foodgrains production, the district actually realized than the computed targets were Cuddalore, Villuppuram, Thiuvannamalai, Salem and Dharmapuri. It was also evident that the districts except Villuppuram, Coimbatore, Erode, Tiruchirapalli, Thanjavur and Tirunelveli had not achieved potential target in the utilization of fertilizer. Regarding the foodgrains productivity Thiruvarur, Nagapattinam and Madurai districts had exceeded the targets. Cropping intensity was found to exceed the target values in the districts of Salem, Dharmapuri and Thiruvarur. Therefore, Thanjavur was a model district for other districts in the foodgrains production in Tamil Nadu. The Kanniakumari district was lagging behind in the pattern and measure of development of foodgrains production in Tamil Nadu.

Shah (2003)\(^{36}\) investigated the slow growth foodgrain crops in Maharashtra. The findings of the study showed tremendous increase in pulses output over the past decade and a half in majority of the pulses growing regions of Maharashtra. Both yield and area expansion had contributed to this increase in pulses output. However, coarse cereals had shown very slow growth in their output, especially after the late eighties period. Although there had been perceptible rise in yield of coarse cereals over time, this yield expansion could not raise coarse cereal output as majority of the regions of Maharashtra had shown a decline in area under these crops. In fact, the effect of area reduction was so intense that it had outweighed the effect of yield expansion and consequently there had been a very slow growth in output of coarse cereals.

Srivastava et al., (2003)\(^{37}\) made an attempt to know about the growth in area, production and productivity of pulses in eastern Uttar Pradesh. They estimated the Compound growth rates by fitting the exponential function to the district-wise data. They found that arhar production declined at a compound rate of 0.3 per cent per annum in the study area. This was mainly due to the negative growth in productivity.


Kumar and Jain (2004)\textsuperscript{38} analyzed the growth pace in foodgrain production and resource use for major grain producing States of India. More specifically the objectives of the study were:

1. To study the growth behaviour in foodgrain production;
2. To study the growth behaviour in resource use in agriculture, and
3. To highlight the policy implications of the study.

Jahanmohan et al., (2005)\textsuperscript{39} investigated the growth performance of agriculture in agro-climatic zones of Tamil Nadu. This was organized into five sections viz., section I gave the introduction; section II depicted methodology including sources of data; section III explicited the outcome of the study; section IV summarized the results with conclusion and section V provided the references. Compound growth rates of area, production and productivity of the crops were worked out by fitting exponential function for all the periods separately.

Kumar et al., (2005)\textsuperscript{40} enquired into the production performance of maize crop in northern India. The study was mainly based on secondary data pertaining to area, production and yield of maize crops. These secondary data were collected from the Directorate of Economics and Statistics (DES), Government of India, various issues of Economics Survey, and other published sources. This study pertained to the traditional maize growing States of Punjab, Uttar Pradesh, Bihar, Rajasthan, Madhya Pradesh and Orissa, which together account for about 60 per cent of the maize area.

Tuteja (2006)\textsuperscript{41} analyzed the growth performance in terms of area, production and yield of five important pulse crops (gram, arhar, moong, urad and massar) along with


total pulses at the all India level. She concluded that the all India pulse production grew at the dismal rate of 0.7 per cent per annum.

Alagh (2007)\textsuperscript{42} studied the macro story of faster growth of the agricultural sector since the eighties. Also growth was sourced by yield in the eighties with area showing no growth. This study concluded that the cropping patterns were different and different areas, also because these factors were of a long term or permanent nature and there was a kind of basic stability in cropping patterns. They changed because of economic reasons or technological reasons—but the change was slower.

Tuteja (2007)\textsuperscript{43} discussed about the need for second green revolution in India. The author concluded that India needed second green revolution to bring food security to its billion plus population, to remove distress of farming community and to make its agriculture globally competitive.

Lawwa and Kumar (2008)\textsuperscript{44} measured the growth performance of oilseeds by calculating the compound growth rates, variability and decomposition analysis. The requisite time series data on area, production and yield of oilseeds crops were collected from Agricultural Department, directorate of economics and statistics Rajasthan etc. For measuring the compound growth rates (CGR) in area, production and yield, log-linear equation was used.

Dalwai (2012)\textsuperscript{45} analyzed the dynamics of agricultural growth in India. He concluded that India today has 1.21 billion people and is expected to overtake China and become the world’s most populous country by 2025. This world put tremendous pressure on natural resources and government would have a challenge in providing food, water, health, shelter, sanitation and jobs to all. The challenge is to channelise the additional world force to accelerate the growth of agriculture in the country, by madding it a modern enterprise with appropriate infusion of capital, technology, skilled resources and relevant reforms.

Sharma (2012)\textsuperscript{46} observed the India’s agricultural development under the new economic regime. He found that more than half of the workforce is still engaged in agriculture for their livelihoods and employment, agriculture continues to be a predominant sector of the Indian economy, even though its share in national gross domestic product has declined in recent years. Rapid growth of the non-agricultural sectors, particularly services, in post-reforms period has failed to accelerate agricultural growth or poverty reduction. During the last two decades Indian agriculture has been facing major challenges like deceleration in growth rate, degradation in growth rate, degradation of natural resources, inter-sectoral, inter-regional equity, declining input efficiency, etc.

3.3 Studies Focused on Growth and Instability in Agriculture

Panda (1992)\textsuperscript{47} dealt with growth and instability in the agriculture of Orissa. He found that the analysis revealed positive association between higher growth in yield and higher fluctuations in case of oilseeds. Only in the Eastern Ghats a little deviation was noticed where higher yield growth in oilseeds associated with lower degree if instability.

Kaushik (1993)\textsuperscript{48} points out the growth and instability of oilseeds production. He revealed that the fluctuation in yield was the major cause for the fluctuation in the output and hence the fluctuations in yield had to be controlled to bring kin stability in the output. This would mean concerted research efforts in developing new varieties of oilseeds whose yield potential was stable across different agro-climatic regions. These new varieties of seeds had not only to be high-yielding even under adverse weather conditions but will also have to be disease and pest resistant. The prime concern of farm scientists should be to increase the competitiveness and profitability of oilseeds with that of other field crops.


Tripathy and Gowda (1993) observed that growth, instability and area response of groundnut in Orissa. They identified that area was the dominant source of growth of output during the post-green revolution period. The per hectare yield of groundnut was almost stagnant in the state. Efforts should be directed to increase productivity through development of suitable varieties for different agro-climatic zones by applying recommended fertilizer and pesticides and bringing more area under irrigation during rabi season. The results of the empirical findings of the study emphasis yield stabilizing policies in Central, Eastern Ghat and Northern zones of the state. Concerted efforts should be directed towards strengthening research and extension system and increasing the irrigation facilities in the state to stabilize the productivity of groundnut.

Jha (1994) found that instability in gross return and yield largely declined over years. The decline in yield instability in crop viz., paddy and wheat was brought about with increased area under irrigation over years. Nevertheless, Government’s consistent price policy also helped in reduction of instability in farm harvest prices. Thus, it can be inferred that with new technology, instability in agricultural income reduced with adequate irrigation facilities and consistent price policy. However, the second hypothesis of high instability in agriculture accompanied with high growth rate was established.

Singh and Mathur (1994) analyzed the growth and instability in the production and price of potato in India. They found that the production of potato increased rapidly mainly due to the significant high growth of area in the major growing states. Yield also showed a rising trend but its growth was low in some of the states. Hence, there was a need to raise the yield by the use of improved seeds and package of practices as recommended by the extension organizations of the regions. For storing a semi-perishable commodity like potato, cold storage capacity, particularly on the public and cooperative sectors, should be expanded by the Government.

Ali and Singh (1995)\textsuperscript{52} conducted a study on growth rates and variabilities in area, production and productivity of wheat crop in Chhattisgarh Region and its constituent districts as well as the State of Madhya Pradesh as a whole using time-series data from 1970-71 to 1989-90. For the purpose of analysis, standard statistical techniques of coefficient of variation and linear regression models were employed. Their analysis reveals greater variability in area, production and productivity of wheat.

Jain et al., (1996)\textsuperscript{53} made an assessment of instability of oilseed production in Bundelkhand agro-climatic zone of Madhya Pradesh. They concluded that the contribution of area to production was more evident rather than the yield. Moreover, their analysis revealed that mere extension of area under oilseed crops will not solve the problem of increasing the production, but adequate attention had to be paid to increase the productivity of the oilseed crops. Further, in view of major contribution of soyabean in Guna and groundnut in Shivpuri districts towards total oilseeds of the zone, immediate necessary measures were needed to increase the productivity levels of the crops in the districts.

Vani and Vyasulu (1996)\textsuperscript{54} analyzed the growth, variability and instability of three cereal crops, viz., rice, ragi and jowar, Karnataka with reference to the following questions: What had been the performance of different districts with respect to area, production and yields of these three crops? Had the trend in their production decelerated in 1980s? Had the green revolution brought variability and instability in their yields?

Barmon (1997)\textsuperscript{55} tried to find the production behaviour of pulses in Assam. He found that the State of Assam is endowed with fertile soil, abundant rainfall and favourable climate and as a result varieties of crops are grown in the State. But the production of


pulses in Assam has not been satisfactory. Against the total foodgrains production of 33.80 lakh tones in 1991-92, pulses accounted for only 3.54 lakh tones, which show that the contribution of pulses in the total foodgrains production is quite insignificant.

Reddy (1997) estimated the inter-regional and temporal variations of costs, productivity of growth of paddy in Andhra Pradesh. He analyzed the economics of paddy cultivation in the 1980s in Andhra Pradesh, which revealed the following significant findings: the relatively lower prices of modern inputs, viz., fertilizers and tractors in relation to those of traditional inputs, namely manures and bullock labour, which were partly due to subsidies given to modern inputs had enabled the farmers to substitute modern inputs for traditional inputs and thereby to obtain higher yields at lower costs.

Sardana et al., (1997) enquired into the agricultural performance of different districts (regions) of Haryana during the green revolution and post-green revolution periods, its growth and variability and the important factors determining its performance. This study concluded that there had been reduction in disparities among districts of Haryana with regard to agricultural performance (value of agricultural produce per hectare) during the last 25 years. The potential for growth in agricultural performance with the existing technology lied in the backward districts.

Singh et al., (1997) tried to examine temporal and spatial performance of important foodgrain and non-foodgrain crops in terms of area, production and yield and the factors responsible for determining yield and acreage of important foodgrain crops across the states and the country.

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Shukla (1998)\textsuperscript{59} addressed the growth and instability of pulses production. It was an inter-state analysis. He concluded that area and production of tur and other pulses was increased marginally while area under gram was shrinking. However, the production of gram was found constant because of slight increase in yield during last two decades. The stagnation in yield of pulses was observed because of low input use and growing of this crop under unirrigated conditions.

Radha and Prasad (1999)\textsuperscript{60} analyzed the variability and instability of area, production and productivity of rice and maize in Northern Telangana Zone of Andhra Pradesh. They found that in maize, the area was found to be decreased during ex-post NARP over ex-ante, but the mean values of production and yield exhibited a positive change. Though the coefficients of variation was found to be increasing in areas and yield, the production variation decreased i.e., attaining stability of maize production was observed during the second period.

Krishnamoorthy and Reddy (2002)\textsuperscript{61} examined the question of growth and instability in exports and imports of India over a two-decade period ranging from 1980-81 to 2001-02. Regression results relating to these two variables had been reported both in rupee and dollar terms. They attempted a granger causality test between growth and instability of exports and imports in India over a longer period namely 1949-50 to 2001-02. The results however remained inconclusive.

Shiyani (2002)\textsuperscript{62} examined the growth and instability of inland fish production in Gujarat. He used ratio percentage methods to estimate relative share of different species in total production. In order to examine the period-wise trend of fish production linear and exponential function was finally selected considering the higher value of coefficient of determination (R\textsuperscript{2}).


Singh and Srivastava (2003)\textsuperscript{63} addressed the growth and instability in sugarcane production in Uttar Pradesh. This study made use of time-series data on area, production and productivity of sugarcane for western, eastern and central (including Bundelkhand) regions as well as for the state with reference to the period, 1980-81 to 1998-99 and was based on the data available from secondary sources. Semi-log equations were fitted to estimate compound growth rates in area, production and productivity of cane. Instability in area, production and productivity was measured through coefficient of variation analysis using de-trended data. The production instability was also decomposed to examine the magnitude of various components of regional sugarcane production variability.

Job and Nandamohan (2004)\textsuperscript{64} estimated the rice production in Kerala. This analysis was primarily based on secondary data. Time series data on area, production and productivity were complied from the various issues of “Statistics for Planning” and “Economic Review” published by the Bureau of Economics and Statistics, Government of Kerala and Kerala State Planning Board, respectively. In this study an exponential trend, which approximately beat uniform rate of growth, and log quadratic trend, which was an extension of an exponential equation by adding a quadric term were used.

Kumar and Badal (2004)\textsuperscript{65} evaluated the State level time series data on area, production and yield of various fruits and vegetables for the period 1991-92 to 1999-2000 were obtained from various issues of Horticulture Production Year Book, National Horticulture Board, Ministry of Agriculture, GOI, New Delhi. Compound Growth Rate of area and productivity was computed using this study.

Shaheen and Shiyaní (2004)\textsuperscript{66} emphasized that growth and instability of Fruit Crops in Jammu and Kashmir. The study was based on the secondary data collected from

published sources. The district-wise time series data pertaining to area, production and yield of fruit crops were scanned from Directorate of Horticulture, Srinagar, Government of Jammu and Kashmir (J & K). The study also gives the instability index (I.I) given by Cuddy Della Valle (1978) which corrected the coefficient of variation.

Lakshmanan et al., (2005)\(^{67}\) studied the growth and instability of pulse economy in India. They concluded that area and production of Arhar and other pulses was increased marginally while that of Gram was shrinking. However, the production of Gram was found constant because of slight increase in productivity during the last two decades. A stagnation in yield of pulses was observed because of low input use and growing this crop under unirrigated conditions.

Kumar and Sharma (2006)\(^{68}\) evaluated government price policy in controlling food price variability using monthly indices of wholesale prices of wheat, rice and coarse-grains. Annual price analysis showed that inter-year variability in annual nominal prices declined for both wheat and rice in the nineties as compared to eighties. The variability declined for the real price of rice also but the real price of wheat and nominal and real prices of coarse grains displayed increased variability during the 1990s in comparison to 1980s analysis of monthly prices revealed that intra-year variability shot up for wheat while it came down for rice during the nineties in comparison to eighties.

Sadeesh et al., (2006)\(^{69}\) focused the growth and instability of major oilseeds in India. The study was based on the time-series data of area, production and yield of the major oilseeds in India for the period of 1971-72 to 2002-03. The statistical information pertaining to the period under study was gathered from www.indiastat.com. This study covered the period from 1971-72 to 2002-03 including the implementation of Technology Mission on Oilseeds in 1986. For analyzing the data, they used compound growth rates and co-efficient of variation.


Swain and Bhakar (2006)\textsuperscript{70} analyzed the trends in the area, production and yield of some common commercial crops, cereals and pulse crops growth in Rajasthan. They also focused on the degree of fluctuations in the growth of area, production and yield of commercial crops.

Swain (2007)\textsuperscript{71} studied the trends and variability in the growth of oilseeds production in Rajasthan. The study concluded that production of most of the oilseeds have increased mainly due to the area expansion. Thus he suggested that the level of oilseeds production can be increased in future only by increasing the yield rather than the area under oilseeds in Rajasthan. The study also concluded the existence of acutely high degree of variability in the growth of area, production and yield of oilseeds in the state which can be warranted through regular provision of irrigation facility, HYV seeds, fertilizers and different other pre and post harvesting measures to the cultivators by the Government under the kind patronage of technology mission on oilseeds (TMO).

Hasan et al., (2008)\textsuperscript{72} measured the change and instability in area, production, and yield of two major cereal crops wheat and maize in Bangladesh based on secondary data during 1980/81-2003/04 using different statistical techniques. They found that area and production of wheat increased satisfactorily. But yield was not increased to meet the demand of the country. In the case of maize, significant increment happened in yield during the study period. Area and production of maize also increased to fulfill the increasing demand of population. Presently production of maize increased more rapidly than its area. They also found that the growth in area, production, and yield of wheat slightly improved in period-II, whereas the growth rate in area, production, and yield of maize improved rapidly. Though both of wheat and maize are unstable crops, maize showed very instability in its area and production because of its increasing tendency in the recent years.


Jhagrawat and Varghese (2008)\textsuperscript{73} enquired into agricultural production growth and instability during new economic regime in Rajasthan. This study concluded that the crops maize, barley, arhar, groundnut, rapeseed and mustard, mango, papaya and guava were found to have positive growth in production due to positive growth in yield in Rajasthan during new economic regime. The crops wheat, maize, bajra, jowar, barley, moth, groundnut, rapeseed and mustard, corriander, mango, papaya and guava were found to have positive growth in yield with positive yield effect in the increased production of these crops.

Roy (2008)\textsuperscript{74} examined state wise growth rates and fluctuations in terms of total agricultural production on India during 1970-1971 to 2000-2001. the broad findings of this study included (1) a tendency towards deceleration in the growth of total agricultural production in India in recent years; (2) tolerable impact of green revolution on crop-output fluctuation; (3) absence of definite pattern with regard to the association between growth and fluctuation, and; (4) the major driving force behind the output growth and fluctuation in productivity hence the technological improvement.

Chand and Raju (2009)\textsuperscript{75} discussed about the instability in Indian agriculture during different phases of technology and policy. They found that when a longer period was taken into consideration, which witnessed spread of improved technology to large area, the inference on increase in instability due to adoption of new technology gets totally refuted at country level.

\textbf{3.4 Studies Focused on Decomposition of Sources of Instability}

Hazell (1982)\textsuperscript{76} employed variance decomposition model to investigate the sources of instability in cereal production in India. He reported that the variance of total production growth in India during 1970-1971 to 2000-2001 was decomposed into five components: (1) technology, (2) environment, (3) policy, (4) price, and (5) population. The results showed that technology was the dominant factor in determining the growth of cereal production in India.


cereal production increased by 342 per cent between 1954-65 and 1967-78 and 82 per cent of this variance was due to increase in co-variance of production between crops grown in different states. He pointed out that as continued growth in food grain production is of paramount importance to India, the most promising approach is to focus on maximizing growth and to offset the resulting effects of increased production instability through policies designed to stabilize consumption rather than production.

Jamal and Zaman (1992)\textsuperscript{77} analyzed the growth trend in agricultural value of output. It tried to decompose the growth into several components which could build a framework for reflective speculation on some policy alternative. The main purpose of the paper was to modify the existing methodology and to give a clear picture of all components. This objective was achieved by dropping explicit ‘pooled-effect-term’ from the scheme through further decomposing the conventional ‘residual term’ by introducing some new indices of price, quantity and yield changes and by using logarithm to make the analysis more convenient for interpretation.

Patel and Agarwal (1994)\textsuperscript{78} examined the extent of instability existing in the production of groundnut in Gujarat. The study concluded that the production performance of groundnut oilseed in the Gujarat state had not been an encouraging one. Growth rates of its production in the state as well as in districts were negative during both the time periods. This was mainly due to negative growth rate in productivity of the crop whereas area under the crop has not shown any significant change overtime.

Nagaraj and Gowda (1997)\textsuperscript{79} made an attempt to know about the growth and instability in the area, production and productivity of safflower in Karnataka. They used district-wise time series data on area, production and yield of safflower and other related agricultural statistics. They found that the production of safflower in the State was destabilized due to interaction between changes in mean yield and area variances implying that increase in mean yield results in greater variability of area.


Tripathy and Mishra (1997)\textsuperscript{80} found that growth and instability of Ragi production in Orissa. They identified that during post-green revolution period, area was the dominant source of output growth of ragi in the State as well as district level. As area expansion has limited scope, effort to increase per hectare yield will be major thrust in increasing ragi production in the State in future. The stagnation of per hectare yield of ragi calls for development of varieties suitable to agro-climatic zone and application of higher dose of inputs.

Siju and Kombairaju (2001)\textsuperscript{81} estimated the rice production in Tamil Nadu. They found that an increased trend of production and productivity had been observed. In the pre-green revolution period, the growth in production was solely due to increase in area under rice in the state. In the post-green revolution period area showed a decreased trend even though the rate of decline was statistically not significant. In the post-green revolution period productivity showed positive and significant growth. The decline in area was more than compensated by increase in productivity and hence, production registered positive growth during the post-green revolution period.

Kalamkar et al., (2002)\textsuperscript{82} dealt with coarse cereals and pulses production in India. They concluded that the area under total coarse grains had significantly declined whereas area under total pulses had been stagnanted over a period of time. The magnitude of reduction in area under barley, small millets and jowar had been quite substantial where it was only marginal in case of bajra and ragi. There had been marginal increase in production and yield of coarse grains and pulses during period of time.

Salim and Ananthan (2003)\textsuperscript{83} made an attempt to find out the sources of growth and variability in Indian marine products exports. They employed Hazell’s decomposition model and found that that the contribution of change in mean export quantity was the highest among the other components of change. Their findings also


indicated that, the revenue had been generated primarily from the changes ill the export quantities and interaction between the export quantity and export value with no sizeable contribution and realization from the unit value.

Alemu (2005)\textsuperscript{84} conducted a study to measure the causes of instability in cereal production in Ethiopia. In this study the extent of instability in cereal production was analyzed by computing the following statistics, namely average production, coefficient of variation (CV), and F-statistics. The CVs were computed based on results on the fitted trend lines of polynomials of different order. He found that production instability was caused more by increased yield instability than instability in an area. Yield instability could be the result of changes in technology, changes in policy and changes in weather conditions. It was concluded by this study that instability regarding yield was predominantly the result of weather variability.

Manjumdar and Basu (2005)\textsuperscript{85} conducted a study of growth composition of foodgrains output in West Bengal. The main sources of data for this study were from the various issues of Economic Review and Statistical Abstract published by Government of West Bengal. The data used for this study were the state and district level output, yields, area and harvest prices of the different foodgrains. Aus rice, aman rice, boro rice, wheat, barley, gram and other pulses are considered in the foodgrain items. The average farm harvest price of the three normal years (1987, 1988, 1989) had been taken as constant price weight. As the harvest price for the other pulses were directly available, an estimate on the basis of price ratio to similar crops had been made for the analysis.

Reddy (2005)\textsuperscript{86} examined growth and instability of chickpea production at state and national level. The study pertained to major chickpea growing states and the country as a whole. Time series data on chickpea production area and yield for these states for 33 years was collected from Directorate of Economics and Statistics of the Ministry of

\textsuperscript{84} Alemu, Z. G., (2005), “Causes of Instability in Cereal Production in Ethiopia”, \textit{Working Paper}, Department of Agricultural Economics, Faculty of Natural and Agricultural Sciences at the University of the Free State, Ethiopia.


Agriculture, Government of India. For calculation of Compound Growth Rate (CGR), Coppocks Instability Index (CII) and decomposition of change production and variability, whole period was divided into two sub periods.

Meenakshi and Gayathri (2006)\textsuperscript{87} measured instability in cereals production. They identified that change in the interaction between change in mean area and yield variance had been an important contributor to the cereals production instability in Tamil Nadu state. Therefore, efforts should be made to stabilize cereals production in the state.

Sharma et al., (2006)\textsuperscript{88} carried out a study on the extent and source of instability in foodgrains production in India. They found that an increase in average production of major food grain crops, namely, rice, maize, bajra and pulses and total food grains in the nineties over eighties. The decomposition of change in average production further revealed that increase in mean yield was the most important source of increase in the average production of individual crops and total foodgrains. The notable exceptions were jowar, small millets and ragi where increase in area was an important source of increase in average production.

Mahir and Abdelaziz (2011)\textsuperscript{89} conducted a study to measure the extent of instability and contribution of different components to change in mean production of the main crops grown in the Gezira scheme. They used time series data covering the period before the adoption of liberalization policy (1970/71 to 1991/92) and the period after the adoption of liberalization policy (1992/93 to 2007/08). The main crops included in the study were sorghum, wheat, cotton and groundnuts. They found that changes in mean yield accounted for large shares of the change in mean production of wheat and sorghum but change in mean area contributed largely in cotton and groundnuts. Furthermore, their analysis showed that changes in the variance of yield accounted for large share of


changes in the variance of production for sorghum, while for wheat the large share was due to variance of area. The changes in the residual term were important in explaining the changes in the variance of production in the case of groundnuts.

### 3.5 Other Related Studies

Sharma (1992)\(^9\) examined the Indian cereals economy was net subsidized by estimating Producer Subsidy Equivalent (PSE) of rice, wheat, sorghum and maize at region-specific level. First he examined an overview of the government intervention in cereals economy. Then he presented the methodology for estimating PSEs and the results were presented. Policy implications followed finally.

Bhalla (1995)\(^1\) examined the implications of globalization of Indian agriculture, keeping in view the dimensions of domestic demand and supply of foodgrains and some other important agricultural commodities in India. Therefore globalization of Indian agriculture offered both opportunities and challenges to the policy makers. There do exist opportunities for deriving large benefits through massive increase in agricultural exports specially exports of high value labour intensive allied agricultural products.

Arya and Maheshwari (1996)\(^2\) analyzed the agriculture production and productivity trends in the region comprising Haryana, Rajasthan, Gujarat and the Union territories of Daman & Diu, Dadra and Nagar Haveli. In view of the agricultural problems being faced by these states and union territories they suggested a national research agenda for these regions.

Gopalappa (1996)\(^3\) emphasized the crop diversification and income levels in Karimnagar district of Andhra Pradesh. He found that there was a significant change in

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the income levels and standard of living of the marginal and small farmers due to diversification of the farm activities. To achieve these, the farmers had to be supported by means of financial assistance and extension service.

Kumar and Mathur (1996)\(^{94}\) examined the changes in the consumption pattern and decomposed the changes in consumption due to price, income and non-price (structural shifts) factors. They concluded increase in the demand for non-cereals and non-crop commodities vis-à-vis cereals would provide incentives to the producers to diversify their production. The extent of diversification due to structural changes in consumption would be compounded by increased demand for the export market, especially for fruits, vegetables, and marine products as a result of new economic policies and globalization.

Pandey and Sharma (1996)\(^{95}\) attempted to make the evaluation with a view to examine the conflict, between crop diversification and self-sufficiency in foodgrains. The timeframe for the analysis related to the post-green revolution period in which the role of technological changes had been prominent and also held the promise future.

Radhakrishna (1996)\(^{96}\) conducted a study of food trends, public distribution system and food security concerns. He found that there was a significant change in the foodgrain scenario from a scarcity to a surplus situation because of the acceleration in the production of foodgrains in the 1980s. More significant, foodgrains stocks held by the government have increased beyond the requirements. The predictions were that the surplus situation would sustain, that agriculture would be diversified and that the exports of rice, wheat and agro-products would increase.

Satyasai and Viswanathan (1996)\(^{97}\) explained the diversification of Indian agriculture and food security. The study suggested that Indian agriculture had witnessed

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diversification with impressive improvements in the shares of livestock and fishery sectors in the total income from agriculture. Within the crop sector, the pattern of diversification was characterized by growth in the share of non-foodgrain crops as a group.

Singh and Grewal (1996) highlighted the economic profile of rice production in India with a focus on identifying the factors, having bearing differential levels of productivity. The major factors associated with wider ranging level of productivity of rice across states were assured irrigation and associated expenditure on fertilizers, manures, machinery. Besides, the institutional problems of consolidation of holdings and tenurial arrangements.

Vyas (1996) discussed the concept of diversification which was relevant to the Indian situation. Then, they looked into the rationale for diversification between agriculture and non-farm sector as well as within agriculture and, examined the determinants of such changes at the enterprise level. They concluded by referring to the desired public policies to sub-serve the objectives of diversification.

Shah (1997) assessed the foodgrain production in India. He concluded that India had witnessed an upward trend in the foodgrain output due to introduction of seed-fertilizer-water technology in the post-green revolution period. However, this technology revolution could gain momentum only in some select regions of the country and that too; in terms of some cereal crops like rice and wheat. By and large, the impact of new technology, popularly known as HYV, was tardy and dismal in the case of pulses and coarse cereals. This gave reflection that the growth in the production of superior cereals had been achieved at the cost of coarse cereals and pulses through reallocation of land.

Shah (1997) focused some of the more recent trends in production and demonstrated that the yield based growth in food production had taken place in most

states including dry land regions; that the diversification was a large process that had already set in before liberalization; and that the shift from oilseeds to food grain production was essential for economic sustainability of dry land farming.

Nagaraj et al., (1998)\textsuperscript{102} focused to evaluate the resource use efficiency in cultivation of various crops under different cropping systems. The results of the study indicated that the regression coefficients for manures and fertilizers were negative in paddy production. He also found that land and human labour were the two factors significantly influenced the sunflower and jowar cultivation and in the case of groundnut manures, fertilizers and human labour had a significant influence on the gross returns.

Ranjan and Singh (1998)\textsuperscript{103} dealt with the cropping pattern in North Bihar during post-green revolution period. The analysis of crop-mix indicated cereal dominated cropping pattern in north Bihar. Rice and wheat jointly constituted more than 60 per cent of gross cropped area in the project area during period under study. There was no marked increase in rice area but wheat area showed an increasing trend. Oilseeds are, no doubt, unimportant crops with respect to area but gained in area during post-green revolution period.

Gangwar (1999)\textsuperscript{104} expressed his evidence which revealed that the crop productivity could increased from 40 to 162 per cent by providing irrigation facilities using Bamboo boring. As against traditionally monocropped systems, the crop sequence like greengram-potato-rice in Assam, maize-fallow-potato in Ganga Diara of Bihar and maize-potato-wheat in Saryu Diara of the Uttar Pradesh had been identified to be most potential using improved crop varieties in Diara areas.


Poddar et al., (1999)\textsuperscript{105} estimated the cropping sequences which were of paramount importance to the farmer from the point of view of his farm incomes. Farmer selected crop mix based on the net returns from different cropping sequences over a period of time. But at times net returns serve as poor indicators for selecting a sustainable sequence. To overcome this lacuna, the sustainable value index, index of variability and benefit cost ratios were worked out to find out the profitable cropping sequences.

Ram (1999)\textsuperscript{106} pointed out the cropping pattern diversification in Orissa. He discussed on the trend of diversification of cropping pattern in Orissa from 1980-81 to 1993-94 revealed an overall departure from cereals towards oilseeds, pulses and vegetables. Although, area under winter and autumn rice during kharif and summer rice during rabi had increased, the rate of increase was significant for the latter only.

Badal and Singh (2000)\textsuperscript{107} reviewed the resource productivity and allocative efficiency in Maize production in Bihar. They concluded that resource use efficiency for different inputs varied widely across the crops and there was scope to reallocate the resources in order to achieve optimal allocation of inputs. High yielding varieties (HYVs) of rabi maize offered a greater scope for input-use for an enhanced productivity compared to any other crop of the season. Human labour which was available in abundance could be increased on HYVs maize farms in both rabi and kharif as well as on wheat farms.

Basavaraja (2000)\textsuperscript{108} conducted a study in the northern dry zone of Karnataka, was an attempt to estimate the yield gaps (difference between the potential and actual yield) in crop production and identify the factors responsible for such gaps. In general, the difference between the potential farm yield and actual yield (Gap-II) was larger than the difference between the potential yield and potential farm yield (Gap-I) and gaps varied from crop to crop. The yield gaps were attributable to the inability of the farmers


to apply critical inputs to the recommended level. Major portion of yield gaps and variation there-in were explained by the variation in the constraint variables included in the model.

Kumar De (2000)\textsuperscript{109} points out agricultural diversification particularly the changing cropping pattern had been contributing significantly to the rural development in West Bengal, which was an important agricultural state of India over a long period of time. The paper examined the spatio-temporal nature of crop diversification in the state in terms of some crop diversification indices.

Venkatram and Subramanian (2000)\textsuperscript{110} assessed the supply of major food crops in Southern districts of Tamil Nadu. The estimation on cropping pattern index showed a change in cropping pattern. There was a gradual decline either in area under the food crops (or) their share in gross cropped area.

Hazra (2001)\textsuperscript{111} tried to find the rice production scenario in India and central intervention. He classified his study of rice development programmes and made strategies to step-up rice productivity.

Sekhar (2002)\textsuperscript{112} examined the agriculture and rural development. In his study, he discussed the context of deceleration in agricultural growth, rural employment and a slowdown in the decline in rural poverty over the last decade, comprehensive policy reforms were required to generate long-term sustainable growth in agriculture. This was also crucial from the standpoint of overall economic growth and equity. The broad reforms suggested above pertain to policies on subsidies, trade and land reforms.


Shenoi (2002)\textsuperscript{113} points out the agricultural policy during the tenth plan. He concluded that the satisfactory performance of the agricultural sector during the last ten years, despite increased outlays, which had been wasted on subsidy oriented stem to blame, not the India farmer. Our scientists and farmers were amongst the best in the world, but we had given them a system which defeated them all. The Indian farmer did not seek out hand-outs, but only a fair support system with reasonable supply of technology, inputs and market incentives. What was needed was the shedding of the subsidy syndrome, the promotion of liberal input and output markets, and dynamic extension and research systems in the course of the Tenth Plan.

Gupta and Athavale (2003)\textsuperscript{114} evaluated thirteen States of the country were covered in this study. It was proposed that in the State, sample districts/blocks should be so selected so as to cover all the agro-climatic zones/regions. The district selected for field work among the districts of respective zones was representing the highest area under pulse crop. From each of the selected districts 5 blocks were selected and from each block one village was selected. A sample of 10 pulse growers from each village was randomly selected by adjusting the available size classes. In this way, 50 farmers from each of the districts were selected for their study. The study was based on both primary as well as secondary data. Primary data was collected from sample farmers, mandis and dal processors (mill). The reference year of the study was agricultural year 1998-99.

Kalamkar (2003)\textsuperscript{115} measured the economics of pulse production in Maharashtra. He observed that the problems of increasing production of pulses in the state were confronted with various economic constraints in the form of low yield, income, rainfed condition under high risk situation and low level of technology with poor management. In order to increase the production of pulses, particularly yield per hectare, it would be


essential to develop some new high yield varieties suitable to agro-climatic regions. Efforts would also had to be made to improve the efficiency of the marketing so that producer could get their due share in the prices paid by the ultimate consumer.

Bhushan (2005)\textsuperscript{116} applied the Data Envelopment Analysis (DEA) approach to estimate the Malmquist productivity index for the wheat producing states in India. With the DEA approach, the Malmquist index could be decomposed into technical change and efficiency change. The technical change component captured shifts in the production frontier, provided a measure of innovation.

Kaur and Sekhon (2005)\textsuperscript{117} enquired into input growth, total factor productivity in Punjab agriculture. They identified that total factor productivity had shown dismal performance in Punjab agriculture, since the eighties. It was negative in two districts during the eighties and in six districts during the nineties. The found the output growth in all the districts and both in 1980s and 1990s had been quite significantly due to technological change had been adopted by the farmers but the contribution of technical efficiency was much lower and even negative in five districts during the 1980s and as many as 10 districts in the 1990s suggested that the resource adjustments required for the adoption of technological changes had not been forthcoming.

Singh et al., (2005)\textsuperscript{118} pointed out the rice economy of India. They noted that India’s rice economy had undergone tremendous changes since the launch of green revolution technology during the late 1960s. The profound impact had been aptly witnessed in the rice whose production had shown spectacular increase and enabled the country to move from chronic food shortage to an era of food surplus. Besides, technology and increased use of inputs, government interventions and support in terms of minimum guaranteed prices of output and large scale procurements from producers at remunerative prices had played a key role in the growth of rice economy.


Bathla (2006)\textsuperscript{119} noted that regional dimensions of inter-crop diversification in India. The overall analysis carried out at the national and state levels reveals intercrop area shifts in favour of high yielding crops viz. wheat, paddy, oilseeds, cotton and sugarcane up to the eighties and towards paddy, sugarcane, fruits-vegetables, fibres, plantations, condiments and spices during the nineties and early 2000 while area under wheat and paddy (rice) had expanded solely at the cost of low yield growth crops viz. Coarse cereals and pulses due to price support and HYV programme, high value commercial crops had benefited both from area shifts as well as fresh land brought under cultivation.

Lekshmi et al., (2006)\textsuperscript{120} dealt with the yield gap among rice growers in Kancheepuram District of North Eastern Zone, with the aims to study the profile characteristics of farmers cultivating rice in specific agro-climatic zones and assess the yield gap prevailing in popular rice varieties. They also studied the factors influencing yield gap as perceived by the farmers.

Bhende and Kalirajan (2007)\textsuperscript{121} estimated farm-specific technical efficiency for rice, sorghum, groundnut and cotton using Stochastic Frontier Production Function approach. Further, they attempted to identify the determinants of technical efficiency. They had used the farm level cross section data collected by the University of Agricultural Sciences, Bangalore under the scheme of cost of cultivation of crops. The analysis of technical efficiency indicated that there was a considerable scope to improve the productivity levels of both food as well as cash crops with the existing level of input use and the available technology.

Marothia et al., (2007)\textsuperscript{122} analyzed the crop diversification in Chhattisgarh state. This study clearly indicated that there was no evidence of crop diversification in the


agro-climatic zones as well as in the state even after a massive emphasis placed on agriculture diversification, particularly after the formation of the state.

Verma et al., (2007) made an attempt on production and consumption pattern of major food items in North Eastern Region of India. They found that rural people had started spending more on pulses, milk and milk products, edible oils, meat, egg, fish, vegetables and fruits. With the increase in level of income the urban as well as rural people had started expending more on superior food items. With the change in consumption pattern per capita per month demand for cereals and cereal substitutes had decreased and expected to decrease further in near future. So there was a great need to develop the strategies for increased the production of superior items keeping in view the globalization of agricultural trade.

Sekhon et al., (2008) conducted a study of long term demand for foodgrains in Punjab. They examined the present production and consumption level of foodgrains. They also made an attempt to calculate demand for major foodgrains i.e. rice and wheat, up to the year 2030 under different scenarios of growth in income.

Tuteja (2008) addressed long run vision for food management in India. The author noted that the recent worldwide gallop in food prices had refocused attention on food management that had been relegated to the sidelines. India was also experiencing around 12 per cent inflation which was hurting the poor. Prices of food items were skyrocketing despite fall in per capita consumption in rural and urban areas between 1999-2000 and 2004-05. This was due to shrinkage in the supply of food items in the market. But in the long run, it was a problem of population pressure, productivity and food management. These factors could be handled by vision and commitment.

The forgoing chapter provides the review of studies related to growth and instability in agriculture, which would be helpful to formulate objectives given in the next chapter.