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Title of thesis	:	Economic analysis of total factor productivity in agriculture in Konkan region (M.S.)
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THESIS ABSTRACT

The total factor productivity of crop sector has now started showing sign of decline at a few places and stagnation at many places in the region. Under this backdrop the present study has been planned to analyze the performance of agriculture in Konkan region by measuring Total input index (TII), Total output index (TOI) and Total factor productivity index (TFP) at district levels.

For this analysis secondary data were collected from various Government publications to study trends in parameters of agricultural development and their contribution towards total factor productivity in agriculture in each district and Konkan region as a whole, for the period from 1980-81 to 1999-2000. The analysis was done with the help of growth rates, composite index of development and growth in Total factor productivity in agriculture, which was supported by total factor productivity decomposition.

In Konkan region during 1980-90 (decade I), the growth in input index was high (0.912%), as compared to growth in output index (0.883%)

as a result negative total factor productivity growth (-0.02%) during 1990-2000 (decade II), the growth in total input index was less (0.997%) than growth in total output index (1.006%) which turned out to be positive (0.009%) total factor productivity growth. At the entire period (1980-2000) the growth in total input index and total output index was 0.95 and 0.94 per cent per annum. While growth in total factor productivity index was (-0.0082%) negative.

The agricultural development studied through composite index revealed that the level of development was maximum in Ratnagiri district (87.72%) followed by Sindhudurg district (52.70%), Raigad district (48.00%) and Thane district (46.34%) in the year 1999-2000.

In Konkan region, for the entire period (1980-2000) the growth in TII and TOI was 0.95 and 0.94 per cent per annum. Therefore, growth in TFPI was negative (-0.0082). During first decade TFP growth was negative (-0.02). However, in second decade the growth in TFPI was positive (0.008) but very low.

The TFP growth in overall Konkan region was negligible. This implied that over the period of time there was no development in Konkan region in agriculture. However, the real picture of Konkan region showed that the agriculture sector in Konkan region is developing day by day. This is mainly because of horticultural development to press in the region. Due to unavailability of data on horticultural sector only food grain crops were considered for estimating TFP growth in agriculture. Generally in Konkan region, the food grain crops are non-remunerative.

The increasing growth rate in output is to be obtained in future, the productivity of all inputs together will have to be increased by emboding technologies or package of practices.

The different technologies for different input will have to be disseminated properly to the farmers (a) it is therefore suggested to enhance the use of hybrid rice seed and increased area under yield

yielding varieties which is only 2.1 to 5.2 per cent at present. (b) Secondly, the use of not only recommended doses of fertilizer but also the improved fertilizer application method i.e. newly introduced fertilized application method of urea brickets will have to be popularized. (c) Cultivation practices – line planting, maintain plant population more specifically to the fullest extent possible. (d) proper irrigation and drainage to the field.

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Place:

Date : **(V. K. Khobarkar)**

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CHAPTER I
INTRODUCTION

Agriculture is a way of life, a tradition, for which centuries has shaped the thought, the outlook, the culture and the economic life of the people of India. Agriculture, therefore, is and will continue to be central to all strategies for planned socio-economic development of the country. Rapid growth of agriculture is essential not only to achieve self-reliance at national level but also for household food security and to bring about equity in distribution of income and wealth resulting in rapid reduction in poverty levels. Since independence India has made impressive strides of progress on agricultural front during the last three decades, increasing food production by four times from about 50 million tonnes to about 200 million tonnes now. Adoption of agricultural technology and favourable policy support, production strategies, public investment in research and infrastructure coupled with appropriate policy mix have not only helped in achieving self sufficiency in food production but also made the country a net exporter of agricultural commodities. Therefore, agriculture has been accorded the top most priority in almost every five-year plan of the any developing country.

Agriculture has also become a relatively unrewarding profession due to generally unfavourable price regime and low value addition, causing abandoning of farming and increasing migration from rural areas. The situation is likely to be exaggerated further in the wake of integration of agricultural trend in the global system, unless immediate corrective measures are taken.

Over 200 million Indian farmers and farm workers have been the backbone of Indian agriculture. Despite having achieved national food security, the well being of the farming community continues to be a matter of grave concern for the planners and policy makers in the country. The establishment of an agrarian economy which ensures food and nutrition to

India's billion people, raw material for its industrial base surpluses for exports, fair and reward system for the farming community for their services will be the mainstay of reforms in the agriculture sector.

The National Policy on Agriculture seeks to actualized the vast tapped and untapped growth potential of Indian agriculture, strengthen rural infrastructure to support faster agricultural development, promote value addition, accelerate the growth of agro-business, create employment in rural areas, secure a fair standard of living for the farmers and agricultural workers and their families, discourage migration to urban area and face the challenges arising out of economy liberalization and globalization over the next two decades it aims to attain:

- A growth rate in excess of 4 per cent per annum in agriculture sector,
- Growth that is based on efficient use of resources and conserves, our soil water and bio-diversity,
- Growth with equity i.e. growth which is widespread across regions and farmers,
- Growth that is demand driven and caters to domestic markets and maximizes benefits from exports of agricultural products in the face of the challenges arising from liberalization and globalization.
- Growth that is sustainable technologically, environmentally and economically.

The government of India trusts that the statement of National Agriculture Policy will receive the fullest support from all sections of the people and lead to sustainable development of agriculture, create gainful employment on a self sustaining basis in rural areas, raise standards of living for the farming communities, preserve environment and serve as a vehicle for building in the resurgent national economy.

Development is the process, which improves the quality of life. Agricultural plays a crucial role in the economic growth and development of a country. It is a dominant sector in the economy, particularly that of developing nations like India. Agricultural development is a process, which bring about changes in capital formation, per capita income and national income of a country. Agricultural development has a builtin advantage of automatic development of agriculture based industries to supply the needed agricultural production inputs like improved seeds, chemicals, implements and agro industries to process the agricultural output like cotton, sugarcane, paddy, pulses, fruits etc. The process of agricultural development thus gives an immense boost to maximize the employment creation and income generation resulting in poverty eradication. Developmental programmes in various fields were taken up in the country in a planned way through various five year plans with the main objective of enhancing the quality of life of general masses by providing the basic necessities of life as well as effecting improvement in their social and economic well-being. The 'green revolution in agriculture sector and the commendable progress in the industrial front have certainly increased the total production in agriculture and manufactured goods, but there is no indication that these have been able to reduce substantially the inequality and poverty. It has been observed that the proportion of landless, agricultural labourers and industrial workers have increased over the years but their wages have not kept pace with the rate of inflation. However, in a large sized federal country like India, there is likely to exist wide disparities in the levels of development and the rate of growth in different regions of the country. It has been a continued endeavor of scientists and planners to measure the level of development in different regions of the country in order to identify where a given region stands in relation to others.

Social development, by definition is not a predetermined state but it is a continuous process of improvement of levels of living. As

development is a multidimensional process, its impact cannot be captured fully by any single indicator. Moreover, a number of indicator when analyzed individually, do not provide an integrated and easily, comprehensible picture of reality. It is generally observed the level of socio-economic development depends much on measures of introduction of improved agricultural practices like application of irrigation, fertilizers, pesticides etc.

Agriculture is an important primary sector and any developing economy dependent primarily on agriculture has to undergo the process of agricultural development for accelerating the economic growth. The process of economic development of a country mainly depends upon as to how the agricultural sector is advancing. The performance of agricultural sector is therefore crucial in the process of economic development of a country. This is especially true in case of a predominantly agricultural and over populated country like India, where agriculture accounts for about 28 per cent to the national income and provides employment to about 67 per cent of the total population. The development of agriculture has significant effects on growth of the other sectors of economy. It helps the process industrialization by providing raw material to the leading agro based industries as well as small scale and cottage industries. Nearly two-third of country's population is dependent on agriculture, of which 42 per cent are cultivators and about 25 per cent are agricultural labours. Through the share of agricultural sector in gross domestic product (GDP) has been declining continuously, it still continues to play an important role in increasing the national income practically every year. Agriculture sector is also responsible for the growth of the industry, trade, transport banking and business services which in turn influence the growth of GDP.

Though the agricultural development is taking place in India through the adoption of modern technology, it is not uniform throughout the country. Developmental programmes had been implemented in Maharashtra state in a planned way to bring out uniform regional

development because one of the main objectives of the planning has been a progressive reduction in regional disparities in the pace of development. Even though, in agricultural sector, the green revolution has increased the total crop production and in the industrial sector, commendable progress has been made due to implementation of modern improved techniques, yet the regional disparities in the levels of development are not declining over time.

Recently, productivity growth has focus of agricultural development programmes has assumed significance as growth due to expansion has reached a plateau. Creation and sustenance of infrastructure are essential for augmenting farm productivity. Supportive sector like markets, roads, mechanization and other infrastructure are necessary for realizing higher incomes than merely adopting new technology. The first phase of green revolution was development of primary technology in the form of new varieties, methods and practices which results the boosted productivity growth per unit of land through intensification of inputs used including labour per hectare. The second phase of green revolution was in strengthening the supportive and complementary sectors. Technology alone cannot augment productivity, as infrastructure is crucial as well as regional, agro-climatic and socio-economic factor have to be addressed to augment farm productivity of primary factors of production and there is need to measure the effect of these technological changes.

Total factor productivity (TFP) index can be used as one measure of the effect of the technological change. TFP index that measures the growth in the net output that is not accounted for by the growth of basic factors inputs such as land, labour, and capital, but the technological change is embodied in them is superior to the partial approach, as it is a composite measure of productivity, which relates outputs to all input simultaneously. TFP, sometimes referred to as multifactor productivity, is a true measure of economic efficiency. It can be interpreted as a measure of change in cost of production of unit of product, holding all factor prices constant

(Evenson and Pray, 1991). Alternatively, it can be interpreted as a measure of the change in output relative to a weighted combination of all inputs, where the weights are factor shares. Therefore TFP concept, which implies an index of output per unit of total factor productivity inputs, measure properly these shifts or increase in output, holding all input constant.

The development of agriculture is a process through which the shift takes place from the stage of traditional agriculture to the stage of modernized agriculture resulting in increasing productivity and production per unit of resources due to use of modern technology. During the process of transformation, the position of original equilibrium changes and production function shifts to the higher level and occupies new equilibrium position where associated with the use of high yielding varieties, adoption of package of practices including use of fertilizer, plant protection measures, irrigation modern machinery etc. for increasing productivity of farm enterprises. The process aims at getting the maximum advantage of the available resources *viz.*, land, labour, capital etc. on the farm and finally depicts the prominent changes in the resource use and allocation, productivity of crops over a period of time in the particular area. Thus the process of agricultural development is important from the viewpoint of increasing agricultural production in the country. Therefore development the quality of life, development programme have been implemented in the state in a plane way to bring out uniform regional development because one of the main objective of planning has been progressive reduction in regional disparities in the pace of development. Eventhough in the agricultural sector, commendable progress has been made due to implementation of modern improved techniques, yet the regional disparities in the levels of development are not declining over time.

In view of this, to assess the state of agricultural development in Konkan region has great relevance under changing socio-economic dimensions and market oriented agriculture production technologies. The

present study entitled "Economic analysis of total factor productivity in agriculture in Konkan region", has great practical utility for the future planning for agriculture development in the Konkan region.

Problem

The total factor productivity of crop sector has now started showing sign of decline at a few places and stagnation at many places in the region. Under this backdrop the present study has been planned to analyze the performance of agriculture in Konkan region by measuring TFP indices at district levels. The district level analysis has captured the location specific differentials at micro level, no study has been undertaken in the recent years to analyze trend in TFP at the disaggregated district level or region levels particularly in Konkan region.

Keeping in view above aspects present study is therefore, undertaken with the following specific objectives:

Objectives:

1) To estimate trends in important socio-economic indicators of the Konkan agriculture.
2) To analyze growth in agriculture production and important factors in study area.
3) To develop composite index of agricultural development in the Konkan region.
4) To estimate total factor productivity of important factors *viz.*, socio-economic infrastructure and regional factors on agriculture productivity in Konkan region.
5) To suggest policy implications based on findings.

Hypotheses:

1) There is increase in production of crops in each district.
2) There is increase in area under high yielding varieties, irrigated area and fertilizer consumption due to increase in credit flow.

3) During study period productivity of factors of production has increased.
4) There has been positive impact of socio-economic, infrastructure, regional factors on agriculture production in Konkan region.

Scope and limitation of the study:

Total factor productivity is an important measure to evaluate the performance of any production system and growth process in a particular area. It is both necessary and sufficient condition for development process in a identified area. The critical analysis of total factor productivity will serve as a guideline to determine future strategies.

The scope of the present study is limited only to overall agricultural development of the Konkan region. The findings of the study will be useful to Government agencies and also to the planners in different fields to plan their strategies in economic development of the Konkan region. The comparison of the parameter of economic development through composite index of the district with the average situation in Konkan region helps to understand whether the district is progressing with Konkan region or lagging behind. Coefficient of growth rates help in formulating future plan. The coefficients of growth and trend analysis for different parameter will serve as a basis for formulating growth models for future development.

The present study was restricted to factor productivity analysis of rice and ragi crops of the region, which occupy approximately 80 per cent of the net cropped area in the region, no doubt there is very negligible area under certain pulses and oilseed in the region. These were not considering for analysis. Hence, estimates of TFP in agriculture in Konkan region are excluding, input output relationship of horticultural crops as the time series data on input use and production for different horticultural crops was not available from any of the source. Therefore, the utility of this study is confined to cereals crop of the reign.

CHAPTER II

REVIEW OF LITERATURE

While carrying out any systematic research, it is necessary to have knowledge of the similar previous research work carried out by other researcher. It gives an insight in respect of manner in which the problem has been tackled, the nature of results obtained and the conclusion arrived, it may be true that the previous research work might have been carried out in India and several other developing countries under different set of condition. Nevertheless, such knowledge is helpful in designing the research problem, adopting suitable methodology and interpreting the result properly. The review of past literature therefore forms an integral part of any systematic research work. Therefore, the literature closely related to the present study is reviewed in this chapter.

The literature is grouped into following categories:

2.1 Importance of agricultural development.

2.2 Growth in area, production and productivity of crops.

2.3 Growth in resource endowments and other related parameter

2.4 Composite index of development

2.5 Total factor productivity analysis.

2.1 Importance of agricultural development:

Gupta (1976) studied the agricultural development in Haryana state for this purpose; he obtained a data on different parameters of agriculture *viz.*, land use. Crop patterns, livestock, capital assets, and output of principal crops with their prices etc. for the period from 1952-53 to 1974-75 i.e. for 22 years. He tried to study the relative changes in crop output for the two states. i.e. Haryana and Punjab. Triannual averages for two periods i.e. before and after reorganization of the state

were used along with corresponding all India figures for the sake of comparison, linear and compound growth rates of output, and area of principal crops in Haryana state workout.

Kale *et al.* (1998) studied the progress of agricultural development in Parbhani district over a period of 20 years 1960-61 to 1979-80. It was assessed with a view to measuring the magnitude of growth and fluctuations in the pre-green and post-green revolution periods. Data regarding area production and yield of major cereal crops like rice, wheat, *kharif* and *Rabi* Jowar and bajara, pulses, gram as well as cash crop like cotton, sugarcane, and groundnut were used. The results revealed positive growth rate with higher C.V. in most of the cereals crop in the post green revolution period over the entire period where as change for pulses and cash crops were not remarkable.

Thakkar and Chole (1992) studied the agricultural development opportunity of farmers and factors related with it. The results indicated that majority respondents had moderate development opportunity. The independent variables namely, caste, education, land holding, annual income, social participation, socio-economic status Cosmo politeness, risk preference, level of aspiration and independent were found positively related with development opportunity. The major 10 variables explained variation in development to the extent of 61.90 per cent. The result of path analysis showed that socio-economic status and income were the most important variables affecting directly and positively.

Anonymous (1993) studied the agricultural development and distribution of gains through inter-regional and intra-regional analysis in the Uttar Pradesh and found that the growth of area under potato was highest (62.80%) followed by wheat (37.85%), the production of cotton and pulses was decreased negatively in the region and the state as a whole and the average consumption of fertilizer in all the district as

well as regions of the state had increased positively since 1970-71 to 1990-91. Further, they concluded that the gains of agricultural development had not been shared equally as a consequence both regional and inter-regional inequalities have increased.

Li-San-Duk (1998) studied the agricultural development in Korea, for the year 1960 to 1968. He observed decrease in share of agriculture in GNP from 37.6 per cent in 1960 to 8.2 percent in 1993. The main constraint to development was average size of farm (not more than 3 ha. of cultivated area), which does not allow the most effective use of technology advances. There was also a declining trend in the number of farms and rural population as a result of outflow of young people to towns.

Barber *et al.* (2000) studied the agricultural development in Kolhapur district (MS). The study concluded that the western Maharashtra was always ahead in development in general and Kolhapur district in particular. The various infrastructure facilities had been exploited to the fullest extent in Kolhapur district. The main constraint in agricultural development was of fragmented and small land holdings. The cultivators of the district had achieved substantial success in agriculture by forming cooperative institutions, revealed that the compound growth rate of area sown more than once, net and gross irrigation area, area under irrigated crops growth rates farm harvest prices have shown significant increase.

Gawade (2002) studied the agricultural development in Ratnagiri district (MS). She concluded that the positive growth was taking place in terms of area under food crops, irrigation production and productivity of important crops, area under HYV's of rice and agricultural wages in Ratnagiri district.

2.2 Growth rates of area, production and productivity of crops:

Subha Rao and Nageswara Rao (1986) studied the growth rates in area, production and yield per hectare of barley and tobacco in India as compared with other barley growing countries of the world during the period of 1967 to 1989 and they concluded that these other countries have relatively lower contribution in the world production of barley and tobacco.

Sale (1987) studied the performance of principal crops in Maharashtra during the period 1956-60 to 1982-83. On the basis of estimated linear and compound growth rates of area, production and productivity of individual crops. The performance of *Kharif* Jowar and sugarcane was satisfactory, while performance of *Rabi* Jowar and groundnut was unsatisfactory during the period. The higher growth rate in production of *Kharif* Jowar and sugarcane were partly due to area expansion and partly due to improvement in productivity. The observed that inter-district disparities in performance of the most of the crops mainly due to variations in the extent of adoption of technological change in agriculture.

Umesh and Bisaliah (1987) attempted to account for productivity differentials, which have engaged with the introduction of different high yielding varieties of rice in Kospet taluka, Bellara district, Karnataka. Econometric analysis showed that technical change (in terms of Vari etal change) due to the introduction of high yielding varieties was the Hicks non-neutral type. This implies that shifts in factor demand functions have not been parallel and that functional income distribution has been altered with the introduction of these varieties in agriculture. A positive productivity differential (28%) emerged by introducing the Sonamassuri variety in place of the Tellhahamsa variety, varietial effect per acre is estimated to have contributed about 19 per cent of this gain, with plant nutrient the other dominant contributor. The efficiency gain contributed by this variety in terms of resources saved and resources loss averted is estimated at Rs. 192 and Rs. 254 per acre, respectively, 6 per cent positive

productivity differential has been generated by introducing the Tellhamsa variety in place of the Massuri variety. About 4 per cent should be attributed by the varietal effect. This variety is estimated to have contributed to efficiency gain in terms of resource saving (about Rs. 37 per cent) and in terms of resource loss averted (Rs. 40 %) per acre. The productivity differential due to introduction of the sonamassuri variety in to Massuri variety farm is estimated at about 34 per cent about 17 per cent is attributed to an upward shift in production function in terms of varietial change, and about 16 per cent to the use of additional amounts of labour and plant nutrients. The varietial productivity gain has contributed in generating resource saving of Rs. 217 per acre and in averting resources loss to the extent of Rs. 306 per acre.

Walia *et al.* (1987) studied the growth analysis and trends of area production and yield of potato in major potato growing states in India. For this study the secondary data for period of 30 years from 1950-51 to 1979-80 were divided in to three decades and each for the major potato growing states of India like Assam, Bihar, Madhya Pradesh, Uttar Pradesh, West Bengal and Himachal Pradesh and they concluded that increase in area in all state are significantly except in Punjab during 1960-61 to 1969-70 and Himachal Pradesh during the period 1970-71 to 1979-80. The growth rate of production was highest in Uttar Pradesh (19.99) followed by Madhya Pradesh. All states has positive growth of production and decline yields rates was observed in Bihar and Madhya Pradesh during 1950-51 to 1969-70.

Singh and Swarup (1988) analyzed the growth rate n area, yield and output of important pulses of Himachal Pradesh during the period 1972-73 to 1981-82 and studied the growth rates of different elements to output of pulses in each district of state. They concluded that the relative acreage under pulses has decreased at the compound growth rate of 0.92 per cent annum. While absolute area under all pulses declined at the rate of 0.79 per cent per annum. Among the pulses, only lentil showed positive

growth in productivity to the tune of 0.23 per cent per annum. The growth in cropping pattern of gram, blackgram and horsegram showed positive trend to the tune of 0.04 per cent to 0.60 per cent per annum respectively.

Mitra and Jena (1991) conducted study on growth rates of groundnut production in Orissa. A decomposition analysis and objectives was to evaluate the growth rate of area, production and productivity of the crop. For this purpose, the entire period of thirty-six year was divided in to two parts *viz.*, (Period 1 1950-53 to 1962-65, II) period II covers 1967-70 to 1983-86. Growth rates of the entire period i.e. from 1950-51 to 1985-86 were also studied. The author concluded that the compound growth rate of area were 3.70** per cent, 9.83** per cent and 8017** per cent in I, II and III period compound growth rate of productivity were5086** per cent, 9076** per cent, and 10.47** per cent respectively compound growth rate were 2.12** per cent 0.16** per cent and 2.11** per cent.

Jagannathan (1998) studied the trends and patterns of agricultural growth of different crops in India. The study revealed that there was an increase in yield and there by production in Indian agriculture. Green revolution improved growth of area, yield and there by production of all crops at an increasing rate in the early phase of green revolution. It was hence, concluded that the public investment had to play a major role in the technological and infrastructure development for agricultural growth concentrating more on inter-crop and optimum utilization.

Anonymous (1999) studied the growth in agriculture production in India. The growth in agriculture production was about 3.9 per cent in 1998-99 as against drop of 6 per cent in the preceding year. Food grains production increased annually by 3.22 per cent during fifties mainly because of expansion in food grain area. Sixties recorded a low annual growth of 1.72 per cent necessitating large scale of imports of food grains. Annual growth of 2.08 per cent was recorded during seventies. This decade was the turning point in the India's food grain economy and the

path of self-sufficiency was marked by the revolutionary changes in the seed technology that push up productivity levels first in wheat and latter in rice in eights. An annual growth of 3.5 percent in food grain in eighties was the hallmark of the green revolution that enables India to become self sufficient in food grains and even a marginal exporter.

2.3 Growth in resource endowments and other related parameter

Johl and Singh (1966) had studies the changes in land use pattern in Punjab state for the period from 1950-51 to 1964-65. They concluded that land put to non-agricultural uses increased at a significant rate of 2.51 per cent per annum. This occurred due to expanding urban and industrial centers, development of roads and canals and community centers and institutions in the rural area of the state. Due to emerging water-logging and soil erosion conditions in some parts of the state, barren and uncultivable land also increased to some extent. As a result, the land not available for cultivation increased at a significant rate of 0.09 per annum in Punjab the period under study.

Giri (1968), Made an attempt to investigate in to changes in the land use and crop pattern in all districts of Madras state for the period 1950-51 and 1964-65. The data on different land use classes were used for estimation of compound growth rates by using exponential function. They concluded that the net area sown in the state increased at the rate of 0.93 per cent per annum. It increased at higher rate ranging from 1.09 to 2.64 per cent per annum in Ramanathapuram, Salem, Nilgiris and North Arcot district

The growth of irrigation in different districts in the state as a whole from the levels reached in 1950-51 had not been such as to produce a large impact of increasing multiple cropping. The large gap between the extent of irrigation and intensity that much of the available irrigation has been directed to raise of one crop and increasing its productivity.

Sori (1974), studied the cropping pattern and crop intensity in various size classes of farms in some IADP (Indian agricultural development programme) districts of India for the period from 1962-1963 and 1964-65. For the purpose of analysis, cultivators were divided in to three classes according to size of their farms. For determining changes in cropping pattern, the proportionate area under different crops was worked out for each category of size classes in a district for individual years i.e. 1962-63, 1963-64 and 1964-65. They found significant changes in a cropping pattern of the districts selected for study. According to him the changes in the cropping pattern and crop intensity were due to introduction of high yielding early varieties and improved agricultural technology

Prahladachar and Venkataramanan (1980) studied the growth rates and cropping pattern changes in agriculture in six states viz., Punjab, Rajasthan, Uttar Pradesh, Bihar, Maharashtra and Andhra Pradesh during a period of 1950-51 to 1974-75 and they concluded that crop output growth in Punjab was large due to technological transformation aid by spared of HYV crop and irrigation. In Rajasthan, increase of subsistence agriculture and growing in farming conditions were observed. In Bihar nearly 2/3 of growth in crop output was contributed by yield increase. In Maharashtra, inferior cropping pattern and relatively low yield for most crops and percentage of net cropped area, irrigated was low.

Fertilizer association of India (1982) reported that fertilizer consumption in India increased at a compound annual rate of 9.3 per cent during the year 1971 to 1981. Observation of the study revealed violent fluctuation in fertilizer consumption from year to year as well as amongst regions and states. Pubjab, Haryana and Uttar Pradesh recorded higher growth rate in fertilizer consumption where as other state such as Gujrat and Bihar indicated lower rates of growth, suggestions were made to create efficient distribution system in order to promote growth fertilizer.

Pranesh Kumar and Sharma (1985) studied the growth rates of agricultural wages in Haryana. The study concluded that the real wages of agricultural labours during the post green revolution period were distinctly higher than those during pre-green revolution period for all agricultural labour engaged in different agricultural operation have registered a very low growth rate and these have remained almost constant over the period under study.

Narappanawar (1989) conducted a comparative study of wage rates of agriculture labours in the Karnataka state over the period at 1956-57 to 1971-72. He concluded that: 1) The real wage rate showed declining trend during 1961-62 to 1984-85 and increased marginally in year 1976-78, 2) The rural population which depends on wage as the main source of the incomes has grown steadily over time.

Verma (1990) concluded a study to find out the level of actual utilization of inputs by farmer in Akola district with respect to hybrid Jowar (CSH-9) as against recommended level and he found that the use of nitrogen, potash and phosphorous was far below the recommendation, the utilization gap being 46.66 and93.00 per cent respectively and on an average per hectare utilization of labour was workout to be 49.00,39.00 and 14.28 days for male, female and bullock labour respectively, the per hectare production of hybrid Jowar was 24.65 qtls, as against 48 qtls of potential production.

Pawar and Gaikwad (1993) studied wage employment and income of small farmers in Maharashtra at a two points of a time. Their study concluded that wage rate increased by about 58-60 per cent during 1976 to 1982, while the family expenditure increased almost by 103 per cent. It was further revealed that insufficient own farm employment forced them to seek employment outside their own farm. Employment on other farm was one-third of the total, while income from wage earning was less than one-fourth of the total family income.

Pandey and Kumar (1993) studied the agricultural wages, output and productivity in Orissa for the period 1960-61, 1970-71 and 1980-81 to 1990-91. The study reveals that there is a significant variation in real wage rate over the years; however, the variation over the district is not significant. The real wages in almost all the district have declined during the sixties and the seventies but increased marginally during the eighties. The relative wage of male labour to female labour has decreased over the period I almost all the districts. Interestingly, the male and female wage rate is equal in seven out of thirteen districts in 1991. The real wage rates in Orissa were still below the national averages rates. With few expectations, a positive effect of wages rates on output of rice and its components, i.e. area and yield, is observed in almost all the district of Orissa during the last three decades.

Prudhvikar Reddy (1998) studied the trends in agricultural wages in Andhra Pradesh. The HYV technology in paddy crop, which was initially confined to canal, irrigated area which had impact of this on the trends in agricultural wages in different agro-climatic zones. The analysis revealed that the real wages of all categories of labour have increased at the state as well as zonal level by different magnitude from zone to zone. It also indicated continuous persistence of zonal variation in wages.

2.4 Composite index of development:

Iynger and Sudarshan (1982) studied on methods of classifying regions from multivariate data by using Composite index, the study area categorized into highly developed, developing and backward state of development on basis of score of parameters considered for developing composite index.

Narain *et al.* (1997) studied the level if development of different districts of Karnataka with the help of composite index. The socio-economic development in eight districts was better than that in remaining 13 districts. Seven districts were found to be better developed

in agriculture. Better developed districts in agriculture covered about 36 per cent area and 33 per cent population. The overall socio-economic development in the state was positively associated with agricultural development had been observed among different districts of the state.

Bhatia (1999) conducted study on rural infrastructure, and growth in Agriculture. The state wise composite index of infrastructure, per hectare yield of food grain and value of agricultural production developed and concluded that the state of Punjab which has highest yield of food grain and value of agricultural production per hectare, followed by Tamil Nadu and Haryana, Rajastan and Madhya Pradesh which have a very low index of infrastructure have a low yield of food grains but with a high value of agriculture output per hectare because of special feature of cropping system. Also examines the role of infrastructure is significant influencing the per hectare yield of food grain and value of output from agriculture in the state.

Prem Narain *et al.* (2000), studied the development in Tamil Nadu with the help of composite index of development. With respect to socio-economic development twelve districts were observed to be better developed in agriculture and infrastructure development. The over all socio-economic development was positively associated with agricultural development. Better developed districts were found to be thickly population as compared to low developed districts. Six districts were observed to be low developed districts. In order to reduce the disparities in level of development potential target for various development indicators had been estimated for the low developed districts.

Jahagirdar (2001), studied inter district disparities in agricultural performance, an out come of infrastructure in Maharashtra. Development indices were calculated by using different four methods. These methods were composite index of development suggested by Prem Narain, development index by weighted average method as

suggested by Younger, development index by principle component analysis method, development index by ranking method in three periods 1977-78, 1987-88 and 1997-98.

According to composite index of development as suggested by Prem Narain 26 indicators for 29 districts were used for study. It was observed that 10 districts were developed, their composite index of development lies between 0.91 to 0.99. 13 districts belonging to western Maharashtra, while the developing districts were from Vidarbha and Marathwada.

Deshmukh (2004) studied the level of development I five district of Amaravati division of Maharashtra states, with the help of composite index of development. On the basis of optimum combination of sixty-six indicator, from this, eighteen indicators connected with infrastructure in agriculture and fourteen indicators with agricultural inputs and rest of fifteen indicators presents area, production and productivity, for the year 1984-85 to 2001-2002 at different period time 1984-1985 (end year of vith five year plan), 1989-1990 (viith five year plan), 1996-1997 (end year of viiith five year plan) and 2001-2002 (end year of ixth five year plan). These district was categorized in to six categorized most developed, developed, moderately developed, under developed, backward and most backward.

They reported that Agricultural development was observed more in Amaravati district which as categorized as 'developed' (2001-2002) as compared to 'Moderately developed' (1984-85). Buldhana district had shown upward agricultural development and categorized as 'Maderately developed' in the year 2001-02 than that of categorized as 'backward' in 1984-85. Yawatmal district remains 'Moderately developed' in 1984-85 to 2001-02. In case of Akola district, Agricultural development was reduced from period 1984-85 to 2001-02 and it was categorized as under developed. Washim district was categorized as backward' it may because Washim district was newly formed few year

before i.e. 1996. Agricultural developments of district significantly differ from each other over a period of time.

2.5 Total factor productivity analysis.

Christensen (1975) discussed about the various index numbers advocated by different authors and more particularly about Laspeyres index and Tornqvist index. The Laspeyres index is exact for linear production function, which specifies a priori that all factors are perfect substitute in the production process. Tornqvist Index is exact for the homogeneous translog production function. The fisher index is geometric mean of Laspeyres and passche indices. This index is exact for quadratic production function, which is flexible. The homogeneous translog production function also provides a second order approximation to an arbitrary twice-differential homogeneous production function. In contrast to the assumption of perfect substitutability in case if linear function, the Translog function does not require inputs to be perfect substitutes. Keeping in view the advantage of Tornqvist Divisia index, it was recommended for use in analyzing most production situations.

Patil and Jha (1978) studied changes in output, input and agricultural productivity growth in Maharashtra state, India in 1951-52 to 1971-72. During the sub-period 1951-52 to 1960-61, 18 out of 25 district recorded positive output growth, growth in inputs varied between 0.82 per cent and 2.82 per cent per annum in different district and the average growth in inputs was nearly 1.84 per cent and a negligible growth in modern input was observed. Total factor productivity growth rates were positive in 14 districts and were between 0.85 per cent to 5.92 per cent per annum. During the sub-period 1960-61 to 1971-72 the rate growth decreased. Only 9 out of 23 districts showed growth rates had over 2.5 per cent per annum. Some 2.09 per cent of this increased was due to growth in modern inputs although output growth did not seem to be related to growth in either traditional or modern inputs. Only 3 district recorded

productivity gains; other showed declines in productivity. During the sixties agricultural output stagnated in spite of rapid growth in modern inputs mainly because the technological assets acquired in the 1950 s had depreciated greatly and this completely nullified the condition of modern inputs. Agricultural research and extension to disseminate new technology have a most critical role in rapid output growth.

Bramhananda (1982) estimated TFP for agricultural sector (crop production and livestock) of India vis-à-vis other sectors. The chain index of productivity in agriculture sector shoed a productivity improvement of 1.5 per cent per annum during 1950 and thereafter it declines 0.8 per cent per annum between 1960-61 and 1970-71 and of 0.3 per cent per annum between 1970-71 and 1980-81. After studying other sector also, he observed, that as we move from first to the third state decade, TFP growth rates moves down universally. Thus the contribution of improvement in TFP to sectoral growth shown to have become less and less as we move from the first decade to the third decade. The most important commodity-producing sector like agriculture had a negative contribution to TFP a growth in the third decade. The productivity growth momentum is thus lost.

Singh and Singh (1985) found that despite increase in income in the agricultural sector in Punjab, due to recent technological breakthrough, the proportion of the rural population below the poverty line has increased. The study examined the relationship between growth in output and factor shares, particularly the relative share of labour vis-à-vis non- labor input factor. It was noted that the relative share of labour in gross value of output, both in accounting sense and also from the point of view of its contribution to output, has in general increased after an initial decline following the technological breakthrough in Punjab agriculture. This was primarily due to a sharp increase in cropping intensity and a shift in the cropping labour intensive crop activities.

Adinarayana *et al.* (1986) found significant increase in paddy productivity since introduction of high yielding varieties in Andhra Pradesh (India) during the mid 1960 s using production function analysis, the study showed that the relative value share of land has declined while the value shares of labour, fertilizer and capital have improved significantly. The increase in the relative share of labour indicated that farmers were benefited from the general rise in productivity but the rural sector on the whole might lose to the urban sector on the whole might lose to the substantial value share attributed to fertilizer and capital services. Appropriate policy measures may also be needed to check the decline in the factor share of land.

In case of wheat in Punjab, because the input index has changed little (account of increase in chemical and machinery inputs more than canceled by a decline in labour and animal power units), the total factor productivity index is highly correlated with yield which has steadily grown over the year, particularly in 1980 s on account of increasing labour productivity as a result of mechanization and also may relate to an increase in input efficiency as farmers have learned how t manage the new technology better.

Paul and Mehta (1991) estimated translog cost function to provide measures of factor demand. Elasticity of substitution, biases of technical change and to test hypothesis about the structure of production technology in Indian agriculture. The study covered the period 1960-61 to 1982-82. The cost function was tested for homothetically, homogeneity and Cobb-Douglas structure. The results showed that agriculture technology was biased towards the use of labour and capital and towards the saving of fertilizer and other inputs.

Sidhu and Byerlee (1991) attempted a quantitative study of the "Green Revolution" associated with Mexican varieties of wheat in the Indian Punjab. Results indicated that the technical change has been cost

saving and has not been strongly biased in either a labour- saving or a capital- saving. Wheat production experienced a favourable cost curve on the order of about 16 per cent. Input demand increased capitalized land values led to inferences about income distribution and constitute a source for reinvestment designed to maintain the momentum of the "Green Revolution".

Pinstrup *et al.* (1991) stated that technological change has been effective in increasing the yields of staple and cash crop such as rice and wheat in south Asia and has raised the income of farmers considerably over the last 25 years. The study focused on analyzing the impact of technological change on nutritional standards in area that have displayed success in economic terms as a result of the Green Revolution. Data were derived from a study carried out by India' s, Madras and UK' s Cambridge universities, on villages in North Arcot district, Tamil Nadu. The changes in household incomes and expenditure were examined between 1972-73 and 1082-83 and the proportion of income spent on rice was estimated. Protein consumption levels were analyzed and deficiencies in the typical diet were identified. They concluded that most farm household were consuming 80% of the recommended calorie intake by 1982-83, as result of income increase. Much improvement in nutritional status was also assumed to be a consequence of greater rice producing by each household.

Bhattacharya (1992) attempted to formulate a geometric index model to quantitatively estimate the impact of technological advancement in agriculture, and to analyze regional differences of such change in Uttar Pradesh, India, using data collected over two time periods: 1950-51 to 1966-67 and 1987-88. Since a geometric index model is considered technological change is estimated by the ratio of output index and the input index. The study concluded that the areas that

benefited from new technology were those where water supplies were assured. Suitable varieties of high yielding crop wise until recently, not available for rain- fed condition: this development is welcoming.

Kumar and Mruthyunjaya (1992) estimated total factor productivity for wheat in Indian states. During the period 1972-89, the TFP index has rise by around 1.9 per cent in Punjab, 2.7 per cent in Haryana and Rajastan 2.6 per cent in Uttar Pradesh and 0.4 per cent in Madhya Pradesh. Thus, the TFP growth rates in wheat sector in the Northern India states were much above the rate of growth in TFP not only in India and Pakistan crops sector (around 1per cent) but also during postwar agriculture period in United States of America (around 1.5 per cent). The productivity growth was responsible for 37 to 53 per cent of total output growth in the frontline states, ground 17 per cent in Madhya Pradesh and nearly all the output growth in Rajastan.

Rosegrant and Evenson (1992) estimated the annual growth in TFP for the crops sectors in India, Bangladesh and Pakistan for the period 1957-88. In India, TFP grew relatively steadily over time with modest variation in growth rate over period, but large fluctuation due to weather variation, particularly large drops in TFP occurred in the severe draught years of 1965, 1966 and 1979. Variation in TFP around trend was due to nearly entirely to variation in output as total input use increase smoothly over time. With total output growth increasing at 3 per cent per annum, productively growth has accounted for approximately one-third of total output in the Indian crop sector.

Tuteja (1992) examined changes in factor proportions in wheat and rice farms in the Indian Pubjab and Haryana and the role of price and technological change on the factor proportions. Technological change in terms of capital- output level was measured. An impact of technological change on factor proportions was analyzed via capital-labour ratio, capital-land ratio and land–labour ratio. The capital-land

ratio has increased from 2.26 to 4.26 over the period 1970-71 to 1984-85. Generally, the capital-labour ratio was lower on rice farms as compared to wheat farms. The capital-land ratio has risen with the changing level of technology. On wheat farms in the Indian Punjab, this ratio rose from 1.25 to 1.98 between 1970 to 1984-85. In Haryana, it rose from 2 to 2.67 over the period. The land-labour ratio also tends to rise with technology change. The land-labour ratio on wheat farm in the Indian Punjab and Haryana have shown increase of 18078 per cent and 11.25 per cent respectively, over the period. The price parity indices were found to be favourable for land and unfavourable for capital and output. This did not however pose a threat increasing impact of modern input. The policy implication is that investment in agricultural research; extension and irrigation could be more effective than manipulating input-output prices.

Dholakia and Dholakia (1993) examine the sources of growth of total factor productivity Indian agriculture for three periods: I) the pre-green revolution (1950-51 to1966-67); ii) the initial phase of the green revolution (1966-67 to 198081); and iii) the modernization phase (1980-81 onwards). The study shows that total factor productivity growth in agriculture has been the prime driving force behind the acceleration of overall growth in the Indian economy achieved during the 1980s. Technical progress as measured through TFPG has not been directly determined by capital, labour or capital per worker. Modern inputs such as HYV seeds, fertilizer and irrigation have successfully raised TFPG n Indian agriculture, particularly during the 1980 s.

David *et al.* (1994) analyzed the trends in agriculture productivity and explained hoe institutional and policy reforms have affected productivity through their effects on the intensive structure and technological potential of land, labour and total factor productivity, the chapter first reviewed the institutional and policy reforms affecting agriculture, and then presented the trends in growth of agricultural

output and agricultural input. Due to the lack of data on livestock, the trends in input use and productivity growth pertained only to the crop sub sector. Despite serious data limitation, the analysis attempted to infer broad trends and patterns of productivity changes and their determinants in agriculture statistics. Productivity growth was analyzed by agriculture output to those of inputs. Partial productivity was a major determinant of farm income and wages. In a labour abundant/ land scare economy such as Vietnam, increases in labour productivity was achieved not by introducing labour saving technology, but by raising land productivity. The growth of rice output was decomposed to determine the relative contribution of expansion in cultivated area, cropping intensity, and yield. The paper concludes that the country must invest in developing appropriate data for monitoring and analyzing growth in order to provide information, on policy changes and investment requirement necessary to sustain productivity growth in agriculture.

Kumar and Rosegrant (1994) estimated TFP for rice in India. The results revealed that though growth in input index has declined from 2.99 per cent in 1970 s to 2.13 per cent in 1980s. Similarly, the output index decline from 4.30 per cent during 1970s to 3.10 percent during 1980s. Closely following the input-output index, the TFP through decline from 1.31 per cent during 1970s to 0.97 per cent during 1980s. Thus the recent studies covering the period up to 1980s in Indian crop sector indicated that growth has declined in 1980s as compared to 1970s as shown in rice.

Pingai and Anderson (1994) in their paper discussed the cause of the changing rice productivity and the prospects for reversing the trend by means of tapping unexploited profitable yield potential or through a substantial increase in input use efficiency. It was observed that rice yield growth in Asia declined sharply in the 1980 s, from an annual growth rate of 2.6 per cent in the 1970 s to 1.5 per cent during the period

beginning in 1981. The evidence suggested that progress in yield potential has been so slow, those progressive farmers were quickly bridging the gap under commercial conditions and what research workers could produce under the most favorable experimental conditions. Productivity differences between farmers are not explained by differences in access to technology or inputs, but rather by differences in land quality (especially distance from irrigation canal and differences in farmer's technical knowledge (human capital). These were structural differences that could not be easily bridge in the short term to medium term. The yield gap between farmers was not profitable exploitable and further yield growth would need to come through a shift in the technological yield frontier. Both expected yield increments and probabilities of success were highest for research in the most promising approaches in these environments were changes in plant architecture and the exploitation of hybrid vigour, which could improve rice yield potential by 20 per cent to 25 per cent within the next five to ten years. Achievement of relatively high levels of fertilizer use in Asia has shifted the focus of concern to that of improving the efficiency of fertilizer use. Further work needed to be done on location- specific research. The increasing importance of efficiency in input use compared to input and crop variety promotion would place greater demands on the extension services.

Kalirajan and Shand (1997) examined the sources of output growth in Indian Agriculture for the period 1980 to 1990 state wise analysis. The study concluded that TFP growth in the pre-reform period was negative in four out of fifteen states and at the end of the decade. It was small for those states where the contribution of TFP growth was positive. The contribution of technology to output growth declined substantially, particularly from 1988 to 1990. During the period of analysis technical efficiency increased slowly, and it would be useful to identify the cause for such performance in technical efficiency.

Jha and Kumar (1998) dealt with that the rice- wheat cropping system (RWCS), which is spread in the most fertile regions cover by the predominantly in the states, Punjab, Haryana and Uttar Pradesh. According to them sustainability of RWCS in the IGP was crucial for the country s public distribution system and food security. TFP is used as a measure of sustainability. The share of TFP in the growth rate of rice and wheat production was declining. The yield was more input based. The use of modern inputs like adoption of high yielding varieties, irrigation, chemical fertilizer, pesticide etc has already reached a very high level in IGP. The organic source of nutrient like organic manure and legume area were rapidly declined in the RWCS. Further scope of increasing yield of rice and wheat from modern inputs and area expansion seemed to be remote. The higher growth in yield and production of the RWCS could only be achieved through better management of existing soil and water resources. Despite positive effect of legumes, there area had decline, as they were substituted by rice and wheat, which were profitable crops. New varieties of legume has also not encouraged their adoption thus other methods like remunerative prices, better procurement method, adequate support by public and private seed sector may encourage the adoption of legume in RWCS.

Brithal *et al.* (1999) revealed that livestock output growth grew at 2.59 per cent per annum over 1950-51 to 1995-96. The input index increased by 10.79 per cent per annum and TFP grew at about 0.8 per cent, implying that technical change contribute about 30 per cent to overall growth over the last 45 years period wise results were more revealing. There was no TFP growth in the first period (1950-51 to 1970-71) implying no technical change. Out put growth proceeded along the traditional production function and was driven by growth in output was 1.3 per cent per annum. Since then output and TFP was increasing. The real swing started in 1980s when sectors output growth touched nearly 4

per cent and the TFP growth jumped to nearly 1.8 per cent contributing 45 per cent of the total output growth.

Patil *et al.* (1999) studied the factors affecting food grains productivity in Maharashtra. It was observed that there was a positive relationship between integrated land food grains, female labour. Hence, increasing irrigated area as well as amount of credit used could increase productivity. Educational standard of the people and replacement of female labour lead to an increase in mechanization would lead to an increase in productivity.

Renuka Pillai (2000) studied on analysis of paddy productivity growth in West Bengal and Orissa by using Divisia-Tornqvist index and studied the overall picture that emerged from her analysis in the input productivity has indeed played on important role I the growth performance in the 1980s and early 1990s in this region, while growth inputs and total factor productivity have contributed significantly to the output growth in both the states. The improvement in input productivity in West Bengal has been brought about both by efficiency and technology in the presence of variation across season and seed varieties, improvement in production technology between 1986-87 and 1990-91.

Sharma and Sharma (2000) studied on farm size-productivity Relationship: Empirical evidence from an agriculturally developed region of Himachal Pradesh. He concluded that macro evidence from an agriculturally developed region, where new technology had permeated quite thoroughly, showed the existence of inverse farm size productivity relationship in the production of wheat, paddy and also when all the crops taken together. In case of other crops, which included maize, oilseed pulses, berseem etc., the negative relationship was not so robust and in some cases, it was even positive through statistically insignificant. The result further showed that the small farms used higher amount of human labour and fertilizer as compared to higher

farm size categories. The regression results also confirmed the inverse relationship coefficient in most of the cases, except in the case of other crops, and were negative and statistically significant. In broader terms, the results of the study do not support the view that the inverse farm size-productivity relationship has disappeared with the spread of new agricultural technology. On the contrary, negative relationship appeared to have become stronger.

Singh and Pal (2002) studied on sustainability of rice-wheat system in Eastern Uttar Pradesh: An economic analysis. They reported that growth in total factor productivity (TFP) was decelerating in the green revolution region practicing rice-wheat cropping system. The result showed that crops yields have become more stable over time and the system was moving towards specialization growth in the output and input.

Sinddalingappa and Chinnapa (2002) studied on factors influencing total factor productivity in the dry agro climatic zone of Karnataka state. The study concluded that due to improvement in infrastructure, regional and agro-climatic and related factors contributed positively to the productivity of major crops as revealed by the increasing trends in TFP growth three periods.

The above reviews are mainly concentrated towards growth analysis and effect of explanatory variables on agricultural development at various locations. There are very few studies on composite index of development and total factor productivity in agriculture, particularly, in the zone of high rainfall like Konkan, in depth analysis of various parameters of agricultural development and their effect on total factor productivity in agriculture is necessary.

CHAPTER III

SOCIO-ECONOMIC BACKGROUND OF KONKAN REGION (Excluding Bombay)

This chapter is devoted to the socio-economic background of the study area. A brief account of geographical and socio-economic conditions prevailing in the selected area is given so as to have good understanding of the region and this will also help in the interpretation of the results and drawing inferences.

3.1 Location :

The Konkan region of Maharashtra falls under west Coast plains and Ghat region (Zone No. XII). It has a long narrow strip stretching from North to South along the west Coast of India. It position on the world map is given by 15^0 37' to 18^0 04' north latitude and 73^0 19' to 74^0 13' east longitude. The region comprises greater Mumbai, Thane, Raigad, Ratnagiri and Sindhudurg districts of Maharashtra State. The total geographical area of Konkan region is 29.41 lakh hectares. The region has a hilly terrain and receives heavy rainfall ranging from 3000 to 4000 mm mostly during June to September. The climate is warm and humid almost throughout the year. The soils are mainly lateritic and medium black.

The Konkan region shows variation in agro-climatic features, soil types, crops and cropping pattern. Based on these variations, the region is broadly divided into two agro-climatic zones *viz.*, South Konkan Coastal Zone and North includes Ratnagiri and Sindhudurg district whereas the North zones includes Raigad and thane districts.

Boundaries:

All the four districts have surrounded by sahyadri hills to the east beyond which there are boundaries of six districts of western Maharashtra region, Gujarat state towards north, Arabian sea to the west and Goa to the south. The Konkan have a coastal line of 720 km (including Greater Bombay).

3.2 Topography:

The Konkan can be divided in to three natural zones from the point of view of topography viz., (i) The coastal zone which is marked by rice cultivation on low lying areas and plantation of mango on hill slopes, coconut and areca nut along seacoast. (ii) The plateau surface, which is used for cereals crops rice, nagli etc. and cashew nut on hill slopes, (iii) the hilly zones have goods forests. The Sahyadri ranges on the eastern boundary have highly uneven natural surface and are agriculturally poor and natural vegetation is negligible.

3.3 Soil:

Soils constitute the physical basis of an agriculture enterprise and play a vital role in the agricultural economy. Soils of Konkan region are found in several grads depending on their location and admixture of different rocks. The predominant soils in south Konkan are leteritic which very in colour from bright red to brownish. They are always acidic and fairly well supplied with nitrogen and organic matter. While the soils of north Konkan are made up of 'Deccan Trap' which very in colour from brownish to black.

3.4 Climate:

The climatic conditions in the region are strongly influenced by its geographical conditions. It is distinctly different on coastal strip where it is very humid and warm. On the other hand, the climate on the eastern slopes and plains at the foot of slopes is comparatively less humid. The percent humidity ranges from 50-80 throughout the year. On an average, temperature ranges from 16 ^{0}Cto 40^{0}C. The summer season from March to may is followed by the south-west monsoon season from June to September. The period from December to February is winter. Being the coastal district, the variation in temperature during the day and through the season is not large. Maximum temperature at the seacoast rarely goes beyond 38^{0}C and in the interior; it seldom crosses 40^{0}C owing to the proximity of the sea.

3.5 Rainfall:

Rainfall is the most dominant single weather parameter that influences plant growth and crop production because of its uncertainty and variable nature. Rainfall is not uniform in all parts of the Konkan region. It increases rapidly from Western Ghats on eastern border. The Konkan region gets assured rainfall ranging from 2000 to 40000 mm from the southwest monsoon during the months from June to September. Generally, the highest rainfall in the month of July. It is less towards the north than south.

3.6 Area and population:

The total geographical area of Konkan region is 29,410 sq km. According to 2001 census, total population of Konkan region was 94.50. Out of which, male population was 47.90 lakhs and female population was 46.60 lakhs. The density of population per sq. km. was 427 as against 256 for Maharashtra state. The proportion of rural population was higher than urban population. Rural population was 47.99 lakhs and urban population was 52.01 lakhs.

3.7 Land utilization:

The land utilization information of Konkan region is presented in Table 3.1.

It is observed from the Table 3.1 that the net sown area is only 27.84 per cent of the total geographical area in the region. The area sown more than once is only 2.43 per cent. Unculturable land constitutes 17.62 per cent. It shows that the topography of the region makes large part of its land unsuitable for cultivation. While proportion of Culturable wasteland in the Konkan region is 9.28 per cent. This shows that there is good scope to bring the follow land under plantation crops, particularly mango and cashew.

Table 3.1 Land utilization in Konkan region

Sr. No.	Land use category	Area (00 ha)	Percentage to total geographical area
1.	**Total geographical area**	**29410**	**100.00**
2.	**Area under forest**	**5234**	**17.79**
3.	**Barren and unculturable land**	**4631**	**15.74**
4.	**Land put for non-agril. Uses**	**1822**	**6.19**
5.	**Culturable waste land**	**2787**	**9.48**
6.	**Permanent pasture and other grazing land**	**1123**	**3.81**
7.	**Land under miscellaneous trees crops and groves**	**1404**	**4.78**
8.	**Current fallows**	**1047**	**3.58**
9.	**Other fallows**	**1628**	**5.54**
10.	**Net sown area**	**9734**	**33.09**
11.	**Area sown more than once**	**751**	**2.55**
12.	**Gross cropped area**	**9300**	**31.62**

Source: Districtwise Agricultural Statistical Information on Maharashtra, Part-II (2001-02), Commissionerate of Agriculture, Pune.

This is being done by the government of Maharashtra through Employment Guarantee Scheme (EGS), which provides a good amount of subsidy to the farmers for undertaking plantation of horticulture crops. The area under forest is 17.93 per cent, which is also less than the recommended level of 30 per cent of the total geographical area. Efforts need to be done to increase area under forest and protect the available forest by following strict measures. The gross cropped area accounts for about 31.62 per cent of the total geographical area.

3.8 Cropping pattern:

As the Konkan region is situated near the seacoast, there is heavy rainfall during monsoon. Paddy and Nagli are the major cereals grown in

the region. Paddy cultivation is done on lowlands and the varkas lands are utilized for cultivation of hill millets like Nagli, Kodra and Vari, etc. Varkas lands on hill slopes in heavy rainfall area provide good drainage and hence mango and cashew nut orchards thrive well on such lands. On coastal plains, coconut and areca nut gardens are well established. The cropping pattern of the Konkan region is given in Table 3.2.

Table 3.2 Cropping pattern of Konkan region

Sr. No.	Crops	Area in ('00' ha)	Percentage to gross cropped area
1.	Cereals		
	a) Paddy	4373	47.02
	b) Other cereals	788	8.47
	Total cereals	5091	54.74
2.	Pulses		
	a) Tur	350	3.76
	b) Gram	50	0.53
	c) Other pulses	44	0.47
	Total pulses	444	4.77
3.	Total foodgrains (Cereals and Pulses)	5535	59.51
4.	Total oilseed	132	1.41
5.	Total fruits and vegetables	1457	15.69
6.	Fodder crops (natural grass lands)	2176	23.39
7.	Total cropped area	9300	100

Source: Districtwise Agricultural Statistical Information on Maharashtra, Part-II (2001-02), Commissionerate of Agriculture, Pune.

It can be seen from the table 3.2 that the cropping pattern of Konkan region is dominated by cereal crops. Paddy is a major cereal crop occupying 47.02 per cent of the gross cropped area. The area under foodgrain crops, is 59.51 per cent which includes the area under pulses accounting for

about 4.77 per cent. Area under oilseed crops is less than two per cent. Fruits and vegetable crops occupy about 15.69 per cent of the gross cropped area having further scope of increasing area under these crops by bringing Culturable wasteland under cultivation, which stands at about 9.28 per cent of the total geographical area. The area under fodder crops is about 23.39 per cent. In fact, there is no much commercial cultivation of fodder crops in the region except, few patches in Thane and Raigad districts. The area shown in cropping pattern gives an idea about area under natural grasses lands from where mostly dry grass is harvested.

3.9 Fishery:

The marine fishing is practiced all over the coastline of 720 km in all four districts of Konkan (excluding Greater Bombay). Fishing is carried out with the traditional boats as well as mechanized trawlers. The fishery trade has flourished in Thane district, as there is always demand for fish in Bombay market. Fishing trade is increasing gradually and still has vast potentialities. Total marine fish production during 2000-01 from four districts was 246874 M.T.

There are 141 fisheries societies working in four districts. The details about coastal length and fish production in each district during 2000-01 is given in Table 3.3.

Table 3.3. Marine fish production

District	Coastal length (km)	Production (MT)	Productivity MT/km length
Thane	112	73017	651.93
Raigad	240	47834	199.30
Ratnagiri	167	96644	578.70
Sindhudurg	121	29379	242.80
Konkan region	640	246874	385.74

Source: Socio-economic Review and District Statistical Abstract of the respective district, 2000-01.

It is seen from the table that the production per km. length in Thane district was highest (651.93 MT) Followed by Ratnagiri (578.70 MT), Raigad (199.30 MT) and Sindhudurg (242.80 MT). In the Konkan region, per km. length fish production is 385.74 MT

3.10 Livestock:

Livestock makes substantial contribution to the economy by providing subsidiary income to the farmers, food to human populating and employment to labours. The livestock population in Konkan region as per 1998 census is presented in table 3.4.

Table 3.4. Livestock population in Konkan region

('000' numbers)

Sr. No	Category	Number	Percentage to total livestock
1.	**Cattle**	**1844**	**61.14**
2.	**Buffalo**	**258**	**8.55**
3.	**Total bovine**	**2102**	**69.69**
4.	**Sheep**	**2**	**0.066**
5.	**Goats**	**469**	**15.55**
6.	**Horses**	**185**	**6.13**
7.	**Other livestock**	**138**	**4.57**
8.	**Total livestock**	**3016**	**100**
9.	**Total poultry birds including other birds**	**5687**	**-**

Source: Socio-economic Review and District Statistical Abstract of the respective district 2000-01.

Table 3.4 indicated that as per livestock census 1998, total livestock population in Konkan region was 30.16 lakh heads, of which 69.69 per cent was bovine population. Cattle and buffalo population was 61.14 and 8.55 percent, respectively.

3.11 District wise milch animals:

The information regarding district wise milch animals is presented in Table 3.5.

It is observed from the Table 3.5 that in Konkan region, there were 402025 milch animal of which maximum (37.84 %) were in Raigad district followed by Thane (27.74%), Ratnagiri (21.76%) and Sindhudurg district (12.66). Among different types of milch animals, the proportion of crossbreed cows was maximum (50.38) in Ratnagiri and it was minimum (11.29%) in Raigad district.

Table 3.5 Districtwise milch animals

(Number)

Sr. No.	District	Category			Total milch animal
		Cow		Buffalo	
		Crossbreed	Indigenous		
1.	Thane	3692 (25.69)	59292 (27.16)	48547 (28.65)	111531 (27.74)
2.	Raigad	1623 (11.29)	73865 (33.84)	76640 (45.25)	152128 (37.84)
3.	Ratnagiri	7241 (50.38)	59081 (27.09)	21173 (12.49)	87495 (21.76)
4.	Sindhudurg	1815 (12.64)	25998 (11.91)	23058 (13.61)	50871 (12.66)
5.	Konkan Region	14371 (100)	218236 (100)	169418 (100)	402025 (100)

(Figures in parenthesis are indicate percentage to Konkan)

Source: Socio-economic Review and District Statistical Abstract of the respective district 2000-01.

As regards indigenous cows, the proportion was maximum (33.84) in Raigad district and was minimum in Sindhudurg district (11.91%). In respect of milch buffalo, maximum proportion was in Raigad district

(45.25%) followed by Thane district (28.65%), Sindhudurg district (13.61%) and Ratnagiri district (12.49%).

The analysis revealed that Thane and Raigad districts are having leading position in respect of number of milch animals. This is particularly true in respect of number of milch buffaloes.

3.12 Transport and communication:

The total road length and length of railway route in the year 2000-01 was 24148.24 Km. and 941.72 Km, respectively. The road length maintained by all authorities per 100 sq. km. of geographical area in the Konkan region in 2000-01 was 82.10 km. A major State highway viz., Bombay-Goa highway runs lengthwise and serves as an important means of communication. Most of the villages and towns are connected by small roads to highway. The Konkan railway is also becoming a major source of transport in the region. Telecommunication facilities are also well developed in the region, which helps in fast communication.

3.13 Co-operative societies:

Co-operative sector covers various aspects of agricultural needs such as extension to agriculture credits and provision of agricultural inputs through co-operative societies. At the end of 2000-01, there were 21238 all types of co-operative societies in the Konkan region of which 1285 (6.05%) were co-operative credit societies, 1986 (9.35%) non-agricultural credit societies, 115 (0.54%) marketing societies, 1967 (9.27%) productive enterprises, 15885 (74.79%) social service and other co-operative society.

CHAPTER IV

METHODOLOGY

The success of any scientific research ultimately depends upon the research methods used. It is therefore, necessary to adopt a suitable and appropriate analytical method in economic research also. The reliability and validity of the result depends upon the method and procedure of sampling, collection of data and analytical tools used in the study for deriving meaningful conclusions as per objective of the study. The methodology followed for the present study is presented in this chapter.

4.1 Sample and data:

Data on socio-economic indicators and infrastructure indicators for Konkan region comprising of Thane, Raigad, Ratnagiri and Sindhudurg district are described. The study used the data on following variables for the period of twenty years from 1980-81 to 1999-2000, for each district of Konkan region and Konkan region is whole. The same data is used in the total factor productivity analysis. The missing years data of same the variables were predicted, using 'interpolations based on trends' in the available data.

4.1.1 Selected parameters for agricultural development:

The selected parameters are grouped as under:

1. **Socio-economic indicators:**

   i) Total geographical area (00 ha)

   ii) Rural population as per cent to total population

   iii) Working population as per cent to total worker

   iv) Agriculture worker as percent to total worker

   v) Marketing facilities (No. of market yards)

vi) Road length per square km

vii) Credit flow to Agriculture (Rs'000'per ha NCA)

viii) Population density (No.)

ix) Mechanization (No.)

a) Number of tractors per 1000 ha of net cropped area.

b) Power tillers per 1000 ha of net cropped area.

c) Electric pump sets per 1000 ha of net cropped area.

x) Actual rainfall (mm)

2. Growth parameters:

i) Area, production and productivity of crops and crop groups.

ii) Land use pattern (hundred ha)

iii) Quantity of fertilizer used (MT)

iv) Area under high yielding varieties (hundred ha)

v) Farm labour wage rates index

vi) Cropping intensity (%)

vii) Irrigated and gross irrigated area (hundred ha)

3. Other variables (based on census)

i) Population density per sq. km

ii) Sex ratio

iii) Population growth rate (%)

iv) Literacy percentage

4.1.2 Sources of data:

The time series data are required to fulfill the objectives. Such data were collected from secondary sources i.e. different published

records of the state government, cooperative and private institutions viz.,

i) Season and Crop Reports, Department of Agriculture, Government of Maharashtra, Pune.

ii) Statistical Abstract of Maharashtra State, Directorate of Economics and Statistics, Government of Maharashtra, Mumbai.

iii) Epitomes of Agriculture in Maharashtra Part II.

iv) Socioeconomic Review and District Statistical Abstracts of Thane, Raigad, Ratnagiri and Sindhudurg, Directorate of Economics and Statistics, Government of Maharashtra, Mumbai and

v) Census reports viz., agricultural census, population census

4.2 Methods of analysis:

For the purpose of analysis, the study is divided into four parts:

Part-I :

Temporal changes in parameters of agricultural economy of different districts in Konkan region and Konkan region as a whole. This part enhances background information of the study area and the problem under study.

Part-II : Growth rates analysis:

The development of agriculture in Konkan region is studies growth rates in the various selected parameters of development.

4.2.1 Linear Growth Rate (LGR):

Linear trend equation used for estimating linear growth rates. It is represented as under:

$$Y = a + bx + e$$

$$LGR\ (\%) = \frac{b}{\hat{y}} \times 100$$

Where,

Y = Dependent variable for which growth is estimated

a = Intercept or constant

b = Regression or trend coefficient

x = Period (in years)

$\hat{y}$ = Estimated value of dependent variable (y)

e = Error term with zero mean and constant variance.

4.2.2 Compound Growth Rates (CGR):

Compound growth rate is estimated to study the percentage increase or decrease in the selected parameter. The following exponential growth function is used.

$$Y = ab^{x} e$$

Where,

Y = Dependent variable for which growth is estimated

a = Intercept or constant

b = Regression or trend coefficient

x = Period (in years)

e = Error terms with zero mean and constant variance

The above equation is reduced in the following linear equation, on taking logarithms.

$$\log y = \log a + (\log b) \, . \, x$$

Compound growth rate (CGR %) was estimated by

$$CGR\ (\%) = [\text{Antilog}\ (\log b) - 1] \times 100$$

The growth rate are tested for significance,

$$t = \frac{|b|}{S.E.(b)}$$

With appropriate, degrees of freedom at 5 per cent and 1 per cent level of significance.

PART II

4.2.3 Infrastructure development index (composite index):

The importance of infrastructure in productivity enhancement cannot be over looked. The high degree of variability of infrastructure facility are visible in Konkan region. We attempted here to construct Composite index of infrastructure development in the light of availability of published data from different sources.

Composite index were need for studying the influence of socio-economic infrastructure and regional variables on agriculture productivity in Konkan region. The various indicators were taken for socio-economic infrastructure and regional variables were recorded in different levels of measurement. The study periods is classified into two periods *viz.*, 1980-1990 and 1990-2000. The values of these variables are not quite suitable for simple additions in combined analysis. Hence, variables were transformed and standardized and standardized values are used to build up the composite index of socio-economic infrastructure and regional variables. The best value of each indicator was identified and deviations of transformed variable from corresponding best values were obtained for each indicator. The composite indices have been obtained separately for agriculture, infrastructure, and socio-economic development for different districts in Konkan. The value of composite index is always non-negative and lies between 0 and 1. A value close to zero indicated higher level of development where a value close to one indicated the lower level of development.

The composite indices can be used as yard-stick to classify the sub-regions and develop appropriate plans. It helps us to classify the sub-regions based on a set of large multivariate data. The information contained in the large set is transformed in to small set of indices, which provide a convenient method for classification. One of the most

commonly used methods is by Iyengar and Sudarshan (1982). It is simple and does not have restrictive assumption of linearity in relation to indicators. A brief summary of the methodology is given below:

Let us assume that there are d districts and m development indicators and Xid is the observed value of I^{th} development indicators for d^{th} district (I=1,2,3,----, m,d= 1,2,3,-------, n). First these values are related positively to the development, the standardization is achieved by employing the formula :

$$Yid = (Xid-Min\ Xid) / (Max\ Xid- Min\ Xid)$$

Where,

Min Xid and Max Xid are the minimum and maximum of (xi1, xi2--, xin), respectively. When the values of Xid are negatively related to the development as in the case of area under waste lands, infact mortality rate etc., the standardized value will be computed by the formula:

$$Yid = (Max\ Xid- Xid) / (Max\ Xid- Min\ Xid)$$

obviously these standardized indices lie between 0-1. The level or stage of development of d^{th} district is assumed to be a linear sum of Yid as :

$$Yid = Wi\ Yid$$

Where, ($0 < W < 1$ and $Wi=1$) are the weights determined by:

$$Wi = K$$

$$Var\ (Yi)\ \text{and}$$

$$K = [1/var\ (Yi)]^{-1}$$

The choice of weights in this manner would ensure that large variation in any one of the indicators would not unduly dominate the

contribution of the rest of the indicators and distort inter district comparisons.

For classificatory purpose, a simple ranking of the district indices *viz.,* Yd was done.

Part IV : Estimation of Total Factor Productivity:

(Decomposition analysis)

The triennium averages were used to even out the fluctuations in various indicators and parameters. However, the triennium averages for the factor/ variables concerning population census can not be taken because census are conducted every after ten years and reported for a one period of time e.g. 1971, 1981 and so on.

4.2.4 Analysis of Total Factor Productivity (TFP):

Total factor productivity concept implies an index of total output per unit total factor inputs. TFP growth measures the increase in output i.e. not accounted for by the increase in total inputs. Changes in total factor productivity index can be used as a one of the measures such as output per unit of individual inputs and have limitations as indicators of real productivity change i.e. partial productivity measures. Thus, total factor productivity index that measures the growth in net output i.e. not accounted for by the growth in basic factor input such as land, labour capital, it is superior to partial approach as it is composite measure of productivity, which related output to all inputs simultaneously.

Technological advancement has been a major contributing factor to the economic growth. Since the publication of pioneering work of Schultz (1953), Solow (1957) and Griliches (1964), voluminous literature dealing with the measurement and analysis of productivity at different levels of aggregation has appeared. Three approaches for the measurement are the most representative: I) the parametric approach which models the state of technology by including a time trend in the production or cost functions and then partial differentiation with respect

to time (or other proxies) to get estimates of technological changes; ii) the accounting approach which approximates technological change by the construction of factor productivity indices, mainly the rate of change of total factor productivity indices (Christenses, 1975); and iii) a more recent approach, termed 'non-parametric' by Chavas and Cox (1988) and Cox and Chavas (1990), which identifies a group of implied linear inequalities that a profit maximizing (or cost minimizing) firm must satisfy and estimate the rate of technological change using linear programming.

The accounting approach is popular because it is simple to calculate and requires no econometric estimation and, therefore, the data requirement is minimal. The use of TFP indices gained prominence since Diewert (1976, 1978) proved that Theil-Tornquist discrete approximation to the Divisia index is consistent in aggregation and superlative to a linear homogenous trans logarithmic production function. Thus, the Divisia-Tornqvist index is used in the present study for computing total output index (TOI), total input index (TII) and total factor productivity index (TFPI) in crop sector for different districts in Konkan region and Konkan region as a whole.

As far as Konkan region is concerned; though there is a substantial production of horticultural crops, which is highly valued, there is not published and recorded time series data regarding input use and production. However, there is availability of systematic data on acerage, input use, prices of input and output of rice and ragi crops (either published or recorded). Therefore present study was restricted to factor productivity analysis of these two major cereals of the region which occupy approximately 80 per cent of the net cropped area in the region. No doubt, there is a very negligible area under certain pulses and oilseeds in Konkan region and hence, these were not considered for analysis.

Six inputs (seed, male labour, female labour, bullock labour, fertilizer (N), FYM and rental value of land) were considered for analysis. Rental value of land is taken as a one sixth of gross value of

produce, bullock labour input as a number of bullock pair in days, FYM input taken as a quintal per hectare and human labour male or female in days.

The data on these inputs were collected from records of cost of cultivation scheme operated in Maharashtra State in the Department of Agricultural Economics, College of Agriculture, Dapoli. Share of each input cost was computed as proportion to the total production cost. Input cost share and input quantity data for each district were used for computing the input index. The farm harvest price and production of crop at district level were used to compute the output index. The value of a grain and byproduct included into output index. The total factor productivity index was computed by dividing the output index by input index for each district (Renuka Pillai, 2001). By specifying TOI, TII equal to 1 in the initial year, the following equations provided the total output index, total input index and total factor productivity index for a specified period.

TFP indices are computed as follows :

Total output index (TOI)

$$TOI_t / TOI_{t-1} = \pi_j (Q_{jt} / Q_{jt-1})^{(Rjt + R jt-1)\ 1/2}$$

Total input index (TII):

$$TII_t / TII_{t-1} = \pi_j (X_{it} / X_{it-1})^{(S_{it} + S_{it-1})\ 1/2}$$

Total factor productivity index (TFPI):

$$TFPI_t = (TOIt / TII_t) \times 100$$

Where,

R_{it} = is the share of output j in the total revenue

Q_{jt} = is output j

S_{it} = is the share of input i in total input cost

X_{it} = is input i and

Growth rate in TFP = Growth rate in TOI – Growth rate in TII

For productivity measure over a long period of time, chaining indexes for successive time periods is preferable. With chain linking, an index is calculated for two successive periods t and t-1, over a whole period to T (sample from time t = 0 and t = T) and the separate indices were then multiplied together. Chain linking index takes into account the changes in relative values/ cost throughout the period of study. This procedure has the advantage that no single period plays a dominant role in determining share and biases are likely to be reduced.

Total factor productivity decomposition:

Important parameter used in total factor productivity decomposition are given below :

$$Y = ax_1^{b_1} X_2^{b_2} \ldots\ldots\ldots\ldots\ldots X_n^{b_n}$$

$$\log y = \text{loa } a + b_1 \log X_1 + b_2 \log X_2 \ldots\ldots\ldots b_n \log X_n$$

Where,

Y = Total factor productivity index

b_0 = Constant

X_1 = Number of market yard per 1000 ha of net cultivated area

X_2 = Proportion of area under horticulture crop in net cultivated area

X_3 = Number of irrigation pumps sets per 1000 ha of net cultivated area

X_4 = Number of tractor per 1000 ha of net cultivated area

X_5 = Number of power tiller per 1000 ha of net cultivated area

X_6 = Total amount of loan per 1000 ha of net cultivated area

X_7 = Annual rainfall in mm.

X_8 = Road density (km /1000ha of net cultivated area)

X_9 = Proportion of forest area to geographical area

X_{10} = Proportion of net crop area under high yielding varieties

X_{11} = Fertilizer use per 1000 ha of net cultivated area

X_{12} = Proportion of irrigated area to net cultivated area

The decomposition of TFP is undertaken by estimating the effect of factors like rural literacy, credit, infrastructure, research and extension stocks. This would reveal the importance of location specific factors in boosting TFP of agriculture. This analysis is based on log linear regression frameworks involving pooled time series- cross-sectional data.

Due to multicolinearity problem, step down log linear regression method is used to identify significant parameter. This method consisted of examining only best regressors, which were retained, in the model. Using the significant level of 1 per cent and 5 per cent the obtained variables were identified as the sources of total factor productivity growth. The percentage contribution of significant variables contributing total factor productivity growth was estimated through standardized regression technique. These obtained 'standardized normal variates' are unitless and hence only used to estimate the per cent contribution of individual variable in total factor productivity growth.

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Table 5.4. Production and productivity of principal crops (1999-2000)

(Figures in parentheses are percentage to Konkan region)

Sr. No.	Particulars	Thane		Raigad		Ratnagiri		Sindhudurg		Konkan	
		Production ('00' MT)	Yield (kg/ha)	Production ('00' MT)	Yield (kg/ha)	Production ('00' MT)	Yield (kg/ha)	Production ('00' MT)	Yield (kg/ha)	Production ('00' MT)	Yield (kg/ha)
1.	**Rice**	**3020 (30.06)**	**2130**	**3285 (32.69)**	**2421**	**1928 (19.19)**	**2413**	**1813 (18.06)**	**2269**	**10046 (100.00)**	**2295**
2.	**Total cereals**	**3270 (30.56)**	**1915**	**3394 (31.73)**	**2249**	**2186 (20.43)**	**2096**	**1850 (17.28)**	**2224**	**10700 (100.00)**	**2102**
3.	**Total pulses**	**107 (45.73)**	**560**	**65 (27.77)**	**508**	**32 (13.67)**	**508**	**30 (12.83)**	**484**	**234 (100.00)**	**527**
4.	**Total food grain**	**3377 (30.29)**	**1779**	**3459 (31.00)**	**2113**	**2218 (19.87)**	**2005**	**2103 (18.84)**	**2103**	**11157 (100.00)**	**1975**
5.	**Total oil seed**	**22 (16.94)**	**493**	**5 (3.84)**	**500**	**17 (13.07)**	**708**	**86 (66.15)**	**1593**	**130 (100.00)**	**982**

Table 5.8. Mean, S.D. and C.V. for area under principal crops in Konkan region

(Area in '00' ha)

Particulars	Thane					Raigad					Ratnagiri				
	Beginning of the year 1980	End of the year 2000	Mean	S.D.	C.V. (%)	Beginning of the year 1980	End of the year 2000	Mean	S.D.	C.V. (%)	Beginning of the year 1980	End of the year 2000	Mean	S.D.	C.V. (%)
Rice	**1449**	**1418**	**1499.63**	**28.25**	**1.90**	**1436**	**1357**	**1456.8**	**67.31**	**4.62**	**750**	**789**	**800.74**	**24.58**	**3.07**
Total cereals	**1811**	**1707**	**1812.73**	**36.11**	**1.99**	**1772**	**1509**	**1726**	**121.4**	**7.03**	**1456**	**1043**	**1306.84**	**137.43**	**10.52**
Total pulses	**180**	**191**	**187.9**	**45.41**	**24.17**	**162**	**128**	**138.79**	**32.85**	**23.67**	**90**	**63**	**55.32**	**18.00**	**32.54**
Total food grain	**1951**	**1898**	**1944.5**	**57.51**	**2.88**	**1934**	**1637**	**1865**	**128.4**	**6.88**	**1546**	**1106**	**1369.58**	**150.48**	**10.99**
Total oil seed	**49**	**44**	**45.94**	**11.38**	**24.76**	**26**	**10**	**19.26**	**8.83**	**45.84**	**100**	**24**	**68.32**	**34.32**	**50.24**

Particulars	Sindhudurg					Konkan				
	Beginning of the year 1980	End of the year 2000	Mean	S.D.	C.V. (%)	Beginning of the year 1980	End of the year 2000	Mean	S.D.	C.V. (%)
Rice	**720**	**799**	**783.26**	**29.46**	**3.76**	**4461**	**4373**	**4532.6**	**84.78**	**1.87**
Total cereals	**832**	**832**	**889.73**	**54.66**	**6.14**	**5871**	**5081**	**5596.2**	**304.41**	**5.34**
Total pulses	**39**	**62**	**57.31**	**24.26**	**42.33**	**264**	**444**	**429.25**	**102.3**	**23.8**
Total food grain	**871**	**894**	**823.5**	**54.36**	**5.8**	**6135**	**5525**	**5850**	**322.5**	**5.25**
Total oil seed	**22**	**54**	**38.63**	**16.00**	**41.43**	**197**	**132**	**175.2**	**39.79**	**13.82**

Table 5.13. Mean, S.D. and C.V. of high yielding varieties under principal crops in Konkan region

(Area in '00' ha)

Particulars	Thane					Raigad					Ratnagiri				
	Beginning of the year 1980	End of the year 2000	Mean	S.D.	C.V. (%)	Beginning of the year 1980	End of the year 2000	Mean	S.D.	C.V. (%)	Beginning of the year 1980	End of the year 2000	Mean	S.D.	C.V. (%)
HYV	**87**	**132.7**	**111.19**	**14.09**	**12.6**	**105.5**	**123.6**	**122.4**	**9.45**	**7.72**	**41.93**	**73.4**	**58.63**	**12.75**	**21.75**

Particulars	Sindhudurg					Konkan				
	Beginning of the year 1980	End of the year 2000	Mean	S.D.	C.V. (%)	Beginning of the year 1980	End of the year 2000	Mean	S.D.	C.V. (%)
HYV	**24.77**	**72.40**	**46.06**	**13.06**	**28.35**	**259.2**	**402.1**	**341.5**	**48.55**	**14.21**

Table 5.11. Mean, S.D. and C.V. of fertilizer consumption in Konkan region

(in MT)

Particulars	Thane					Raigad					Ratnagiri				
	Beginning of the year 1980	End of the year 2000	Mean	S.D.	C.V. (%)	Beginning of the year 1980	End of the year 2000	Mean	S.D.	C.V. (%)	Beginning of the year 1980	End of the year 2000	Mean	S.D.	C.V. (%)
N	**4724**	**12865**	**8341**	**3146**	**37.72**	**5809**	**12171**	**8871**	**2538**	**28.6**	**4151**	**7226**	**4820.21**	**1562.43**	**32.41**
P	**1007**	**1848**	**1907**	**1212**	**63.55**	**1297**	**1811**	**1731.63**	**1174.41**	**67.82**	**832**	**1025**	**979.11**	**303.84**	**31.03**
K	**514**	**1426**	**1340**	**644.4**	**48.08**	**999**	**1036**	**1206**	**876.4**	**72.64**	**639**	**728**	**792.16**	**366.4**	**46.26**
Total	**6245**	**16139**	**11816.2**	**4357.3**	**36.87**	**8105**	**15018**	**11973.1**	**4150.60**	**34.66**	**5622**	**8979**	**6710.8**	**1930.76**	**28.77**

Particulars	Sindhudurg					Konkan				
	Beginning of the year 1980	End of the year 2000	Mean	S.D.	C.V. (%)	Beginning of the year 1980	End of the year 2000	Mean	S.D.	C.V. (%)
N	**2256**	**3999**	**2894.21**	**1014.63**	**35.05**	**16940**	**36261**	**25390.9**	**7955.4**	**31.33**
P	**814**	**1839**	**1182.3**	**444.49**	**37.59**	**3950**	**6523**	**5798.8**	**2368.0**	**40.83**
K	**508**	**1247**	**811.21**	**271.7**	**33.49**	**2660**	**4437**	**3965.4**	**1649.2**	**41.58**
Total	**3578**	**7085**	**4997.0**	**1622.13**	**32.45**	**23550**	**47221**	**34549.95**	**11815.19**	**34.19**

Table 5.12. Mean, S.D. and C.V. of wage rates in Konkan region

(in Rs.)

Particulars	Thane					Raigad					Ratnagiri				
	Beginning of the year 1980	End of the year 2000	Mean	S.D.	C.V. (%)	Beginning of the year 1980	End of the year 2000	Mean	S.D.	C.V. (%)	Beginning of the year 1980	End of the year 2000	Mean	S.D.	C.V. (%)
Field labour															
(a Male	**6.18**	**45.25**	**20.20**	**12.78**	**63.27**	**6.76**	**52.18**	**25.29**	**15.45**	**60.86**	**9.03**	**55.97**	**26.54**	**16.12**	**60.74**
(b) Female	**5.61**	**33.69**	**16.09**	**9.63**	**59.89**	**5.49**	**41.62**	**20.00**	**18.87**	**59.34**	**6.59**	**41.70**	**18.87**	**11.99**	**63.51**
Other agril. labour															
(a) Male	**5.51**	**38.02**	**19.59**	**11.88**	**60.67**	**5.66**	**45.00**	**21.29**	**12.81**	**59.86**	**8.60**	**50.62**	**25.80**	**14.92**	**57.83**
(b) Female	**4.59**	**29.68**	**15.25**	**8.88**	**58.26**	**5.89**	**35.97**	**17.91**	**10.07**	**56.21**	**6.10**	**38.87**	**18.14**	**11.29**	**62.24**

Particulars	Sindhudurg					Konkan				
	Beginning of the year 1980	End of the year 2000	Mean	S.D.	C.V. (%)	Beginning of the year 1980	End of the year 2000	Mean	S.D.	C.V. (%)
Field labour										
(a Male	**6.76**	**63.16**	**31.46**	**19.02**	**60.52**	**7.64**	**50.83**	**25.96**	**14.41**	**57.44**
(b) Female	**5.49**	**46.83**	**22.85**	**14.26**	**62.41**	**5.96**	**41.18**	**19.34**	**11.48**	**59.37**
Other agril. labour										

(a Male	5.66	53.74	21.81	15.47	62.42	6.92	48.2	24.12	13.55	56.18
(b) Female	5.09	38.8	21.26	12.12	57.00	5.34	36.71	17.99	10.24	56.93

Table 5.7. Mean, S.D. and C.V. for land utilization in Konkan region

(Area in '00' ha)

Particulars	Thane					Raigad					Ratnagiri				
	Beginning of the year 1980	End of the year 2000	Mean	S.D.	C.V. (%)	Beginning of the year 1980	End of the year 2000	Mean	S.D.	C.V. (%)	Beginning of the year 1980	End of the year 2000	Mean	S.D.	C.V. (%)
Forest	**3698**	**3303**	**3405**	**152.9**	**4.48**	**1618**	**1487**	**1545**	**61.11**	**3.95**	**91**	**58**	**71.16**	**15.93**	**22.39**
Barren and unculturable Land	**816**	**390**	**569.6**	**173.9**	**30.54**	**1285**	**1043**	**1139.7**	**108.43**	**9.51**	**2150**	**1979**	**2066.1**	**175.96**	**8.52**
Land under non-agricultural use	**624**	**889**	**776.6**	**93.68**	**12.06**	**450**	**515**	**486.9**	**24.3**	**4.99**	**167**	**208**	**174.26**	**25.28**	**14.50**
Culturable waste	**407**	**187**	**310**	**116**	**37.5**	**367**	**564**	**480.95**	**101.6**	**21.12**	**1939**	**1383**	**1448**	**240.4**	**16.60**
Permanent pasture and other grazing Land	**872**	**460**	**592.6**	**175.6**	**29.63**	**400**	**375**	**369.89**	**28.77**	**7.78**	**148**	**278**	**243.6**	**83.52**	**34.27**
Land under miscellaneous trees and grooves not included in net area sown	**61**	**244**	**153.52**	**80.59**	**52.49**	**243**	**310**	**294.89**	**29.8**	**10.12**	**229**	**498**	**321.4**	**175.25**	**54.52**
Current fallows	**171**	**59**	**125.9**	**79.87**	**63.41**	**234**	**287**	**198.3**	**114.5**	**57.77**	**248**	**503**	**301.53**	**60.10**	**19.93**
Other fallows	**169**	**92**	**150.8**	**94.2**	**62.4**	**397**	**219**	**395.2**	**91.36**	**23.1**	**817**	**678**	**1141.2**	**250.9**	**21.9**

				2	6					1					9
Net area sown	2519	3713	3255	489.5	15.03	1875	2069	1957.3	78.69	4.02	2375	2579	2398.1	108.52	4.53
Area sown more than once	241	353	145.7	88.25	60.56	328	328	187.21	56.45	30.15	81	30	75.16	73.98	98.23
Total cropped area	2760	4081	3406	513.8	15.08	2203	2369	2144.5	100.8	4.70	2456	1408	2474.8	155.92	6.30

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Particulars	Sindhudurg					Konkan				
	Beginning of the year 1980	End of the year 2000	Mean	S.D.	C.V. (%)	Beginning of the year 1980	End of the year 2000	Mean	S.D.	C.V. (%)
Forest	**342**	**386**	**367.47**	**25.62**	**6.97**	**5749**	**5234**	**5379.65**	**199.18**	**3.70**
Barren and unculturable Land	**1380**	**1219**	**1249.2**	**70.78**	**5.66**	**5631**	**4631**	**4995.15**	**481.56**	**9.64**
Land under non-agricultural use	**182**	**210**	**181.10**	**26.10**	**14.43**	**1423**	**1822**	**1620.5**	**153.14**	**9.45**
Culturable waste	**1147**	**653**	**908.5**	**297.48**	**32.74**	**3860**	**2787**	**3110.6**	**490.59**	**15.77**
Permanent pasture and other grazing Land	**24**	**10**	**9.94**	**7.61**	**76.59**	**1444**	**1123**	**1209.2**	**118.71**	**9.81**
Land under miscellaneous trees and grooves not included in net area sown	**308**	**352**	**298**	**118.01**	**39.60**	**841**	**1404**	**1101.2**	**334.85**	**30.40**
Current fallows	**18**	**198**	**78.42**	**74.19**	**94.61**	**671**	**1047**	**716.75**	**192.97**	**26.92**
Other fallows	**420**	**639**	**671.42**	**165.58**	**24.66**	**1803**	**1628**	**2328.5**	**481.53**	**20.68**
Net area sown	**1219**	**1373**	**1275.8**	**91.52**	**7.17**	**7988**	**9734**	**8946.3**	**599.5**	**6.69**
Area sown more than once	**73**	**42**	**91.05**	**58.02**	**63.72**	**723**	**751**	**509.15**	**223.07**	**43.81**
Total cropped area	**1229**	**1415**	**1368**	**116.57**	**8.52**	**8648**	**9300**	**9405.75**	**668.15**	**7.10**

Table 5.9 Mean, S.D. and C.V. for production of principal crops in Konkan region

(Production in '00' MT)

Particulars	Thane					Raigad					Ratnagiri				
	Beginning of the year 1980	End of the year 2000	Mean	S.D.	C.V. (%)	Beginning of the year 1980	End of the year 2000	Mean	S.D.	C.V. (%)	Beginning of the year 1980	End of the year 2000	Mean	S.D.	C.V. (%)
Rice	**2924**	**3020**	**2910.7**	**443.58**	**15.23**	**2741**	**3285**	**3029**	**2964**	**9.7**	**1400**	**1928**	**1705.7**	**285.04**	**16.71**
Total cereals	**3188**	**3270**	**3164.3**	**463.5**	**14.33**	**2976**	**3394**	**3237.8**	**284.5**	**8.7**	**1951**	**2186**	**2157.6**	**300.28**	**13.92**
Total pulses	**49**	**107**	**88.16**	**26.83**	**30.43**	**42**	**65**	**54.26**	**11.68**	**21.51**	**29**	**32**	**21.53**	**9.48**	**44.05**
Total food grain	**3237**	**3377**	**3307**	**509.74**	**15.90**	**3018**	**3459**	**3291**	**290**	**8.82**	**1980**	**2218**	**2099**	**354.40**	**15.83**
Total oil seed	**11**	**22**	**15.42**	**5.37**	**34.88**	**7**	**5**	**7.2**	**3.6**	**51.18**	**22**	**17**	**26.05**	**11.26**	**43.23**

Particulars	Sindhudurg					Konkan				
	Beginning of the year 1980	End of the year 2000	Mean	S.D.	C.V. (%)	Beginning of the year 1980	End of the year 2000	Mean	S.D.	C.V. (%)
Rice	**1280**	**1813**	**1565.57**	**307.57**	**19.64**	**8345**	**10046**	**9255.7**	**1082.7**	**11.69**
Total cereals	**1348**	**1850**	**1679.68**	**272.28**	**16.21**	**9463**	**10700**	**10262.5**	**1004.18**	**9.78**
Total pulses	**9**	**30**	**18.68**	**7.90**	**42.29**	**129**	**234**	**184.3**	**49.31**	**26.75**
Total food grain	**1357**	**1880**	**1218.5**	**283.88**	**16.79**	**9612**	**10934**	**10273**	**993.81**	**9.52**

Total oil seed	**12**	**86**	**61.73**	**42.01**	**68.05**	**52**	**130**	**111.4**	**42.41**	**38.07**

Table 5.10. Mean, S.D. and C.V. for productivity under different crops in Konkan region

(Productivity in kg/ha)

Particulars	Thane					Raigad					Ratnagiri				
	Beginning of the year 1980	End of the year 2000	Mean	S.D.	C.V. (%)	Beginning of the year 1980	End of the year 2000	Mean	S.D.	C.V. (%)	Beginning of the year 1980	End of the year 2000	Mean	S.D.	C.V. (%)
Rice	**1951**	**2130**	**1938.42**	**283.2**	**14.61**	**1837**	**2421**	**2085.3**	**272.5**	**13.06**	**1463**	**2413**	**2108.32**	**379.8**	**18.01**
Total cereals	**1760**	**1915**	**1744.42**	**239.56**	**13.73**	**1679**	**2249**	**1889**	**251.2**	**13.30**	**1473**	**2096**	**1693.1**	**332.4**	**19.63**
Total pulses	**272**	**560**	**479.68**	**140.51**	**29.29**	**259**	**508**	**397.4**	**110.3**	**27.75**	**225**	**508**	**365.00**	**126.9**	**34.79**
Total food grain	**2032**	**2475**	**2253.5**	**222.25**	**13.70**	**1938**	**2757**	**2345.5**	**235.5**	**13.26**	**1698**	**2604**	**2151**	**323.07**	**19.79**
Total oil seed	**225**	**493**	**342**	**62.83**	**18.37**	**269**	**500**	**428.1**	**172.1**	**40.22**	**279**	**708**	**425.16**	**125.88**	**29.61**

Particulars	Sindhudurg					Konkan				
	Beginning of the year 1980	End of the year 2000	Mean	S.D.	C.V. (%)	Beginning of the year 1980	End of the year 2000	Mean	S.D.	C.V. (%)
Rice	**1720**	**2269**	**2005.8**	**356.23**	**17.75**	**1863**	**2295**	**2069.5**	**303.82**	**15.68**
Total cereals	**1473**	**2224**	**1890.4**	**368.76**	**19.50**	**1625**	**2102**	**1812.3**	**250.23**	**13.80**

Total pulses	**225**	**484**	**347.4**	**94.33**	**27.14**	**225**	**527**	**428**	**121**	**28.2**
Total food grain	**1698**	**2708**	**2203**	**351.43**	**19.47**	**1850**	**2629**	**2239.5**	**236.6**	**13.82**
Total oil seed	**279**	**1593**	**1352.1**	**662.4**	**48.99**	**264**	**982**	**689.9**	**274.6**	**39.81**

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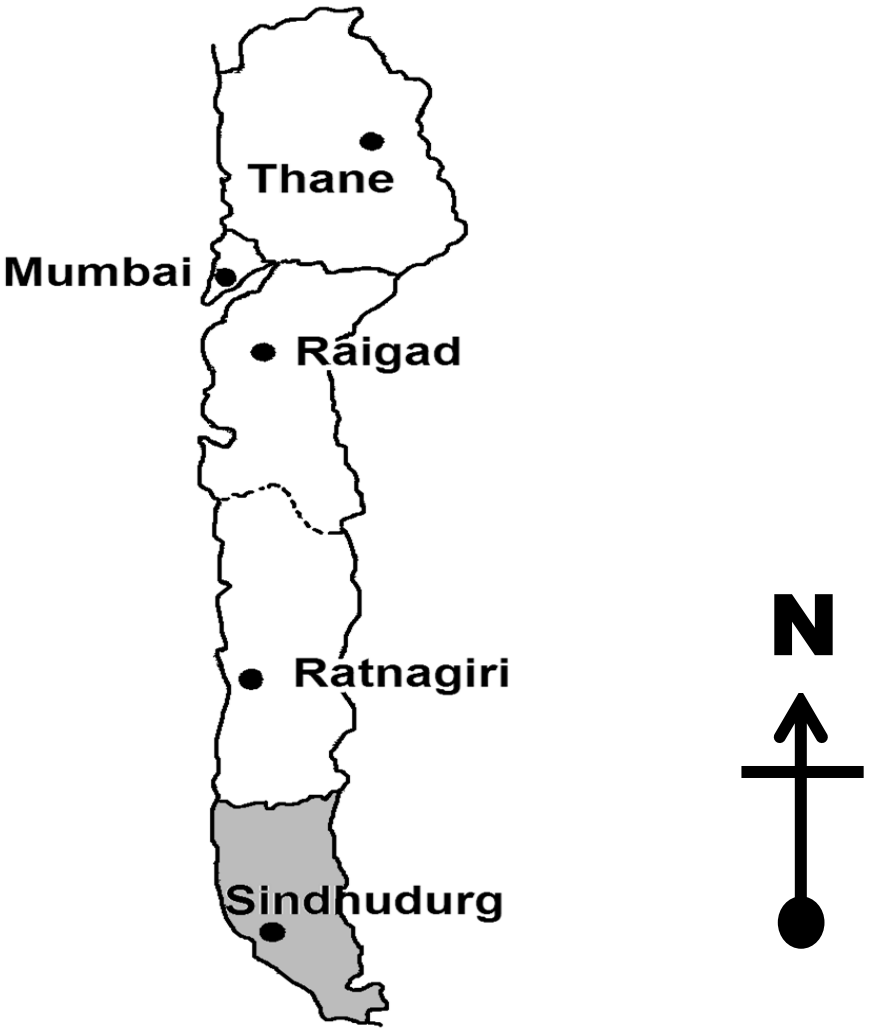
Fig. 1. Map of Konkan region



CHAPTER V

RESULT AND DISCUSSION

The data collected are analysed as per the methodology presented in the previous chapter, keeping in view the objectives of the study. The result of the study are presented and discussed in this chapter in four parts: viz., Part-I: temporal changes in agricultural economy of different districts in Konkan region and Konkan region as a whole. Part-II: growth rates of socio-economic indicators and important crop groups,

Part-III: composite index of some selected parameters of agricultural development and Part-IV: total factor productivity analysis.

PART-I

5.1 AREAS AND POPULATION

The information regarding geographical area, density of population working population, agricultural worker, literacy percentage, sex ratio etc. of different districts in Konkan and Konkan region is given in Table 5.1.

It is observed from Table 5.1 that the total geographical area of Konkan region was 29410 hundred ha. Geographical area under Thane, Raigad, Ratnagiri and Sindhudurg was 9337, 6869, 8164 and 5040 hundred ha, respectively. As per 2001 census, the total population of Konkan region was 128.92 lakhs. Among the four district of Konkan, Thane district shares highest population i.e. 81.28 lakhs as compared to other districts. Whereas Sindhudurg covered lowest population 8.61 lakhs and the total population of Raigad and Ratnagiri district was 22.05 and 16.96 lakhs, respectively. The percentage of rural population to total population was highest in Sindhudurg district (90.91%) and lowest in Thane district (27.41) conversely, lower percentage of urban population to total population was observed in Sindhudurg and highest in Thane district (72.59%). The rural and urban population of Konkan region was 47.99 per cent and 51.01 per cent, respectively. The density of population in Konkan region was 427 per sq. km. In Thane district it was 850 per sq. km., which was comparatively highest than Raigad (308 per sq. km), Ratnagiri (207 per sq. km) and Sindhudurg (185 per sq. km). This is mainly because of nearness of Mumbai city and heavy migration of people to Thane district for search of employment.

Table 5.1 Area and population (2001)

Sr. No.	Particulars	Thane	Raigad	Ratnagiri	Sindhudurg	Konkan
1.	**Area ('00' ha)**	**9337**	**6869**	**8164**	**5040**	**29410**
2.	**Density of population No. of person/ sq.km.**	**850**	**308**	**207**	**185**	**427**
3.	**Total population (No.)**	**8128833**	**2205972**	**1696482**	**861672**	**12892959**
4.	**Rural population (No.)**	**2228873 (27.41)**	**1671185 (75.75)**	**1504341 (88.67)**	**783412 (90.91)**	**6187811 (47.99)**
5.	**Urban population (No.)**	**5899960 (72.59)**	**534787 (24.25)**	**192141 (11.33)**	**78260 (9.09)**	**6705148 (52.01)**
6.	**Total working population (No.)**	**2981612 (36.67)**	**774946 (35.12)**	**601142 (35.43)**	**326617 (37.90)**	**4684317 (36.33)**
7.	**Percentage of working population to total population**	**36.67**	**35.12**	**35.43**	**37.90**	**36.33**
8.	**No. of agricultural worker**	**701398**	**459862**	**391865**	**214210**	**1767335**
9.	**Percentage of agril. workers to total workers**	**23.52**	**59.93**	**65.18**	**65.58**	**37.72**
10.	**Literacy percentage**	**81.00**	**77.32**	**75.35**	**80.52**	**78.75**
11.	**Sex ratio**	**857**	**975**	**1135**	**1077**	**931**

(Figures in parentheses are per cent to total)

According to 2001 census, out of total population of Thane, Raigad, Ratnagiri and Sindhudurg district, the total working population was 36.67, 35.12, 35.43 and 37.90 per cent, respectively. Where as in Konkan region it was 36.33 per cent. The proportion of agricultural workers to total workers in Thane, Raigad, Ratnagiri and Sindhudurg was 23.51, 59.98, 65.18 and 65.58 per cent. The agricultural worker in Konkan region were 17.67 lakhs which was 37.72 per cent of the total

worker in this agricultural worker the contribution of Thane district was more as compared to other district in the region.

From the above table, it can be concluded that, except in Thane district, the district wise proportion of total working population to the total population was much low in the Konkan region. This is because the workers were mainly dependent on agriculture for employment.

5.1.1 Sex ratio:

The sex ratio (female to male) in Konkan region was 931 per 1000 males. The sex ratio in Thane, Raigad, Ratnagiri and Sindhudurg district was 857, 975, 1135 and 1077, respectively. It is seen from the Table 5.1 that the sex ratio in Ratnagiri and Sindhudurg district was highest because of the migration of male workers to cities in search of employment opportunities.

5.1.2 Literacy percentage:

The literacy percentage in Thane district was high (81.00%) followed by Sindhudurg district (80.52%), Raigad district (77.32%) and Ratnagiri district (75.35%) whereas the overall percentage in Konkan region was 78.75. Higher literacy is effect of culture of metropolitan city of Mumbai.

5.2 LAND UTILIZATION

Land utilization pattern depicts the distribution of the reported land into various categories. The districtwise land utilization pattern in the Konkan region for the year 1999-2000 is given in Table 5.2.

Table 5.2. Land utilization pattern (1999-2000)

(Area in '00' ha)

Sr. No.	Particulars	Thane	Raigad	Ratnagiri	Sindhudurg	Konkan
1.	**Reported area**	**9337 (100)**	**6869 (100)**	**8164 (100)**	**5040 (100)**	**29410 (100)**

2.	Forest	3303 (35.38)	1487 (21.66)	58 (0.71)	386 (7.67)	5434 (17.79)
3.	Barren and unculturable land	390 (4.18)	1043 (15.18)	1979 (24.24)	1219 (24.18)	4631 (15.74)
4.	Land under non-agricultural uses	889 (9.52)	515 (7.49)	208 (2.55)	210 (4.16)	1822 (6.19)
5.	Culturable waste	187 (2.00)	5.64 (8.21)	1383 (16.94)	653 (12.79)	2787 (9.48)
6.	Permanent pasture and other grazing land	460 (4.93)	375 (5.45)	278 (3.41)	10 (0.19)	1123 (3.81)
7.	Land under miscellaneous trees and grooves not included in not sown area	244 (2.61)	310 (4.51)	498 (6.09)	352 (6.98)	1404 (4.78)
8.	Current fallows	59 (0.63)	287 (4.18)	503 (6.16)	198 (3.92)	1047 (3.58)
9.	Other fallows	92 (0.99)	219 (3.19)	678 (8.32)	639 (12.87)	1628 (5.54)
10.	Net sown area	3713 (39.77)	2069 (30.13)	2579 (31.58)	1373 (27.24)	9734 (33.09)
11.	Area sown more than once	353	327	29	42	751
12.	Gross cropped area	4081	2369	1408	1415	9300
13.	Cropping intensity (%)	109.46	115.80	102.17	103.05	108.78

(Figures in parentheses are percentage to reported area)

5.2.1 Total reported area:

The total reported area under Thane, Raigad, Ratnagiri and Sindhudurg district and Konkan region was 9337 hundred ha, 6869 hundred ha, 8164 hundred ha, 5040 hundred ha and 29410 hundred ha, respectively.

5.2.2 Forest:

The proportion of area under forest to total reported area was highest in (35.38%) in Thane district, followed by Raigad (21.66%), Sindhudurg (7.67%) and Ratnagiri (0.71%). For Konkan region, the proportion of forest to total reported area was 17.79 per cent. The proportion of area under forest was highest in Thane district, whereas lowest in Ratnagiri district.

5.2.3 Barren and unculturable land:

The percentage share of barren and unculturable land to total reported area was high 24.24 per cent in Ratnagiri and 24.18 per cent Sindhudurg district, while in Thane district it was 4.18 per cent, which was also much less than Raigad district 15.18 per cent and Konkan region 15.74 per cent.

5.2.4 Land under non-agricultural uses:

The land under non-agricultural purposes i.e. residential buildings, industries, factories and road network in Thane, Raigad, Ratnagiri and Sindhudurg district was 9.52 per cent, 7.49 per cent, 2.55 per cent, 4.16 per cent, respectively and 6.19 per cent in Konkan region.

5.2.4 Culturable waste:

The percentage of culturable wasteland to the total reported area was higher (16.94%) in Ratnagiri district. Whereas, it was lower in Thane district (2.00%). For Konkan region, it was 9.48 per cent.

5.2.5 Permanent pasture and other grazing land:

The percentage of land under permanent pasture and other grazing land to total reported area was higher in Raigad district (5.45%)

followed by Thane (4.93%), Ratnagiri (3.41%) and Sindhudurg (0.19%). Whereas, in Konkan region, this percentage was 3.81

5.2.6 Land under miscellaneous trees and grooves:

The percentage of land under miscellaneous trees and grooves to total cropped area was higher in Sindhudurg district (6.98%) and lower in Thane district (2.61%) as compared to the Raigad (4.51%) and Ratnagiri (6.09%) district. However, in Konkan region, this percentage was 4.78

5.2.7. Current fallows:

The percentage of current fallows to total reported area was higher in Ratnagiri district (6.16%) followed by Raigad (4.18%), Sindhudurg (3.92%) and Thane (0.63%). In Konkan region, this percentage was 3.58

5.2.8 Other fallows:

The percentage of other fallows to total reported area was higher in Sindhudurg district (12.87%) and it was very lower in Thane district (0.99%). In Konkan region, the percentage of other fallows to total reported area was 5.54

5.2.9 Net sown area:

The proportion of net sown area to total reported area was higher in Thane district (39.77%) followed by Ratnagiri (31.58%), Raigad (30.13%) and Sindhudurg (27.24%). The proportion of net sown area to total reported area in Konkan region was 33.09 per cent.

5.2.10 Area sown more than once:

During 1999-2000, the area sown more than once was highest in Thane district (353 hundred ha). However, it was lowest in Ratnagiri district (29 hundred ha). In Konkan region, area sown more than once was observed to 751 hundred ha.

5.2.11 Cropping intensity:

Cropping intensity in Raigad district (115.80%) was high as compared Thane (109.46%), Raigad (115.80%), Ratnagiri (102.17%) and Sindhudurg (103.05%) district, respectively. The cropping intensity in Konkan region was 108.78 per cent.

There was more or less similar trend in land use categories in all the districts in Konkan region. However, due to irrigation facilities, cropping intensity was higher in Raigad district followed by Thane compared to Sindhudurg and Ratnagiri districts.

5.3 DISTRIBUTION OF AREA UNDER PRINCIPAL CROPS

The types of crops grown and the proportion of area under different crops decide the agricultural economy of any region. This crop distribution is mainly decided by the climatic conditions and soil type. The information regarding area under principal crops of Konkan region for the year 1999-2000 is presented in Table 5.3.

Table 5.3. Distribution of area under principal crops in Konkan region (1999-2000)

(Area in '00' ha)

Sr. No.	Particulars	Thane	Raigad	Ratnagiri	Sindhudurg	Konkan
1.	**Rice**	**1418 (32.43)**	**1357 (31.14)**	**789 (18.14)**	**799 (18.29)**	**4373 (100)**
2.	**Total cereals**	**1707 (33.52)**	**1509 (29.64)**	**1043 (20.48)**	**832 (16.36)**	**5091 (100)**
3.	**Total pulses**	**191 (43.01)**	**128 (28.82)**	**63 (14.21)**	**62 (13.96)**	**444 (100)**
4.	**Total food grain**	**1898 (34.29)**	**1637 (29.57)**	**1106 (19.98)**	**894 (16.16)**	**5535 (100)**
5.	**Total oil seed**	**44 (33.35)**	**10 (7.57)**	**24 (18.18)**	**54 (40.90)**	**132 (100)**

(Figures in parentheses are percentage with Konkan region)

From this table, it is observed that, the proportion of area under rice in Konkan region was highest (32.43%) in Thane district, followed by Raigad (31.14%), Sindhudurg (18.29%) and Ratnagiri (18.14%). In case of total cereals, this proportion was highest in Thane district (33.52%), followed by Raigad (29.64%), Ratnagiri (20.48%) and Sindhudurg (16.6%). In proportion to Konkan region, the area under total pulses was highest in Thane district (43.01%) and it was lowest in Sindhudurg district (13.96%). In proportion to Konkan region, the area under total food grain was highest in Thane district (34.29%) followed by Raigad (29.57%), Ratnagiri (19.98%) and Sindhudurg district (16.16%). In proportion to Konkan region, area under total oilseed was highest in Sindhudurg district (40.90%), followed by Thane (33.35%), Ratnagiri (18.18%) and Raigad (7.57%).

5.4 PRODUCTION AND PRODUCTIVITY OF PRINCIPAL CROPS

The total production and productivity of principal crops in Thane, Raigad, Ratnagiri and Sindhudurg districts, in comparison with Konkan region, given is in Table 5.4.

Rice is the important staple food crop in Konkan region. The proportion of rice production in Thane, Raigad, Ratnagiri and Sindhudurg district to total production of rice in Konkan region was 3020, 3285, 1928 and 1813 hundred MT, respectively. The productivity of rice in Thane, Raigad, Ratnagiri and Sindhudurg district was 2130, 2421, 2413 and 2269 kg per ha, respectively. Raigad district was more dominant in production and productivity of rice. The total production and productivity of rice in Konkan region was 10046 hundred MT and 2595 kg per ha.

The production of total cereals in Konkan region was 10700 hundred MT. Out of this the contribution of Thane, Raigad, Ratnagiri and Sindhudurg was 30.56, 31.73, 20.43 and 17.28 per cent, respectively. The productivity of Thane, Raigad, Ratnagiri and Sindhudurg district

was 1915, 2249, 2096 and 2224 kg per ha respectively and the productivity of Konkan region was 2102 kg per ha.

In proportion to Konkan region, the production of total pulses in Thane, Raigad, Ratnagiri and Sindhudurg district was 45.73, 27.77, 13.67 and 12.83 per cent.

The productivity of total pulses in respective district was 560, 508, 508 and 484 kg per ha. The productivity of total pulses in Konkan region was 527 kg per ha. The production and productivity of total pulses in Sindhudurg was low whereas it was highest in Thane district.

In Konkan region, the production and productivity of total food grain was 11157 hundred MT and 1975 kg per ha. In proportion to Konkan region, the production of total foodgrains, in Thane, Raigad, Ratnagiri and Sindhudurg district was 30.29, 31.00, 19.87, 18.84 per cent, respectively and the productivity of respective district was 1779, 2113, 2005 and 2103 kg per ha. It showed that Raigad district was contributing more to the production and productivity of food grain in Konkan region, whereas Ratnagiri and Sindhudurg district contributed less to the production and productivity of Konkan region. This was mainly because of higher productivity of foodgrains in Raigad district due to soil and climatic condition.

In proportion to Konkan region, the total oilseed production in Thane, Raigad, Ratnagiri and Sindhudurg district was 16.94, 3.84, 13.07 and 66.15 per cent and productivity was 493, 500, 708 and 1593 kg per ha, respectively. In total oilseed production and productivity the share of Sindhudurg district was highest whereas, share of Raigad district was much less. The overall production and productivity of total oilseed in Konkan region was 130 hundred MT and 982 kg per ha.

5.5 FERTILIZER CONSUMPTION

The information of fertilizers consumption of Thane, Raigad, Ratnagiri and Sindhudurg districts and Konkan region is given in Table 5.5.

The per ha consumption of total NPK fertilizer in Thane, Raigad, Ratnagiri and Sindhudurg was 39.54, 63.39, 63.77 and 50.07 kg, respectively.

Table 5.5. Fertilizer consumption (1999-2000)

(Fertilizer in 'MT')

Sr. No.	Particulars	Thane	Raigad	Ratnagiri	Sindhudurg	Konkan
1.	**N**	**12865 (79.72)**	**12171 (81.06)**	**7226 (80.49)**	**3999 (56.41)**	**36261 (76.78)**
2.	**P**	**1848 (11.45)**	**1811 (12.05)**	**1025 (11.41)**	**1839 (25.95)**	**6523 (13.82)**
3.	**K**	**1426 (8.83)**	**1036 (6.89)**	**728 (8.10)**	**1247 (17.64)**	**4437 (9.39)**
4.	**Total NPK (Consumption)**	**16139 (100.00)**	**15018 (100.00)**	**8979 (100.00)**	**7085 (100.00)**	**47221 (100.00)**
5.	**Per ha consumption of total NPK**	**39.54**	**63.39**	**63.77**	**50.07**	**50.77**

(Figures in parentheses are percentage to total NPK)

From the above discussion, it can be conclude that, the per ha consumption of total NPK was highest in Ratnagiri district (63.77kg) and Raigad district (63.39kg) which was higher than average consumption of Konkan region as a whole. This might be because farmers are know the use chemical fertilizer to increase agricultural production.

5.6 DAILY WAGE RATE OF AGRICULTURAL LABOUR

Daily wages paid to agricultural labour at current prices in Thane, Ratnagiri, Raigad and Sindhudurg and Konkan region are presented in Table 5.6.

Field labour includes ploughman, reaper showers, transplanter, weeder, and harvester while other agril. labours includes load carrying hamals, well diggers, carpenters and earth-workers etc.

Table 5.6. Daily wages paid to agricultural labour at current prices (1999-2000)

(Rs.)

Sr. No.	Particulars	Thane	Raigad	Ratnagiri	Sindhudurg	Konkan
1.	**Field labour**					
	(a) Male	**45.25**	**49.66**	**55.97**	**46.83**	**50.83**
	(b) Female	**33.69**	**39.13**	**41.70**	**29.38**	**41.18**
2.	**Other agril. labour**					
	(a) Male	**38.02**	**42.15**	**50.62**	**56.27**	**48.20**
	(b) Female	**29.68**	**32.97**	**38.87**	**38.80**	**36.71**

In Konkan region, daily wages rates paid to male field labourers at current prices was Rs. 50.83 and for females it was Rs. 41.18 during 1980 while daily wages rate paid to other agricultural male labour at current prices was Rs. 48.20 and for female Rs. 36.71 at the end of the year.

Daily wage rate paid to male field labourers at current prices was high in Ratnagiri Rs. 55.97 and for female Rs. 41.70 whereas wage rate was low in Sindhudurg district Rs. 46.83 for male and Rs. 29.38 for female. Daily wage rate paid to male other agricultural labour was highest in Sindhudurg district Rs. 56.27 and for female was Rs. 38.80 and it was low in Thane district Rs. 38.02 for male and Rs. 29.68 for female. This revealed that as per the minimum wages same wages are not given to male and female labour.

5.7. TRENDS IN LAND UTILIZATION

5.7.1 Area under forest:

It is seen from the Table 5.7 that during the period of 1980, the area under forest in Konkan region was 5749 hundred ha, which decreased to 5234 hundred ha at the end of the year 2000. During this period (1980-2000), the average area under forest was 5379.65 hundred ha. The variability in the area under forest was 3.70 per cent.

The average area under forest in Thane, Raigad, Ratnagiri and Sindhudurg was 3405, 1545, 71.16 and 367.47 hundred ha, respectively and the variability in the area was 4.48, 3.95, 22.39 and 6.97 per cent, respectively.

It is observed from the Table 5.7 that, the area under forest was decreasing in Konkan region. This is not a good sign for agricultural development in the Konkan region.

5.7.2 Area under barren and unculturable land:

The area under barren and unculturable land in Konkan region in the beginning year (1980) was 5631 hundred ha which decreased to 4631 hundred ha at the end of the year 2000. The average area under barren and uncultivable land was 4995.15 hundred ha and the variability in the area was 9.64 per cent.

The average area under barren and uncultivable land in Thane, Raigad, Ratnagiri and Sindhudurg was 569.6, 1139.7, 2066.1 and 1249.2 hundred ha, respectively with variability of 30.54, 9.51, 8.52 and 5.66 per cent, respectively.

5.7.3 Land under non-agricultural use:

The land under non-agricultural use in the beginning year (1980) in Konkan region was 1423 hundred ha which increased 1822 hundred

ha at the end year (2000). The variation in this category was 9.45 per cent.

The variability of land under non-agricultural use in Thane, Raigad, Ratnagiri and Sindhudurg districts showing increasing in trend in the order of 12.06, 4.99, 14.50 and 14.43 per cent. This trend is very slow in Raigad district as compared to other districts in the Konkan region.

5.7.4 Area under culturable waste:

The area under culturable waste in Konkan region at the beginning of the year was 3860 hundred ha which decreased to 2787 hundred ha in the year 2000. The average area under culturable waste was 3110.6 hundred ha and variability was 15.77 per cent.

The area under culturable waste in Thane, Ratnagiri and Sindhudurg district was 407, 1939 and 1147 hundred ha in the beginning of the year and it was decrease to 187, 1383 and 653 hundred ha, respectively. In Raigad district it increased from 367 to 564 hundred ha in the same period.

5.7.5 Area under permanent pasture and other grazing land

During 1980-2000, in the Konkan region, the area under permanent pasture and other grazing land was 1444 hundred ha, which decreased by 1123 hundred ha. The average area under permanent pasture was 1209.20 hundred ha and variability was 9.81 per cent.

The area under permanent pasture and other grazing land in Thane, Raigad and Sindhudurg was 872, 400, 24 hundred ha, at the beginning year decreased to 460, 372 and 10 hundred ha, respectively at the end year while it was increased from 148 to 278 hundred ha for Ratnagiri district. The variability in area was 29.63, 7.78, 34.27 and 76.59 per cent, respectively for Thane, Raigad, Ratnagiri and Sindhudurg districts.

It is seen from the Table 5.7 that, the area under permanent pasture and other grazing land decreased in Konkan region and other three districts except Ratnagiri district. Whereas, it was observed to increase in Ratnagiri district.

5.7.6 Land under miscellaneous trees and grooves:

In Konkan region, the land under miscellaneous trees and grooves increased from 841 hundred ha in 1980 to 1404 hundred ha in 2000. During this period, the average land under this category was 1101.2 hundred ha and variability in the area was 30.40 per cent.

The variability in the land under miscellaneous trees and grooves in Thane, Raigad, Ratnagiri and Sindhudurg districts was found to be 52.49, 10.12, 54.52 and 39.60 per cent, respectively. It is seen from the Table 5.7 that the area under miscellaneous trees and grooves was increased.

5.7.7 Area under current fallows:

Area under current fallows in Konkan region increased from 671 hundred ha in 1980 to 1047 hundred ha in 2000. During this period the average area under current fallows was 716.75 hundred ha and variability 26.92 per cent.

Area under current fallows in Thane district decreased from 171 hundred ha to 59 hundred ha during the period 1980-2000, while in other district it increased. The variability in area under this category in Thane, Raigad, Ratnagiri and Sindhudurg district was 63.41, 57.77, 19.93 and 94.61 per cent, respectively.

5.7.8 Area under other fallows:

The area under other fallows in Konkan region, decreased from 1803 to 1628 hundred ha during period 1980-2000. The average area under this category was 2328.5 hundred ha and variability was 20.68 per cent.

The average area under other fallows in Thane, Raigad, Ratnagiri and Sindhudurg was 150.81, 395.2, 1141.2 and 671.42 hundred ha, respectively and variability was 62.46, 23.11, 21.99 and 24.66 per cent, respectively.

It is seen from the Table 5.7 that the area under other fallows decreased continuously over the study period.

5.7.9 Area under net sown:

The area under Net area sown in Konkan region, increased from 7988 hundred ha to 9734 hundred ha during the period 1980-2000. The average area under net sown was 8946.3 hundred ha and variability was 6.69 per cent.

The average area under net sown category in Thane, Raigad, Ratnagiri and Sindhudurg district increased 3255, 1957.3, 2398.1 and 1275.8 hundred ha during 1980-2000. The variability was 15.03, 4.02, 4.53 and 7.17 per cent in Thane, Raigad, Ratnagiri and Sindhudurg district, respectively.

5.7.10 Area sown more than once:

In Konkan region, the area sown more than once has slightly increased from 723 hundred ha to 751 hundred ha during 1980-2000. The average area was found to 509.15 hundred ha and variability was 43.81 per cent.

In Thane district area sown more than once increased from 241 to 353 during 1980-2000 with average 145.7 hundred ha and variability was 60.56 per cent. In Ratnagiri and Sindhudurg districts, it decreased from 81 to 30 hundred ha and 73 hundred ha to 42 hundred ha during 1980-2000, respectively. In case of Raigad district, it was stable 328 hundred ha during the study period (1980-2000).

5.7.11 Total cropped area:

Total cropped area in Konkan region, was 8648 hundred ha in beginning year and it was 9300 hundred ha at end year. The average area was 9405.75 and variability was 7.10 per cent.

In Thane, Raigad, Ratnagiri and Sindhudurg districts total cropped area was 2760, 2203, 2456 and 1229 hundred ha during 1980 and it was increased to 4081, 2369, 1408 and 1415 hundred ha in 2000, respectively. The average gross cropped area in Thane, Raigad, Ratnagiri and Sindhudurg was 3406, 2144.5, 2474.8 and 1368 hundred ha and variability was 15.08, 4.70, 6.30 and 8.52 per cent, respectively.

It is seen from the table 5.7 that total cropped area has increased in Konkan region as well as Thane, Raigad and Sindhudurg district and it was decrease in Ratnagiri district from 2456 to 1408 hundred ha during same period.

During the study period, (1980-2000), there are substantial changes in land use categories and cropping pattern across different district and Konkan region as a whole, mainly, due to development of industrial sector, increase in population and ecological changes.

5.8 AREA UNDER DIFFERENT CROPS

To know the development of area under different crops in Konkan region and district in Konkan region the mean, S.D. and C.V. of area under different crops were worked out and presented in Table 5.8,

5.8.1 Area under rice:

Table 5.8 reveals that area under rice in Konkan region for beginning year of 1980 was 4461 hundred ha which decreased to 4373 hundred ha at the end of study year 2000. The average area under rice was 4532.6 hundred ha and variability in area under rice was 1.87 per cent. In Thane, Raigad, Ratnagiri and Sindhudurg district the area under rice was 1449, 1436, 750 and 720 hundred ha in 1980. In 2000 it

was found 1418, 1357, 789 and 799 hundred ha, respectively. The average area under rice in Thane, Raigad, Ratnagiri and Sindhudurg district was 1499.63, 1456.8, 800.74 and 783.26 hundred ha and variability was 1.90, 4.62, 3.07 and 3.76 per cent, respectively.

It is seen from the Table 5.8, that the area under rice decreased in Thane and Raigad district and it increased slightly in Ratnagiri and Sindhudurg district.

5.8.2 Area under total cereals:

During the period 1980-2000, the area under total cereals decreased in Konkan region from 5871 to 5081 hundred ha. The average area under total cereals was 5596.2 and variability was 5.34 per cent.

Area under total cereals in Thane, Raigad, Ratnagiri and Sindhudurg district was 1811, 1772, 1456 and 832 hundred ha in the year 1980 and it was 1707, 1509, 1043 and 832 hundred ha in 2000. The average area was 1812.73, 1726, 1306.84 and 889.73 hundred ha and variability percentage in the area was 1.99, 7.03, 10.52 and 6.14, respectively.

5.8.3 Area under total pulses:

In Konkan region, area under pulses increased from 264 hundred ha to 444 hundred ha during the period 1980-2000. The average area was 429.25 hundred ha and variability was 23.8 per cent.

In Thane and Sindhudurg districts, area under total pulses showed increasing in trend from 180 to 191 hundred ha and 39 to 62 hundred ha, respectively during study period 1980-2000. The per cent variability in Thane and Sindhudurg district was 24.17 and 42.33, respectively.

In Raigad and Ratnagiri districts, decreased in area of total pulses from 162 to 128 hundred ha and 90 to 63 hundred ha during study period 1980-2000. The per cent variability in Raigad and Ratnagiri district was 23.67 and 32.54 per cent. It is seen from the

Table 5.8 that the overall trend in total pulses increased in Konkan region.

5.8.4 Area under total foodgrain:

Area under total foodgrain in Konkan region, during 1980-2000 decreased from 6135 to 5525 hundred ha. The average area under total foodgrain was 5850 hundred ha and the variability was 5.25 per cent.

In Thane, Raigad, Ratnagiri and Sindhudurg district area under foodgrain was 1991, 1934, 1546, 871 hundred ha in the beginning of the year 1980 and it was 1898, 1637, 1106 and 894 hundred ha at the end year 2000, respectively. The average total foodgrain area was 1944.5, 1865, 1369.58 and 832.5 hundred ha, respectively. The percentage variability was 2.88, 6.88, 10.99 and 5.8 per cent over the study period.

It is observed that area under total foodgrain in Konkan increased whereas, Thane and Sindhudurg districts showed increase in trend as that of Raigad and Ratnagiri shows decrease in trend of total food grain.

5.8.9 Area under total oilseed:

In Konkan region, area under total oilseed during 1980 was 197 hundred ha and at the end of year 2000 which, decreased to 132 hundred ha. The average total oilseed area in the Konkan region was 175.2 hundred ha and variability was 13.82 per cent.

The area under total oilseed in Thane, Raigad, Ratnagiri and Sindhudurg district was 49, 26, 100 and 22 hundred ha at the beginning of the year (1980) and it was found 44, 10, 24 and 54 hundred ha at the end of year 2000. The average area under total

oilseed was 45.94, 19.26, 68.32 and 38.63 hundred ha over the period 1980-2000 and variability was 24.76, 45.84, 50.24 and 41.43 per cent.

It is seen that the overall area under total oilseed decreased in trend in Konkan region as well as in Thane, Raigad, Ratnagiri district except in Sindhudurg district, it showed increase in trend of total oilseed area over the study period.

5.9 PRODUCTION OF PRINCIPAL CROPS

For studying, the changes in the production of principal crops, their mean, S.D. and C.V. area calculated and given in Table 5.9.

5.9.1 Production of rice

In Konkan region, the production of rice was 8345 hundred MT in the beginning of the year (1980) and 10046 hundred MT at the end year (2000). The average production during the entire period was 9255.7 hundred MT and the variability was 11.69 per cent for the Konkan region.

The districtwise rice production was 2924, 2741, 1400 and 1280 hundred MT for Thane, Raigad, Ratnagiri and Sindhudurg district during 1980 and it was increased to 3020, 3285, 1928 and 1813 hundred MT for Thane, Raigad, Ratnagiri and Sindhudurg at the end of the year.

From the Table 5.9 it is clearly, observed that, the rice production showed increase trend in Konkan region during the study period from (1980-2000).

5.9.2 Production of total cereals:

The total cereals production in Konkan region was 9463 hundred MT in the year 1980 and it has reached 10700 hundred MT in 2000. The average production during 1980-2000 under total cereals was

1004.18 hundred MT in the Konkan region with variability 9.78 per cent.

The production of Thane, Raigad, Ratnagiri and Sindhudurg district was 3188, 2976, 1951 and 1348 hundred MT during 1980 and it increased to 3270, 3394, 2186 and 1850 hundred MT in the end year. The average total cereal production was 3164.3, 3237.8, 2157.6 and 1679.68 hundred MT during the period 1980-2000. The variability Thane, Raigad, Ratnagiri and Sindhudurg district was 14.33, 8.7, 13.92 and 16.21 per cent, respectively.

It is seen from the Table 5.9 that, total cereals production showed increase trend during the study period for Konkan region.

5.9.3 Production of total pulses:

The production of total pulses under Konkan region, was 129 hundred MT in the beginning year (1980) and it was 234 hundred MT during end year (2000).

The average total pulses production in Thane, Raigad, Ratnagiri and Sindhudurg district was 88.16, 54.26, 21.51 and 18.68 hundred MT during the period 1980-2000.

It is seen from the Table 5.9 that Konkan region showed increase in production of total pulses during 1980-2000 and Thane district contributed more to increase the trend as compared to other districts.

5.9.4 Production of foodgrains:

In 1980, the production of total foodgrain was 9683 hundred MT which increased to 10431.1 hundred MT in 2000. The average foodgrain production was 10934.1 hundred MT and the variability in foodgrain production was 9.52 per cent.

The average foodgrain production for above four districts was 3205.1, 3291, 2239.37 and 1689.8 hundred MT. The variability in the production was 15.90, 8.82, 15.83 and 16.79 per cent, respectively.

From this discussion, it can be concluded that the districtwise production of total foodgrain decreased which, resulted into decrease in total foodgrain production of Konkan region over study period.

5.9.5 Production of total oilseed:

During 1980-2000 the production of total oilseed in Konkan region was increased from 52to130 hundred MT. The average production was 111.4 hundred MT with 38.07 per cent variability. Over the period of 20 years average production of total oilseed was

highest in Sindhudurg district (61.73 hundred MT) with high variability of 68.05 per cent, whereas in Raigad district lowest average oilseed production (7.2 hundred MT) with variability of 51.18 per cent.

It is seen from the table 5.9 that the production of total oilseed decreased in Konkan region. This is due to the decrease in trends of Thane, Raigad and Ratnagiri district. Only Sindhudurg district shows increase in trend from 22 hundred MT to 86 hundred MT during 1980-2000 but no more effect on total oilseed production.

5.10 PRODUCTIVITY OF PRINCIPAL CROPS:

The mean, S.D. and C.V. for the productivity of important crops is calculated and worked out and presented in Table 5.10

5.10.1 Productivity of rice:

In Konkan region, the productivity of rice increased from 1863 kg per ha in 1980-1981 to 2295 kg per ha in 1999-2000. The average yield of rice was 2069.5 kg per ha during this period and variability in the yield was 15.68 per cent.

During year 1980-2000, the average productivity of rice was highest in Ratnagiri district 2108.2 kg per ha, followed by Raigad 2085.3 kg per ha, Sindhudurg 2005.8 kg per ha and Thane 1938.42 kg per ha. The variability in rice productivity was 14.61 per cent in Thane, 13.06 per cent in Raigad, 18.01 per cent in Ratnagiri and 17.75 per cent in Sindhudurg.

5.10.2 Productivity of total cereals:

Table 5.11 revealed that the productivity of total cereals increased from 1760 to 1915 kg per ha in Thane, 1679 to 2249 kg per ha in Raigad, 1473 to 2096 in Ratnagiri and 1473 to 2224 in Sindhudurg district during study period. The variability in productivity of total cereals was highest in Ratnagiri (19.63%), followed by Sindhudurg

(19.50%), Thane (13.73%) and Raigad (13.30%). This is due to variation in rainfall pattern in Kharif season.

5.10.3 Productivity of total pulses

During study period, the productivity of total pulses increased in Konkan region, from 225 kg per ha to 527 kg per ha in 1980-2000 periods. The average productivity was 428 kg per ha and the variability was 28.2 per cent.

The variability in pulses productivity within the four districts of Konkan region ranged from 27.14 per cent to 34.79 per cent.

5.10.4 Productivity of total foodgrain:

In Konkan region, the productivity of total foodgrain increased from 1850 kg per ha to 2629 kg per ha in 1980 to 2000. The average productivity of total foodgrain in Konkan region was 2239.5 kg per ha during year 1980 to 2000 and the variability in total foodgrain production was 13.82 per cent.

Productivity of total foodgrain in Thane, Raigad, Ratnagiri and Sindhudurg district was 2032, 1938, 1698 and 1698 kg per ha in 1980 which has increased to 2475, 2757, 2604 and 2708 kg per ha in 2000, respectively. During this period the districtwise average productivity was 2253.5, 2345.5, 2151 and 2203 kg per ha and the variability to the extent of 13.70, 13.26, 19.79 and 19.47 per cent, respectively.

From the table 5.10 it is concluded that the productivity of total food gain in Konkan region was of increasing nature during study period, corresponding to release of modern technologies for different crop.

5.10.5 Productivity of total oilseed:

In Konkan region, the productivity of total oilseed increased from 264 kg per ha to 982 kg per ha in 1980-2000. The average productivity of total oilseed was 689.9 kg per ha and the variability in total oilseed productivity was 39.81 per cent. While, the variability of total oilseed production in Thane, Raigad, Ratnagiri and Sindhudurg

district was 18.37, 40.22, 29.61 and 48.99 per cent, respectively. However, the average productivity of total oilseed was highest in Sindhudurg district (1352.1 kg per ha) and lowest in Thane district (342 kg per ha).

It is observed from the table 5.10, that the districtwise productivity of total oilseed increased during study period, which resulted in the overall increase in productivity in Konkan region.

5.11 FERTILIZER CONSUMPTION:

Fertilizer is the most important input contributing towards productivity and ultimately towards more production. The mean, S.D. and C.V. of fertilizer consumption is calculated and given in Table 5.11.

5.11.1 Nitrogenous fertilizer consumption:

In Konkan region, nitrogenous fertilizer consumption for the beginning year 1980 was 16940 MT, which increased to 36261 MT at the end year 2000. The average consumption was 25390.9 MT and the variability in consumption was 31.33 per cent.

The nitrogenous fertilizer consumption in Thane, Raigad, Ratnagiri and Sindhudurg district was 4724, 5809, 4151 and 2256 MT in 1980, which increase to 12865, 12171, 7226 and 3999 MT, at the end of the year 2000. During this period the districtwise average fertilizer consumption was 8341, 8871, 4820.21 and 2894.21 MT for Thane, Raigad, Ratnagiri and Sindhudurg district, respectively. The variability in nitrogenous fertilizer consumption was 37.72, 28.60, 32.41 and 35.05 per cent in respective district.

From the table 5.11 it is observed that nitrogenous fertilizer consumption in Konkan region has increased during study period. Among the four districts of Konkan region, consumption of

nitrogenous fertilizer was more in Raigad district followed by Thane, Ratnagiri and Sindhudurg.

5.11.2 Phosphatic fertilizer consumption:

In the period, 1980-2000, phosphatic fertilizer consumption in Konkan region increased from 3950 to 6523 MT. The average phosphatic fertilizer consumption in Konkan region was 5798.8 MT and the variability of consumption was 40.83 per cent.

The average phosphatic fertilizer consumption in Thane, Raigad, Ratnagiri and Sindhudurg district during 1980-2000 was 1907, 1731.63, 979.11 and 1182.3 MT, respectively and the consumption of variability was 63.55, 67.82, 31.03 and 37.59 per cent for the respective district.

This table indicated that the overall phosphatic fertilizer consumption was increased during study period. Among the districts of Konkan region Thane district had higher consumption and Ratnagiri had lower consumption of phosphatic fertilizer, during study period.

5.11.3 Potassic fertilizer consumption:

In the Konkan region, the consumption of potassic fertilizer increased from 2660 to 4437 MT in 1980-2000. The average potassic fertilizer consumption in Konkan region was 3965.4 MT and the variability of consumption was 41.58 per cent. In period 1980-2000 the average fertilizer consumption was highest in Thane district (1340 MT) followed by Raigad (1206 MT), Sindhudurg (811 MT) and Ratnagiri
(792 MT) districts. The variability of consumption of phosphatic fertilizer in Thane, Raigad, Ratnagiri and Sindhudurg district was 48.08, 72.62, 46.26 and 33.49 per cent, respectively.

5.11.4 Total NPK consumption:

Total NPK consumption in Konkan region was 23550 MT in 1980, which increased to 47221 MT in 2002. The average fertilizer

consumption was 34549.95 MT and the variability in consumption of total NPK was 34.19 per cent. Total fertilizer consumption in Thane, Raigad, Ratnagiri and Sindhudurg district had increased from 6245, 8105, 5622 and 3578 MT in 1980 and 16139, 15018, 8979 and 7085 in year 2000. The average fertilizer consumption during study period was 11816.2, 11973.1, 6710.8 MT and 4997 MT, respectively. The variability in consumption of fertilizer was 36.87, 34.66, 28.77 and 32.45 per cent in the same order.

From the Table 5.11 it is observed, that the total fertilizer consumption in Konkan increased during the study period. The consumption of fertilizers was more in Raigad district as that of Thane, Ratnagiri and Sindhudurg. This is due to dominance of rice crop in Raigad district.

5.12 AGRICULTURAL WAGES

Wages paid to the agricultural field labour are considered to be an indicator of agricultural development. Field labour includes that labour who carried out operations such as ploughing, sowing, transplanting, harvesting etc. The wage rates at current prices are considered and indicated for Konkan region. The mean, S.D., C.V. of agricultural wages is given in Table 5.12.

5.12.1 Wages paid to male field labour:

In Konkan region, wages paid to male field labour at current prices increased from Rs. 7.64 in 1980-81 to Rs. 50.83 in 2000. The average wages paid was Rs. 25.96. The variability in the wages paid was 57.44 per cent.

The average wages paid to male field labour in Thane, Raigad, Ratnagiri and Sindhudurg district was Rs. 20.20, Rs. 25.29, Rs. 26.54 and Rs. 31.46 during the period of 1980-2000. The variability in the wages was 63.27, 60.86, 60.74 and 60.52 per cent, respectively.

From the table 5.12 it is observed that wages paid to male labour was high in Ratnagiri district.

5.12.2 Wages paid to female field labour:

In Konkan region, wages paid to female labour at current prices increased from Rs. 5.96 to Rs. 41.18 during the period 1980-2000. The average wages paid to female labour was Rs. 19.34. The variability in wages was 59.37 per cent.

The average wages paid to female field labour in Thane, Raigad, Ratnagiri and Sindhudurg district were 16.09, 20.00, 18.87 and 22.85 Rs. The variability of wages was 59.59, 59.34, 63.51 and 62.41 per cent.

The wages paid to female agricultural labour were highest in Raigad district and lowest in Sindhudurg district.

5.12.3 Wages paid to other male agricultural labour:

In Konkan region, the wages paid to other male agricultural labour at current prices increased from Rs. 6.92 to 48.2 during the period 1980 to 2000. The average wages paid was 24.12 Rs. and the variability in wages was 56.18 per cent.

During this period, the average wages paid in Thane, Raigad, Ratnagiri and Sindhudurg district was 19.59, 21.29, 25.80 and 21.81 Rs. and the variability in wages was 60.67, 59.86, 57.83 and 62.42 per cent. From table, it can be concluded that the wages paid male at current prices increased in Konkan region. Among the four districts in the Konkan region higher wages were paid in Ratnagiri district, followed by Sindhudurg, Raigad and Thane district.

5.12.4 Wages paid to other female agril. labour:

In Konkan region, wages paid to other female agril. labour shows increasing trend during 1980 to 2000 from Rs. 5.34 to Rs. 36.71. The average of wages paid was Rs. 17.99 and variability in wages was 56.93 per cent.

During period 1980-2000, the wage rate increased from Rs. 4.59 to 29.68 in Thane, Rs. 5.89 to 35.97 in Raigad, Rs. 6.10 to 38.87 in Ratnagiri and Rs. 5.09 to 38.8 in Sindhudurg district. It indicates the increase in wage rate during study period. The per cent variability was 58.26 per cent in Thane, 56.21 per cent in Raigad, 62.24 per cent in Ratnagiri and 57.00 per cent in Sindhudurg district.

5.13 AREA UNDER HYV's OF RICE

In Konkan region, the areas under HYV's of rice had increased from 259.2 to 402.1 hundred ha in 1980-2000. During this period, the average area was 341.5 hundred ha. Variability in the area was 14.21 per cent. This is due to spread of new varieties.

The average HYV's area in Thane, Raigad, Ratnagiri and Sindhudurg district was 111.19, 122.4, 58.63 and 46.06 hundred ha and the variability in area was 12.6, 7.72, 21.75 and 28.85 per cent for the respective district during period of 1980-2000.

It can be concluded from the Table 5.13 that area under HYV's in Konkan region has increased over a period of time. Among the four district of Konkan region, Raigad district, covered large area under HYV's followed by Thane, Raigad and Sindhudurg district during 1980-2000.

PART-II

5.14 GROWTH IN POPULATION

It observed from the Table 5.14 that in Konkan region, population was 69.98 lakh in 1981which increased to 94.55 lakh in 1991 and 128.92 lakh in 2001. Similar, trend has observed, among all the four districts. However, decadal increase in population *viz.*, 1981 to 1991 and 1991 to 2000 was highest in Thane district (56.59% and 54.52%) followed by Raigad district (22.81% and 20.88%), Ratnagiri district (11.19% and 10.98%) and Sindhudurg district (6.41% and

3.73%). In Konkan region, decadal increase in population was 35.15 per cent and 36.35 per cent, respectively. This indicated that population increase particularly in

Thane district may be due to migration of person to this district for search of employment. Since, it is industrial belt and nearby Mumbai metropolitan region.

Similar observations were made by Gawade (2001) and Kudalkar (2000).

5.15 GROWTH RATES OF LAND UTILIZATION

Simple and compound growth rates of land utilization pattern in Konkan region and Thane, Raigad, Ratnagiri and Sindhudurg district are worked out and given in Table 5.15.

5.15.1 Forest

In Konkan region, during 1980-2000 the compound growth rate of area under forest was negative (-0.53%) but non-significant at 1 per cent level of significance, indicated that the area under forest was decreased by 8.2 hundred ha.

In Thane district, the growth rate of area under forest was negative (-0.6%) but significant, 5 per cent level, this indicated decrease in area under forest by 20.98 hundred ha. However, in Raigad district the growth of area under forest was negative (-0.8%) and non-significant. The growth rate of forest area in Ratnagiri district was (-3.9%) negative but significant at 5 per cent level indicated that decrease in area under forest 2.4 hundred ha, whereas in Sindhudurg district there was an increase in area (0.8%) under forest by 3.09 hundred ha.

From the above results, it is concluded that except Sindhudurg district there was decrease in forest area in three districts, which resulted into decreasing forest area of the Konkan region.

5.15.2 Barren and unculturable land

In Konkan region, compound growth rates for land under barren and unculturable land was negative (-1.3%) but significant at 1 per cent

Table 5.15. Growth rates of land utilization (1981-2000)

Particulars	Linear growth rate ('00'ha)				
	Thane	Raigad	Ratnagiri	Sindhudurg	Konkan region
Forest	**-20.98** (-0.6**)**	**-9.2 NS (-0.8 NS)**	**-2.4** (-3.9**)**	**3.09* (0.8*)**	**-8.2* (-0.53*)**
Barren and unculturable land	**-27.44** (-4.7**)**	**16.02 NS (0.67NS)**	**-17.26*** (-2.05***)**	**-7.4* (-0.5*)**	**-67.70* (-1.3*)**
Land under non-agricultural used	**14.57* (1.9*)**	**3.6* (0.7*)**	**2.64* (5.01*)**	**1.66NS (0.8 NS)**	**22.94* (1.4*)**
Cultural waste	**-17.62* (-5.8*)**	**14.11* (3.12*)**	**-24.70* (-9.7*)**	**-41.86* (-4.4*)**	**-69.24* (-2.1*)**
Permanent pasture and other grazing land	**-25.04* (-3.9*)**	**-1.14 NS (-0.2NS)**	**10.05* (1.4*)**	**0.19 NS (4.3NS)**	**-16.22* (-1.2*)**
Land under miscellaneous trees grooves	**12.32* (9.0*)**	**1.32 NS (0.5NS)**	**-23.61* (-1.5*)**	**8.7** (3.9**)**	**45.25* (4.5*)**
Current fallows	**-5.33** (-5.1**)**	**15.42** (0.20**)**	**6.68NS (0.18 NS)**	**11.85* (20.05*)**	**28.83* (4.2*)**
Other fallows	**-6.7** (-4.6**)**	**12.11NS (1.7NS)**	**3.4NS (1.8 NS)**	**13.56** (2.4**)**	**-9.7 NS (-0.4 NS)**
Net sown area	**76.85* (2.4*)**	**4.01NS (9.2NS)**	**4.6** (1.8**)**	**10.55* (0.8*)**	**95.20* (1.0*)**
Area sown more than once	**7.48** (4.7**)**	**-3.22* (-3.2*)**	**4.23NS (-0.47 NS)**	**5.07** (5.2**)**	**20.13** (3.7**)**
Total cropped area	**85.08* (2.5*)**	**6.8NS (0.31NS)**	**-8.4 NS (-0.5 NS)**	**15.60* (1.15*)**	**98.75* (1.0*)**

(Figures in parentheses are compound growth rates in percentage)

*** Significant at 1%, ** Significant at 5% *** Significant at 10%**
NS : Non-significant

level of significance, indicated decrease in area under this category by 67.17 hundred ha during 1980-2000.

In Thane district, area under this category was negative (-4.7%) but significant at 5 per cent levels of significance, indicated that decrease in area by 27.44 hundred ha. Growth rate of area under Raigad district was (0.67%) non-significant. However, in Ratnagiri district the growth rate under this category was (-2.05%), negative but significant at 10 per cent level indicated that there decrease in area under this category by 17.26 hundred ha. In Sindhudurg district the growth rate was negative (-0.5%) but significant under this category. It indicated that decrease in area by 7.4 hundred ha annually.

5.15.3 Land under non-agriculture use

The growth rates under this category in Konkan region, was positive (1.4%) and significant at 1 per cent level, indicated that increase in area by 22.94 hundred ha throughout study period. Similarly, the growth rate of this category in Thane (1.9%), Raigad (0.7%) and Ratnagiri (5.01%) were positive and significant at 1 per cent level indicated that increase in area under this category were 14.57, 3.6, 2.64 hundred ha. However, in Sindhudurg district has positive (0.8%) but non-significant growth.

5.15.4 Culturable waste

In Konkan region, during the period, 1980-2000 the growth rate of culturable waste was negative (-2.1%) but significant at 1 per cent level, indicated that decrease in area under this category were 69.24 hundred ha.

The growth rate in Thane (-5.8%) and Sindhudurg district were (-4.4%) negative but significant at 1 per cent level of significance, indicated that decrease in area under culturable waste by 17.62 hundred ha in Thane and 41.86 hundred ha in Sindhudurg district.

The growth rate in Raigad district was positive (3.12%) and significant at 1 per cent, level indicated that increase in area under cultural waste by 14.11 hundred ha. However, in Ratnagiri district the growth rate was negative (9.7%) but significant at 1 per cent level indicated decrease in area under culturable waste by 24.70 hundred ha.

5.15.5 Permanent pasture and other grazing land

In Konkan region growth rates in area under permanent pasture and other grazing land was negative (-1.2%) but significant at 1 per cent level, indicated decrease in area under this category by 16.22 hundred ha throughout the study period.

In Thane district, growth rate under this category showed decrease in area by 3.9 per cent, whereas in Raigad district growth rate was negative and non-significant. However, in Ratnagiri showed a positive (1.4%) and significant growth, indicated increase in area under permanent pasture and other grazing land by 10.05 hundred ha. The growth rate in Sindhudurg district was negative (-4.3%) and non-significant over study period. This revealed that there is shift from area under this category in Konkan region to some other uses except in Ratnagiri district.

5.15.6 Miscellaneous trees and grooves

During 1980-2000, the growth rate of land under miscellaneous trees and grooves in Konkan region was increased by 45.25 hundred ha.

In Thane district the growth rate of land under this category was increased by 12.32 hundred ha. Growth rate in Raigad district was positive (0.5%) but non-significant, whereas in Ratnagiri district, it was negative (-1.5%) but significant at 1 per cent level of significance indicated decrease in area under this category by 23.61 hundred ha

throughout the study period. In Sindhudurg district growth rates of area under miscellaneous trees and grooves was increased by 8.7 hundred ha.

5.15.7 Current fallows and other fallows:

During 1980-2000, in Konkan region, growth rate of current fallows was positive (4.2%) and significant at 1 per cent level of significance, indicated increase in area under current fallows by 28.83 hundred ha.

In Thane district, growth rate of current fallows was negative (-5.1%) and significant at 5 per cent level, this indicated decrease in area under current fallow by 5.33 hundred ha, whereas in Raigad district growth rate was positive (0.20%) and significant indicated that increase in area under current fallows by 15.42 hundred ha. In Ratnagiri district it was positive but non-significant result.

The growth rate of land under other fallows showed negative and non-significant result (-0.4%) in Konkan region during 1980-2000. In Thane district, growth rate of other fallows was (-4.6%) negative but significant at 5 per cent level, indicated that decrease in area under this category by 6.7 hundred ha whereas growth rate in Raigad district (1.7%) and Ratnagiri district (1.8%) was non-significant. However, Sindhudurg district showed increasing area under this category by 13.56 hundred ha.

5.15.8 Net sown area

During the period 1980-2000, in Konkan region, the growth rate of net sown area was positive (1%) and significant at 1 per cent level of significance indicated increase in net sown area by 95.20 hundred ha. In Thane and Sindhudurg district growth rate of net sown area increased by 76.85 and 10.5 hundred ha during study period. The growth rate under this category in Raigad district was positive (9.2%) but non-significant result. However, in Ratnagiri district growth rate

showed (1.8%) positive and significant result, there by indicated increase in net-sown area by 4.6 hundred ha.

5.15.9 Area sown more than once

In Konkan region, the growth rate of area sown more than once was significant (3.7%) indicated that increase in area under this category by 20.13 hundred ha. In Thane district, the growth rate under this category was significant (4.7%) and increased by 7.48 hundred ha. In Raigad district, the growth of area sown more than once was negative (3.2%), but significant at 1 per cent level, indicated decrease in area by 3.22 hundred ha. Whereas, in Ratnagiri district, observed non-significant result. In Sindhudurg district, the growth in area under this category was significant (5.2%) which increased by 5.07 hundred ha.

5.15.10 Total cropped area

In Konkan region, the growth rate of total cropped area has increased by 98.75 hundred ha. In Thane and Sindhudurg district, growth rate in total cropped area increased by 85.08 hundred ha and 15.60 hundred ha whereas in Raigad and Ratnagiri district the growth rate in total cropped area was non-significant.

Similar observations were made by Johl and Singh (1966), Giri (1969), Suri (1974), Desai (1977) and Gawade (2001).

5.16 GROWTH RATES OF AREA, PRODUCTION AND PRODUCTIVITY OF PRINCIPAL CROPS IN KONKAN REGION

The compound and linear growth rates of area, production and productivity of principal crops in Konkan region and Thane, Raigad, Ratnagiri and Sindhudurg district are calculated and are given in table 5.16.

5.16.1 Konkan region:

It observed from the Table 5.16 that in Konkan region growth in area under rice was negative (0.20%) but significant at 1 per cent level. It indicated that decrease in area under rice by 3.70 hundred ha annually.

The growth in area under total cereals and total pulses was non-significant in Konkan region, whereas the growth in area under total foodgrain was negative (0.7%) but significant at 5 per cent level, indicated that decrease in area under total foodgrain by 16.06 hundred ha. In case of growth in area under total oilseed was negative and non-significant in Konkan region.

During 1980-2000, in Konkan region, the growth in production of rice was (1.5%) positive and significant at 1 per cent level of significant, indicates that increased in production of rice by 53.89 hundred MT. The growth rate in production of total cereals (1.1%) and total pulses (3.5%) was positive and significant at 1 per cent level for both the crops indicates that increased in production of total cereals ad total pulses was 44.58 and 2.11 hundred MT. The growth rate of production of total food grain was positive (1.36%) and significant at 1 per cent level, indicated that increase in production of total food grain by 138.56 hundred MT. In case of total oilseed the growth increased (5.6%) by 1.48 hundred MT.

In Konkan region, the growth in productivity of rice was positive (1.9%) and significant at 1 per cent level, indicated that increase in productivity of rice by 15.46 kg per ha. The growth rate in productivity of total cereals (1.9%), total pulses (4.4%), total foodgrain (1.9%) and total oilseed was (6.4%) positive and significant at 1 per cent level, by 13.29, 4.78, 12.44 and 13.02 kg per ha, respectively.

5.16.2 Thane district:

As regard the Thane district, it is observed from Table 5.16 that growth in area under rice was negative (0.16) but significant at 5 per cent level indicates that decreased in area under by 2.4 hundred ha. The growth in area under Total cereals, Total pulses, Total food grain

and total oil seed was non-significant during study period (1980-2000).

In Thane district, the growth in production of rice and total cereals was non-significant, whereas in case of total pulses the growth in production of total pulses was (7.1%) positive and significant at 1 per cent level of significant, indicated that increase in production by 13.05 hundred MT. The growth in total foodgrain production (1.3%) and total pulses (3.2%) was positive and significant at 5 per cent level of significant for both the crops indicated that increase in production of 42.51 and 0.40 hundred ha, respectively.

The growth in productivity of rice in Thane district was (1.1%) positive and significant at 10 per cent level, indicated that increase in productivity by 21.43 kg per ha. The growth in productivity of total cereals was non-significant in Thane district. In case of total pulses increased in productivity by (4.4%) 18.46 kg per ha the growth in productivity of total food grain was positive (1%) and significant at 5 per cent level, indicated increase in productivity by 16.76 kg per ha. As far as concern of total oil seed the increase in productivity was 8.11 kg per ha (2.4%).

5.16.3 Raigad district:

It is observed from the table 5.16 that the growth in area under rice was (-0.6) negative but significant at 1 per cent level indicated that decrease in rice area by 8.85 hundred ha over the study period. The growth in area under total cereals was (1.02) negative but significant at 1 per cent level indicated that decrease in area under total cereals by 17.13 hundred ha. In case of total pulses and total oilseed the growth was non-significant, where as the growth in total foodgrain was (4.1) negative but significant at 1 per cent level indicates that decreased in area of total foodgrain by 19.41 hundred ha.

The growth in production of rice was positive (1.02%) and significant at 1 per cent level, indicated that increase in production of rice by 30.89 hundred MT. The growth in production of total cereals was positive (0.74%) and significant at 5 per cent level, indicated that increase in production of total cereals 23.99 hundred MT.

The growth in production of total pulses was (2.3%) positive and significant at 1 per cent level, indicated increase in production by 1.25 hundred MT. In case of growth in production total foodgrain was positive (0.77) and significant at 5 per cent level, indicated increase in production by 25.36 hundred MT. The growth in production of total oilseed was negative (0-5) but significant at 5 per cent level, indicated that decrease in production by 0.14 hundred MT.

The growth in productivity of rice (1.73%) and total cereals (1.78%) was positive and significant at 1 per cent level for both the crops indicated that increase in productivity by 36.61 and 34.44 kg per ha, respectively. Whereas the growth in productivity of total pulses was (0.13%) negative but significant at 1 per cent level, indicated that decrease in productivity by 15.42 kg per ha. The growth in productivity of total foodgrain increased (1.86%) and significant at 1 per cent level, indicated increase in productivity by 36.66 kg per ha. The growth in productivity of total oilseed was (1.3%) negative but significant at 1 per cent level indicated decrease in productivity of total oilseed by 0.25 kg per ha.

5.16.4 Ratnagiri district:

It is observed from the table that, the growth in area under rice was non-significant in Ratnagiri district during study period, whereas the growth in total cereals was negative (-1.7%) but significant at 1 per cent level indicated that decrease in area under total cereals by 22.67 hundred ha. The growth in area under total pulses was non-significant. In case of total foodgrain, the growth was negative (-2.8%)

but significant at 1 per cent level, indicated decrease in area under total foodgrain by 24.08 hundred ha, however the growth in area under total oilseed was non-significant in Ratnagiri district.

The growth in production of rice (2.1%) and total cereals (1.2%) was positive and significant at 1 per cent and 5 per cent level of significance, which indicated that the increase in production of rice and total cereals by 35.19 and 24.88 hundred MT. In case of total pulses the growth was positive (3.8%) and significant at 5 per cent level, indicated that increase in production by 0.62 hundred MT. The growth in production of total foodgrain (5.8%) and total oilseed (-3.10%) was negative but significant at 1 per cent level, indicated that decrease in area under total food grain and total oil seed by 9.5 and 0.83 hundred MT.

The growth in productivity of rice was positive (2.5%) and significant at 1 per cent level, indicated that increase in productivity by 50.32 kg per ha. The growth in productivity of total cereals (2.8%) and total pulses (5.17%) was positive and both were significant at 1 per cent level of significance for both crops indicated that increase in productivity by 47.37 and 17.33 kg per ha. The growth in productivity of total foodgrain (5.8) and total oilseed (3.10) was negative but significant at 1 per cent level for both crops indicated that decrease in productivity by 45.97 and 8.15 kg per ha.

5.16.5 Sindhudurg district:

In Sindhudurg district, the growth in area under rice was (0.36%) positive and significant at 1 per cent level indicated that increase in area by 2.77 hundred ha. In case of growth in area under total cereals, total pulses and total foodgrain was non-significant. The growth in area under total oilseed was positive (7%) and significant at 1 per cent level, indicated that increase in area by 2.3 hundred ha.

The growth in production of rice (2.9%) and total cereals (2.3%) was positive and both were significant at 1 per cent level for both crops indicated that increase in production by 46.23 and 39.16 hundred MT. The growth in production of total pulses (3.5%) was increased by 0.69 hundred MT, whereas the growth in production of total foodgrain (2.5%) and total oilseed (13.8%) was positive and significant at 1 per cent level, indicated that increase in production of total foodgrain and total oilseed was 41.77 and 5.6 hundred MT.

The growth in productivity of rice (2.5%) and total cereals (2.9%) was positive and significant at 1 per cent level for both indicated increase in productivity by 52.14 and 55.56 kg per ha. The growth in productivity of total pulses (4.1%) and total foodgrain (2.8%) was positive and both were significant at 1 per cent level, indicated increase in productivity by 13.65 and 51.75 kg per ha. The growth in total oilseed was positive (8.59%) and significant at 1 per cent level, indicated that increase in productivity by 82.17 kg per ha.

It is indicated by the foregoing analysis that the hypothesis "there is increase in production of a crops in each district" has been proved as the significant compound growth rates of production were observed for important crops and crop groups.

5.17 GROWTH RATES OF CREDIT

Credit is most important input contributing towards increase in agricultural production. Growth in credit was worked out and the result is given in Table 5.17

Table 5.17. Growth rates of credit (Rs '000' / ha net cultivated area)

Particulars	Thane	Raigad	Ratnagiri	Sindhudurg	Konkan
Credit	**-0.03^{NS} (2.9)**	**-0.14* (12.6)**	**0.06* (3.0)**	**0.22* (16.6)**	**0.06* (7.4)**

Figures in parentheses are indicate compound growth rate in percentage

NS – Non-significant, * Significant at 1 per cent level

From the above table, it observed that in Konkan region the growth in credit was positive and significant (0.06%) at 1 per cent level, indicated that increase in credit by Rs. 7.4 thousand per ha of net cultivated area.

In Thane district, the growth in credit showed a non-significant result. In Raigad district the growth in credit was negative (-0.14%), but significant at 1 per cent level, indicated that decrease in growth of credit by Rs. 12.6 thousand per ha of net cultivated area (NCA). However, in Ratnagiri and Sindhudurg district increase in growth of credit by 3.0 and 16.6 per cent of net cultivated area.

5.18 GROWTH RATES OF FERTILIZER CONSUMPTION

Fertilizer is crucial input contributing towards increase in production. Growth in consumption of fertilizer was worked out and the result is given in Table 5.18.

Table 5.18. Growth rates of fertilizer consumption

Particulars	Linear growth rate (MT)				
	Thane	Raigad	Ratnagiri	Sindhudurg	Konkan region
N	**504.37*** **(6.6*)**	**348.15*** **(4.17*)**	**200.86*** **(4.9*)**	**139.18*** **(5.94*)**	**1218.43*** **(5.32*)**
P	**47.73 NS** **(4.00 NS)**	**78.49**** **(5.17**)**	**4.09 NS** **(0.2 NS)**	**57.72*** **(6.06*)**	**191.91**** **(4.06**)**
K	**39.56**** **(4.02**)**	**60.87NS** **(5.15NS)**	**15.16 NS** **(0.8 NS)**	**20.57**** **(3.32**)**	**120.85**** **(8.4**)**
Total NPK	**591.67*** **(5.8*)**	**487.52*** **(4.3*)**	**181.61*** **(3.4**)**	**217.47*** **(5.4*)**	**1531.20*** **(4.9*)**

(Figures in parentheses indicate compound growth rate in percentage)

*** Significant at 5%, ** Significant at 1% NS : Non-significant**

5.18.1 Nitrogenous fertilizer :

It was observed that in Konkan region, the growth rate of nitrogenous fertilizer was positive (5.32%) and significant at 1 per cent level indicated that there is increase in consumption of fertilizer over the period. During, 1980-2000, in Thane, Raigad, Ratnagiri and Sindhudurg district, the growth rate of consumption of nitrogenous fertilizer showed a significant increase of 504.37 MT (6.6%), 384.15 (MT) (4.17%), 200.86 (MT) (4.9%) and 139.18 MT (5.94%), respectively. It indicated that there is increase in consumption of nitrogenous fertilizer among the four districts of Konkan region throughout the study period.

5.18.2 Phosphatic fertilizer:

It was observed from the Table 5.18 that, in Konkan region, the growth rate of phosphatic fertilizer was positive (4.06%) and significant at 5 per cent level indicated that the consumption of phosphatic fertilizer was increased by 191.91 MT during study period.

In Thane district, the growth rate in consumption of phosphatic fertilizer showed a non-significant result, whereas, in Raigad district, the growth rate of consumption of phosphatic fertilizer (5.17%) increased by 78.49 MT. The growth rate for consumption of phosphatic fertilizer showed a non-significant result in Ratnagiri district. However, in Sindhudurg district the growth rate of phosphatic fertilizer consumption was found to be significant (6.6%) and increased by 57.72 MT.

5.18.3 Potassic fertilizer:

It is seen from the Table 5.18 that, a significant increase of 120.85 MT (8.4%) in consumption of a phosphatic fertilizer was observed in Konkan region.

In Thane district, the growth rate in consumption of phosphatic fertilizer was (4.02%) significant increase by 39.56 MT, whereas in Raigad and Ratnagiri district the growth rate of consumption of phosphatic fertilizer was observed to be non-significant. In Sindhudurg district, the growth in consumption of phosphatic fertilizer was significant (3.32%) increased by 20.57 MT.

5.18.4 Total NPK

The growth rate of total NPK consumption, in Konkan region has (4.9%) increased by 1531.20 MT over study period.

In Thane district, the growth rate of consumption of total NPK was (5.8%) 591.67 MT which was highest as compared to Raigad (4.3%) 487.52 MT, Ratnagiri (3.4%) 181.64 MT and Sindhudurg district (5.4%) 217.47 MT.

In Konkan region, along with four districts there was significant increase in consumption of total NPK throughout the study period. The growth in consumption of fertilizer was observed in studies conducted by Fertilizer Association of India (1982).

5.19 GROWTH RATES OF GROSS IRRIGATED AND NET IRRIGATED AREA

The growth rates of gross irrigated and net irrigated area is calculated and given in Table 5.19.

Table 5.19. Growth rates of irrigated area (1980-2000)

Particulars	Linear growth rate ('00'ha)				
	Thane	Raigad	Ratnagiri	Sindhudurg	Konkan region
Net irrigated	**8.5*** **(9.7*)**	**0.94*** ** (0.87***)**	**-0.23 NS (-0.7 NS)**	**13.46*** **(7.3*)**	**16.57*** **(4.19*)**
Gross irrigated	**9.5*** **(9.98*)**	**1.6*** **(1.2*)**	**0.09 NS (0.13 NS)**	**13.07*** **(5.9*)**	**19.37*** **(4.23*)**

(Figures in parentheses indicate compound growth rate in percentage)
*** Significant at 1% level, ** Significant at 5% level,**
*****Significant at 10% level NS – Non-significant**

In Konkan region, the growth rate of gross irrigated area was positive (4.23%) and significant at 5 per cent level. It indicated that gross irrigated area has increased by 19.37 hundred ha. However, the growth in net irrigated area was positive (4.19%) and significant at 1 per cent level of significance indicated that increase in net irrigated area by 16.57 hundred ha.

In Thane district, during the period 1980-2000, the growth rate of gross irrigated area was positive (9.98%). It indicated that increase in gross irrigated area by 9.5 hundred ha, whereas the growth in net irrigated area was positive (9.7%) and significant at 1 per cent level. It indicated that increase in net irrigated area by 8.5 hundred ha. The growth rate in gross irrigated (1.2%) and net irrigated (0.87%) in Raigad district was increased by 1.6 and 0.94 hundred ha, respectively. Only in Ratnagiri district, the growth rate of gross irrigated and net irrigated area was found to be non-significant. In Sindhudurg district the growth rate in gross irrigated area was (5.9%) increased was 13.07 hundred ha and net irrigated area was (7.3%) was increased by 13.46 hundred ha.

5.20 GROWTH RATES OF DAILY WAGES PAID TO AGRICULTURAL AND OTHER AGRICULTURAL LABOUR

Growth rates of daily wages paid to agricultural labour and other field labour is estimated and given in Table 5.20.

5.20.1 Field labour

I) Male :

It is observed from the table 5.20, in Konkan region, the growth in wages paid to male field labour was positive (10.83%) and

significant at 1 per cent level, indicated that increase in wages by Rs. 2.4.

Table 5.20. Growth rates of daily wages paid to agricultural and other field labour (1980-2000)

Particulars	Linear growth rates (Rs.)				
	Thane	Raigad	Ratnagiri	Sindhudurg	Konkan region
A) Field labour					
a) Male	**2.0* (11.31*)**	**2.5* (12.28*)**	**2.5* (10.98*)**	**3.10* (11.65*)**	**2.4* (10.83*)**
b) Female	**1.55* (10.71*)**	**1.96* (11.92*)**	**1.90* (11.29*)**	**2.9* (11.82*)**	**1.8* (10.98*)**
B) Other Agricultural labour					
a) Male	**1.90* (11.45*)**	**1.89* (10.34*)**	**2.4* (10.77*)**	**2.3* (10.43*)**	**2.2* (10.71*)**
b) Female	**1.43* (10.66*)**	**1.67* (11.21*)**	**1.8* (11.19*)**	**1.96* (11.42*)**	**1.60* (10.67*)**

(Figures in parentheses indicate compound growth rate in percentage)
*** Significant at 1% level**

The growth rate in Thane (11.31%), Raigad (12.28%), Ratnagiri (10.98%) and Sindhudurg (11.65%) was positive and significant at 1 per cent level, indicated that increase in wages by Rs. 2, Rs. 2.5, Rs. 2.5 and Rs. 3.10, respectively.

From above discussion, it is concluded that among the four districts of Konkan region, higher wages were paid in Sindhudurg district.

II) Female:

In Konkan region, the growth in wages paid to female labour was (10.98) positive and significant at 1 per cent level of significance, which indicated that increase in wages by Rs. 1.8.

The growth rate in wages paid to female agriculture labour in Thane (10.71%), Raigad (11.92%), Ratnagiri (11.29%) and Sindhudurg (11.82%) was positive and significant at 1 per cent level which indicated that increase in wages by Rs. 1.55, Rs. 1.96, Rs. 1.90 and Rs. 2.9 in respective district.

5.20.2 Other agricultural labour

I) Male :

In Konkan region, the growth in wages paid to male other agricultural labour was positive (10.71%) and significant at 1 per cent level of significance, indicated that increase in wages by Rs. 2.2.

The growth in wages paid to male other agricultural labour in Thane (1.90%), Raigad (1.89%), Ratnagiri (2.4%) and Sindhudurg district (1.96%) indicated that increase in wages by Rs. 1.90, Rs. 1.89, Rs. 2.4 and Rs. 2.3, respectively.

II) Female :

In Konkan region, the growth rate in wages paid to female other agricultural labour (10.71%) increased by Rs. 2.2.

The growth rate in wages paid to female agricultural labour in Thane 1.43 per cent, Raigad 1.67 per cent, Ratnagiri 1.8 per cent and 1.96 per cent in Sindhudurg district indicated increase in wages by Rs. 10.66, 11.21, 11.19 and 11.42, respectively.

5.21 GROWTH RATES OF AREA UNDER HIGH YIELDING VARIETIES OF RICE

Growth rates of area under high yielding varieties of rice are calculated and it is given in Table 5.21.

Table 5.21. Growth rates of area under high yielding varieties of rice

Crop	Linear growth rate ('00'ha)

	Thane	Raigad	Ratnagiri	Sindhudurg	Konkan region
Rice	**2.3* (2.1*)**	**1.2* (1.08*)**	**2.1* (3.7*)**	**2.3* (5.2*)**	**3.2* (2.4*)**

(Figures in parentheses indicate compound growth rate in percentage)

*** Significant at 1 per cent level**

From the above table, it can be seen that in Konkan region, the growth rate of high yielding varieties was positive (2.4%) and significant at 1 per cent level of significance which, indicated that area under high yielding varieties of rice was increased by 3.2 hundred ha. The growth rates of area under high yielding varieties in Thane district (2.1%), Raigad (1.08%), Ratnagiri (3.7%) and Sindhudurg (5.2%) were positive and significant at 1 per cent level of significance indicated that increase in area under high yielding varieties by 2.3, 1.2, 2.1 and 2.3 hundred ha for respective districts.

It is revealed from the above analysis that, hypothesis indicating increase in area under HYVs, irrigated area and fertilizer consumption due to increase in credit flow was proved with the available database.

PART – III

5.22 COMPOSITE INDEX OF AGRICULTURAL DEVELOPMENT

Districtwise agricultural development in Konkan region was studied with the help of methodology suggested by Iynger and Sudarshan (1982). The composite index was calculated for four district of Konkan region. To calculate the composite index, data were collected on 27 indicators responsible for agricultural development, for the year 1980-2000. The value of composite index is always non-negative and it lies between 0 to 1.

It was observed from the Table 5.22 that, during year 1980-81, the composite index vale for Sindhudurg district was 0.3082 and rank

1st and level of development was 69.18%. The composite index of Ratnagiri district was 0.390 and rank 2nd in agricultural development, the level of development. The composite index of Raigad district was 0711 and 28.9 per cent level of development and ranked 4th in Konkan region, while thane district rank in 3rd with 48.56 level of development. As per the value of composite index it showed higher development in Sindhudurg district whereas Raigad district showed lower development during

1990-91. Thane and Raigad district was in 3rd and 4th rank and on a same position for previous decade but composite index values of these districts were 0.5209 and 0.5817, respectively which showed that Raigad district was leading towards development. Composite index in Ratnagiri and Sindhudurg was 0.3364 and 0.3557, respectively. Ratnagiri ranked 1st and Sindhudurg ranked 2nd in agricultural development. During this decade the agricultural development in Ratnagiri was higher than other districts in Konkan region. In the year 1999-2000, it was observed that the level of development in Thane 46.34 per cent and Sindhudurg 52.17 which was decreased. The ranked of Thane district shifted from 3rd to 4th position and Raigad district ranked 3rd, the value of composite index was 0.5201. Ratnagiri district ranked 1st during year 1999-2000 and the value of composite index was 0.3328 with 82.76 per cent level of development.

From the above discussion, it is concluded that, Ratnagiri district achieved first position in agricultural development and Raigad district had shown a good agricultural development. Sindhudurg district was bifurcated from Ratnagiri district in 1980. After bifurcation, there is adverse effect of some of the factors on the development of Sindhudurg district and hence, it exhibited decline in the level of development from 69.18 (1980-81) to 64.43 (1990-91) and to 52.17 in (1999-2000). This needs greater attention for planner and development officials of Sindhudurg district. However, there was steady increasing trend in all the other districts of Konkan region during study period.

This type of result observed by Prem Narain (2002), Jahagirdar (2001) and Bhatiya (1999).

The socio-economic infrastructure and regional factors were having positive effect on increasing agricultural production in Ratnagiri and Sindhudurg district followed by Raigad and Thane districts. Thus, hypothesis in this regard was proved from the analysis of secondary data.

PART-IV

5.23 MEASUREMENT OF TOTAL FACTOR PRODUCTIVITY GROWTH

This study seeks to examine in TFP across districts of Konkan region. This perspective is valuable to identify the district, which are showing clear signs of crop productivity. The total input index (TII), total output index (TOI) and total factor productivity (TFP) indices are constructed for each district in Konkan region and Konkan region as a whole, using Divisia-Tornquist index. As discussed earlier, the entire period under study (1980-2000) was divided into two sub-periods i.e. decade I (1980-90) and decade II (1990-2000). Average annual growth rate in total input index, total output index and total factor productivity index for each district and Konkan region as a whole are computed and given in Table 5.23.

Table 5.23. Average annual growth rates in total input index, total output index and total factor productivity index of crop

(%)

District/year	1980-90	1990-2000	1980-2000

	TII	TOI	TFP	TII	TOI	TFP	TII	TOI	TFP
Thane	**0.912**	**0.933**	**0.02**	**0.996**	**1.012**	**0.016**	**0.954**	**0.973**	**0.02**
Raigad	**0.896**	**0.934**	**0.038**	**1.01**	**0.990**	**-0.020**	**0.0954**	**0.963**	**0.008**
Ratnagiri	**0.901**	**0.960**	**0.05**	**1.00**	**1.005**	**0.005**	**0.0950**	**0.983**	**0.03**
Sindhudurg	**0.981**	**0.96**	**-0.02**	**0.971**	**0.975**	**0.0047**	**0.976**	**0.968**	**-0.007**
Konkan region	**0.908**	**0.883**	**-0.02**	**0.997**	**1.006**	**0.009**	**0.953**	**0.944**	**-0.0082**

5.23.1 Thane district:

From the above table, it is observed that in Thane district, during first decade (1980-90) the growth in input index was 0.912 per cent per annum, while during next decade (1992-2000), it was 0.996 per cent per annum. It implies that there was marginal increase in total input index. During corresponding period, the growth rate in output index was 0.933 per cent per annum, which increased to 1.012 per cent per annum. It shows that there was higher increase in total output index. The magnitude of total factor productivity index was 0.02 per cent per annum in 1980-90. While, it

was 0.016 per cent per annum at the end of 1990-2000. No doubt, during second decade, the total input index and total output index was comparatively higher to that of first decade. It indicated that there was no contributory effect in total factor productivity index growth. Due to increment in input index as well as output index there was no any difference in indices in two periods, this might be due to failure of extension input in transfer of a new technology for agriculture. As regards the total input index, total output index for entire period (1980-2000) was 0.954 and 0.973 per cent per annum which was more or less same. For the same period total factor productivity index was 0.02 per cent per annum.

5.23.2 Raigad district:

As regards the Raigad district, during 1980-1990, the growth rate in input index was 0.896 per cent per annum. While during next decade (1990-2000) it was 1.01. During the same period the growth in output index was 0.934 and 0.99 per cent per annum respectively. It showed that there was moderately increase in input index from 1990-2000, whereas marginal increase in output index. During first decade the growth in total factor productivity index was 0.038 per cent per annum whereas it was negative (-0.02%) in last decade. The growth in input index and output index was higher in second decade as compared to first decade although the growth in total factor productivity was negative (-0.02%), this might be due to adverse effect of technology related variables on crop productivity. For the entire period, the growth in total input index, total output index was 0.954 and 0.963 per cent per annum which were more or less same and therefore growth in total factor productivity index has turned out to be very low (0.008). It implied that

growth in total input index and total output index for entire period were similar and one expects such very low value of total factor productivity index.

5.23.3 Ratnagiri district :

During 1980-90, In Ratnagiri district the growth in input index was 0.96 per cent per annum, whereas growth in total output index was 0.901 per cent per annum, therefore the growth in total factor productivity index was 0.05 per cent per annum. One can conclude that there was positive effect on growth of total factor productivity index. While during 1990-2000 the growth rate in total input index and total output index were 1.00 and 1.005 per cent per annum, respectively, which was more or less same. Therefore, growth in total factor productivity index has turned out to be very negligible (0.005%). With regards to growth rate of entire period (1980-2000) the growth in output index was higher (0.983%) to that of input index (0.950%), therefore growth in total factor productivity index has turned out to be 0.03 per cent per annum.

5.23.4 Sindhudurg district:

During 1980-90, Sindhudurg district has very promising growth rate in total input index (0.981%) and total output index (0.96%). During this decade, the growth in input index was slightly higher than growth in output index, which turned out to be negative 0.02%, total factor productivity growth. During next decade 1990-2000 there was slight decline in total input index, while slight increase in total output index than the first decade showing negligible (0.0047%) growth in total factor productivity. The result of entire period for Sindhudurg district or entire period have

shown similar growth rate in total input index (0.976%) and total output index (0.968%) resulting to very very low change in total factor productivity index (-0.007%).

It is seen from above result that there was neither any similarity nor very contrast growth rate in total factor productivity for all districts under study period. It is because in all the districts the share of rice crop is very high and moreover there are no distinct changes in input use and also the technologies. Therefore, such a result has been depicted.

5.23.5 Konkan region:

For Konkan region as a whole, the growth rate in total input index, total output index has not shown very different results for both the periods than those for each districts. No doubt, slight variation in magnitude of growth rate of a total input index, total output index and total factor productivity index. During first decade (1980-90) the growth in input index was 0.908 per cent per annum, which was slightly higher than output index (0.883%), which resulted into negative total factor productivity (-0.02%). In 1990-2000, increase in input index (0.997%) and output index (1.006%) was more than previous decade, which results into negligible (0.008%) growth in total factor productivity. It is inferred from that, during 1990-2000 there was higher use of input, which had higher output growth. Though resultant total factor productivity was negative (-0.0082) indicating that increase in magnitude of a input had matched corresponding increase in output.

The total factor productivity analysis as regards to crop sector (mainly cereals) was decreased in study period for Konkan region as a whole. Thus, the assumed hypothesis of increasing total factor productivity was disapproved by the observed trend and the effect of explanatory variable.

5.24 TOTAL FACTOR PRODUCTIVITY DECOMPOSITION

In order to identify the determinants of TFP, the log of TFP index was estimated as a function of factors representing different variables included under study.

The influence of identified variables on productivity of crops in four districts and entire Konkan region was estimated using log linear regression. Five decomposition equations were estimated separately, using time series data from 1980-81 to 1999-2000. The step down multiple regression method was used to identify significant parameters for avoiding problem of multicolinearity. This method consists of examining only best regressors retained at significant level of 1 per cent and 5 per cent and result are presented in Table 5.24 (a) (Rangaswami method, 1991). For calculation of per cent contribution of significant variables contributing to total factor productivity growth (TFPG), "Standardized regression" was carried out. The standardized coefficients are unitless and only used to estimate per cent contribution of individual variable in total factor productivity growth. The results are presented in Table 5.24 (b).

5.24.1 Determinants of Total Factor Productivity

5.24.1.1 Konkan region :

For Konkan region, the value of coefficient of determination was 0.67, which indicated that 67 per cent variation in total factor productivity growth (TFPG) was explained by the factor under study. In Konkan region sources of TFP growth was market, credit, actual rainfall, fertilizer, net irrigated area, tractor power tiller. The elasticity coefficient of variable 'market' was negative (0.19%) but significant at

Table 5.24 (a). Estimated parameter of TFP Decomposition

Variables	Thane	Raigad	Ratnagiri	Sindhudurg	Konkan region
Intercept	-41.99	13.44	-35.97	29.98	-8.85
Market (No.of market yard)	--	--	--	--	-0.19** (0.08)
Road length **(Sq km)**	--	-3.9* (1.15)	--	--	--
Credit **(Rs. '000'/NCA)**	0.05** (0.019)	--	--	0.053** (0.02)	-0.096* (0.029)
Actual rainfall **(mm)**	0.40* (0.11)	--	--	--	0.31** (0.12)
Fertilizer (N) **(MT)**	0.51* (0.11)	--	--	-6.00* (1.54)	0.32* (0.10)

Net irrigated area **(hundred ha)**	--	0.87* (0.27)	--	1.86* (0.57)	0.22** (0.108)
Forest **(hundred ha)**	9.03* (1.5)	--	-1.26* (0.36)	-0.37** (0.17)	--
Tractor **(No.)**	-1.82* (0.33)	-0.44* (0.11)	-3.81** (1.41)	-0.25* (0.059)	-1.96* (0.56)
Power tiller **(No.)**	0.99* (0.13)	0.33* (0.09)	-0.95* (0.31)	0.21* (0.041)	1.27* (0.35)
HYVs Rice area **(hundred ha)**	--	2.9* (0.86)	--	--	--
R^2	0.78	0.69	0.40	0.70	0.67

(Figures in parentheses are the standard errors)

* 1 per cent level

** 5 per cent level

5 per cent level of significance. It indicated that if there have been increase in number market yards by 1 per cent total factor productivity growth decreased by 0.19 per cent. This is because of majority of farmers are not having marketable surplus and therefore influence of market on TFP might have turned out to be negative with less

magnitude. The elasticity coefficient of variable 'credit' was also negative (0.0096%) but significant at 1 per cent level of significance. It indicated that credit is increased by 1 per cent total factor productivity decreased by 0.0096 per cent.

The elasticity coefficient of variable 'average rainfall' was positive (0.31%) and significant at 5 per cent level of significance, which indicated that 1 per cent increase in rainfall total factor productivity growth increased by 0.31 per cent. In Konkan region, the crops grown are mainly rice and ragi. These crops survive well and their production depends on rainfall pattern. Therefore, the influence of rainfall was positive on total factor productivity growth. The elasticity coefficient of variable 'fertilizer' was positive (0.32%) and significant at 1 per cent level of significance. It indicated that if there is 1 per cent increase in fertilizer, total factor productivity growth increased by 0.32 per cent. This is because of as stated earlier rice is dominant crop in Konkan region and rice crop gives good response to nitrogenous fertilizer. Therefore, their influence on total factor productivity growth was positive.

The elasticity coefficient of variable 'net irrigated area' was positive (0.22%) and significant at 5 per cent level of significance. From this, one can concluded that the effect of total factor productivity of that of 'net irrigated area' is at the rate of 0.22 per cent for every one per cent increase in irrigated area. This is because of irrigation development is critical for augmenting productivity, which indicated by positive relationship of net irrigated area with productivity. The growth in total factor productivity lies in augmenting productivity under well irrigation and canal irrigation, because personal decisions of farmers in crop planning and management, holds key role for increasing productivity.

The elasticity coefficient of variable 'tractor' was negative (1.96%) but significant at 1 per cent level of significance. It indicated that, 1 per cent increase number of tractors, total factor productivity growth decreased by 1.96 per cent. This is because of the magnitude of tractor in proportion to net sown area is drastically low and hence the negative influence on total factor productivity growth.

The elasticity coefficient of variable 'power tiller' shows a positive (1.27%) and significant at 1 per cent level of significance indicated that if 1 per cent increase in number of power tiller total factor productivity increased by 1.27 per cent. The factor 'power tiller' has explained, a good deal of variation in total factor productivity growth in Konkan region.

5.24.1.2 Thane district :

For the Thane district, the functional relationship between various factors under study and total factor productivity growth has shown that the value of coefficient of multiple determination (R^2) was 0.78. It indicated that 78 per cent variation in total factor productivity was explained by variable under study.

In Thane district, the identified sources of TFP growth were credit, actual rainfall, fertilizer, forest, power tiller and tractor. The elasticity coefficient of variable 'credit' was positive (0.05%) and significant at 5 per cent level of significance. It indicated that 1 per cent increase in credit total factor productivity increased by 0.05 per cent which is less in magnitude because the lifting of credit is low in Thane district. The elasticity coefficient of variable 'actual rainfall' was positive (0.40%) and significant at 1 per cent level of significance. It indicated that 1 per cent increase in rainfall total factor productivity growth increased by 0.40 per cent. This is because rice is dominant crop in Thane district and these crops survive well and productivity depends on rainfall pattern. Therefore, its effect on total factor productivity was positive.

The elasticity coefficient of variable 'fertilizer' was also positive (0.51%) and significant at 1 per cent level of significance. It indicated that 1 per cent increase in fertilizer, total factor productivity growth increased by 0.51 per cent. As explained earlier, rice is dominant crop in Thane district and rice crop gives good response to nitrogenous fertilizer.

The elasticity coefficient of variable 'forest' was positive (9.03%) and significant at 1 per cent level and it indicated that the effect on total productivity growth of the forest area is at 9.03 per cent at every 1 per cent increase in forest area, because forest cover

is complementary to augmenting TFP because of supply of needed biomass for agriculture, similarly forest maintained congenial climate for occurrence of rainfall.

The elasticity coefficient of variable 'tractor' was negative (1.82) but significant at 1 per cent level of significance. It indicates that if 1 per cent increases in number of tractor, total factor productivity growth decreased by 1.82 per cent. This is because of number of tractor have shown increasing trend but their magnitude in proportion to net sown area is drastically low.

The elasticity coefficient of variable 'power tiller' showed positive (0.99%) and significant result, it indicated that 1 per cent increase in number of power tiller; total factor productivity increased by 0.99 per cent.

5.24.1.3 Raigad district:

For Raigad district, the value of coefficient of determination (R^2) was 0.69, which implied that 69 per cent variation is explained by the factor under study.

In Raigad district, road length, net irrigated area, tractor, power tiller and HYVs are the main sources of TFP growth. The elasticity coefficient variable 'road length' was negative (-3.9%) but significant at 1 per cent level of significance. It indicated that 1 per cent increase in road length, total factor productivity decreased by 3.9 per cent. This is due to road network created in Raigad district might have been used for public transport, mainly it had not added towards increasing TFP in agriculture through resources mobilization and transportation.

The elasticity coefficient variable 'tractor' was negative (0.44%) but significant at 1 per cent level of significance. It indicated that if number of tractors increased in 1 per cent, total factor productivity growth decreased by 0.44 per cent because their magnitude to net sown area is very less, mostly the tractor used for non-agricultural purpose.

The elasticity coefficient of variable 'net irrigated area' was positive (0.87%) and significant at 1 per cent level of significance. It indicated that 1 per cent increase in net irrigated area, total factor productivity growth increased by 0.87 per cent. This is because of irrigation development is critical for augmenting productivity, which indicated by positive relationship of net irrigated area with productivity. The growth in total factor productivity lies in augmenting productivity under well irrigation and canal irrigation because private decisions of farmers in crop planning and management holds key role for increasing productivity. Therefore, the contribution of irrigation towards increasing crop productivity is well recognized.

The elasticity coefficient of variable 'power tiller' was positive (0.33%) and significant at 1 per cent level of significance. It indicated that if number of power tillers increased by 1 per cent increase in total factor productivity growth by 0.33 per cent. The elasticity coefficient of variable 'HYVs area' was positive (2.9%) and significant at 1 per cent level of significance. It indicated that 1 per cent increase in HYVs area, total factor productivity increased by 1.3 per cent.

From the above discussion, one can conclude that in Raigad district, among all the identified sources, the power tiller (1.96%) and HYVs area (1.3%) are the major sources of total factor productivity growth.

5.24.1.4 Ratnagiri district :

As regard to Ratnagiri district, the coefficient of determination (R^2) was 0.40, it indicated that 40 per cent variation in total factor productivity was explained by the factor under study.

In Ratnagiri district, forest factor and power tiller are the identified sources of total factor productivity growth. The elasticity coefficient of variable 'forest' was negative (1.26%) but significant at 1 per cent level of significance. It indicated that if forest area increased by 1 per cent, total factor productivity decreased by 1.26 per cent. This is because in Ratnagiri district having uneven

topography as a result there is diversion in use of land for the purposes other than crop production in agriculture. Therefore, it results negative influence on total factor productivity growth.

The elasticity coefficient of variable 'tractor' was negative (3.8%) but significant at 5 per cent level of significance. It indicated that if 1 per cent increases in number of tractor, total factor productivity decreased by 3.18 per cent. This is due to firstly the proportion of number of tractor to net area sown was less. Secondly, tractor use mostly for non-agriculture purpose and therefore its negative influence in total factor productivity growth.

The elasticity coefficient of variable 'power tiller' was negative (0.95%) but significant at 1 per cent level of significance. It indicated that 1 per cent increase in number of power tiller, total factor productivity decreased by 0.95 per cent.

5.24.1.5 Sindhudurg district:

For Sindhudurg district, the value of coefficient of determination was 0.70. It indicated that 70 per cent variation in total factor productivity growth is explained by identified factor under study.

In Sindhudurg district, credit, nitrogenous fertilizer, net irrigated area, forest, tractor and power tiller are the major sources of total factor productivity growth.

The elasticity coefficient of variation 'credit' was positive (0.053%) and significant at 5 per cent level of significance indicated that 1 per cent increase in credit, total factor productivity growth increased by 0.053 per cent. As in case of other districts, in Sindhudurg district also there is not greater use of credit and therefore less magnitude of coefficient. The elasticity coefficient of variable 'fertilizer' showed a negative (6.00%) but significant at 1 per cent level of significance. It indicated that consumption of fertilizer increased by 1 per cent, total factor productivity decreased by 6 per cent. This is due to the crop average in Sindhudurg district is dominated by horticultural crops and more over the negative influence of nitrogen fertilizers only was observed. This district receives very high rainfall and hence leaching of nitrogenous fertilizers applied to field crops, which resulted into negative influence of total factor productivity growth.

The elasticity coefficient of variable 'net irrigated area' was positive (1.86%) and significant at 1 per cent level of significance. It indicated that increased in net irrigated area by 1 per cent, total factor productivity increased by 1.86 per cent. This is because of irrigation development is critical for augmenting productivity, which indicated by positive relationship of net irrigated area with productivity. The growth in total factor productivity lies in augmenting productivity under well irrigation and canal irrigation because private decisions of farmers in crop planning and management holds key role for increasing productivity.

The elasticity coefficient of variable 'forest' was negative (0.37%) and significant at 5 per cent level of significance. It indicated that if forest area increased by 1 per cent, total factor productivity growth decreased by 0.37 per cent. The elasticity coefficient of variable 'tractor' was negative (0.25%) and significant at 1 per cent level of significance. It indicated that increase in number of tractor by 1 per cent, total factor productivity growth decreased by 0.25 per cent. This is because, number of tractor have shown increasing trend but their magnitude in proportion to net sown area is drastically low and hence the influence of tractor on total factor productivity was negative.

The elasticity coefficient of variable 'power tiller' was negative (0.21%) but significant at 1 per cent level of significance. It indicated that increase in number of power tiller by 1 per cent, total factor productivity increased by 0.21 per cent.

5.24.2 Sources of total factor productivity growth

As stated earlier, in Methodology the standardized regression coefficient are used to estimate the per cent contribution of individual variable in total factor productivity growth. The per cent contribution of individual variable in total factor productivity growth was estimated and results are given in Table 5.24(b).

5.24.2.1 Konkan region

It is observed from the table that, in Konkan region market, credit, actual rainfall, fertilizer (N), net irrigated area, tractor and power tiller are the major sources of total factor productivity growth. Among these

Sources, the contribution of variable market (0.29%), credit (0.17%), tractor (50.18%) was negative in total factor productivity growth. However, the contribution of variable ‘actual rainfall’ (0.07%), ‘fertilizer’ (0.27%), ‘net irrigated area’ (0.22%) and ‘power tiller’ (48.78%) was positive in total factor productivity growth. From the above discussion, one can say that among the positive contributed variables, of variable ‘power tiller’ was higher among the other variable.

Table 5.24 (b). Sources of TFP growth

District / Variables	Annual growth rate (%)	Elasticity of TFP	Per cent share of TFP growth explained
Thane			
Credit	2.9	0.05	0.28
Actual Rainfall	0.95	0.49	0.29
Fertilizer (N)	6.6	0.92	1.00
Forest	0.6	4.43	7.03
Tractor	19.35	-5.5	36.60
Power tiller	13.65	6.8	54.76
Raigad			
Road length	0.15	-0.96	7.39
Net irrigated area	0.87	0.58	2.66
Tractor	30.30	-2.4	35.50
Power tiller	14.50	1.91	30.41
HYVs	1.08	1.3	14.04
Ratnagiri			
Forest	3.10	-1.36	20.98
Tractor	15.20	-1.50	25.41
Power tiller	19.70	-2.18	53.62
Sindhudurg			
Credit	16.02	0.50	1.90

Fertilizer (N)	5.94	-1.98	26.41
Net irrigated area	7.30	0.94	6.63
Forest	0.85	-0.49	1.80
Tractor	8.9	-1.66	20.61
Power tiller	21.0	2.40	42.65
Konkan region			
Market	8.31	-1.08	0.29
Credit	7.8	-0.82	0.17
Actual Rainfall	0.82	0.53	0.07
Fertilizer (N)	5.32	1.04	0.27
Net irrigated area	4.19	0.95	0.22
Tractor	27.38	14.21	50.18
Power tiller	6.18	14.01	48.78

The district wise sources of total factor productivity growth and contribution of individual's variable are discussed below:

5.24.2.2 Thane district:

In Thane district, the variable credit, actual rainfall, fertilizer (N), forest, tractor and power tiller are the major sources of total factor productivity growth. Among these sources the contribution of variable tractor (36.60%) was negative while the contribution of variable actual rainfall (0.29%), fertilizer (1.0%), forest (0.73%) and power tiller (54.76%) was positive in total factor productivity growth.

5.24.2.3 Raigad district:

As regards to Raigad district, the variable road length, net irrigated area, tractor, power tiller and high yielding varieties area, are the major sources of total factor productivity growth. Among these sources, the contribution of variable road length (7.39%) and tractor (45.50%) was negative in total factor productivity growth. However, the contribution of variable, net irrigated area (2.66%), power tiller (30.00%) and high yielding variety area (14.04%) was positive in total factor productivity growth.

5.24.2.4 Ratnagiri district:

In Ratnagiri district, the variable forest, tractor and power tiller are the major sources of total factor productivity growth. It is surprising to note that the contribution of variable forest (20.98%), tractor (25.41%) and power tiller (53.62%) was negative in total factor productivity growth.

5.24.2.5 Sindhudurg district:

In Sindhudurg district, the variable credit, fertilizer (N), net irrigated area, forest, tractor and power tiller are the major sources of total factor productivity growth. Among all the sources, the contribution of fertilizer (26.41%), forest (1.80%), tractor (20.61%) was negative in total factor productivity growth. However, the contribution of variable credit (1.90%), net irrigated area (6.63%) and power tiller (62.65%) was positive in total factor productivity growth.

Considering the very low magnitude of total factor productivity growth and the determinants identified, it is visualized that the urgent attention is required from agricultural scientists, extension personals for improving input output productivity relations in case of cereal crops of this region in particular and different pockets of the region.

CHAPTER VI

SUMMARY AND CONCLUSIONS

The total factor productivity of crop sector has now started showing sign of decline at a few places and stagnation at many places in the region. Under this backdrop the present study has been planned to analyze the performance of agriculture in Konkan region by measuring TFP indices at district levels.

For this analysis secondary data were collected from various Government publications to study trends in parameters of agricultural development and their contribution towards total factor productivity in agriculture in each district and Konkan region as a whole. For the period from 1980-81 to 1999-2000. The analysis was done with the help of growth rates, composite index of development and growth in factor productivity in agriculture. This was supported by total factor productivity decomposition.

In Konkan region, during 1980-2000, the area under forest was decreased by 0.53 per cent. However, in Thane, Raigad and Ratnagiri district forest area was decreased by 0.6, 0.8 and 3.9 per cent, respectively whereas only in Sindhudurg district it was increased by 0.8 per cent, except Sindhudurg district, the decrease in area under forest in other districts which was not a good sign for agricultural development in Konkan region.

In Konkan region, the growth rate of land under barren and culturable waste was decreased by 1.3 per cent. In Raigad district the growth rate area under this category was non-significant. However, in Thane, Raigad and Sindhudurg district it was decreased over study period by 4.7, 2.05 and 0.5 per cent, respectively. The growth rate of land under non-agricultural uses, in Konkan region along with three districts Thane, Raigad and Ratnagiri was increased by 1.4, 1.9, 0.7

and 5.1 per cent, respectively. However Sindhudurg district showed positive but non-significant result. In Raigad district the growth rate of land under culturable waste was increased by 0.7 per cent. In Thane, Ratnagiri and Sindhudurg district, the growth rate of area under culturable waste was decreased by 5.8, 9.7 and 4.4 per cent, respectively, in Konkan region also showed decreased in growth under culturable waste by 2.1 per cent. The growth rate of area under permanent pasture was decreased in Konkan region by 1.2 per cent as well as in Thane district, decreased by 3.9 per cent. Only in Ratnagiri district, area under permanent pasture was increased by 1.4 per cent. However, in Raigad and Sindhudurg districts showed non-significant result under this category.

The growth rate of land under miscellaneous trees and grooves in Konkan region was increased by 4.5 per cent. However, in Thane and Sindhudurg, it was increased by 9.0 and 3.9 per cent, whereas Raigad district showed non-significant result. In Ratnagiri district, the growth rate in area under this category was decreased by 1.5 per cent.

In Konkan region, the growth rate of current fallows was increased by 4.2 per cent. However, in Thane district growth rate in area under current fallow was decreased by 5.1 per cent, whereas in Ratnagiri district showed a non-significant result. In Raigad and Sindhudurg district showed increasing area under current follow by 0.2 and 20.05 per cent, respectively. The growth rate of area under other fallows in Konkan region was negative and non-significant. In Thane district showed decrease in area under other fallow by 4.6 per cent. In Ratnagiri and Raigad showed a non-significant result, whereas in Sindhudurg district, the area under other fallow was increased by 2.4 per cent.

In Konkan region, the growth rate in area under net sown was increased by 1 per cent in Konkan region. Increase in area under net sown in Thane, Raigad, Ratnagiri and Sindhudurg district was 2.4, 9.2, 1.8 and 0.8 per cent,

respectively. The growth rate of total cropped area was increased in Konkan region by 1 per cent. In Thane and Sindhudurg district area under total cropped was increased by 2.5 and 1.15 per cent, respectively, whereas in Raigad and Ratnagiri showed non-significant results.

In Konkan region, the area under rice was decreased by 0.20 per cent whereas the production and productivity of rice was increased by 1.5 per cent and 1.9 per cent. In Thane and Raigad district the growth in area under rice was decreased by 0.16 per cent and 0.6 per cent, respectively. However, the production and productivity was increased for both the districts. It is interestingly to note that in Ratnagiri district growth rate of rice area was (-0.007) negative and non-significant but increase in production (2.1%) and productivity (2.5%) due to the technological impact of variables like fertilizer and climatic factor, Sindhudurg district increasing area, production and productivity of rice crop through out the study period.

During 1980-2000, in Konkan region, the growth rate in area under total cereals was (-0.16) negative and non-significant but the production and productivity was increased by 1.1 per cent and 1.9 per cent, respectively. In Thane district, the growth in area total cereals was negative (-0.08%) and non-significant, also the growth in production and productivity was found to be non-significant result for this district. In Raigad and Ratnagiri districts, the growth rate of area under total cereals was decreased by 1.02, 1.7 per cent, respectively. Whereas, in Sindhudurg district it was negative and non-significant. In case of the growth in production of total cereals was increased by 0.74, 1.2 and 2.3 per cent, respectively for Raigad, Ratnagiri and Sindhudurg districts. Similarly, increase in productivity growth was 1.78 per cent, 2.8 per cent and 2.9 per cent, respectively.

The growth rate of area under pulses was non-significant but the production and productivity was increased by 3.5 per cent 4.4 per cent in Konkan region. However, the growth rate of area under total pulses was non-significant in Thane, Raigad, Ratnagiri and Sindhudurg district. As concerned to growth in production of total pulses Thane district was highest in growth (7.1%), followed by Ratnagiri (3.8%), Sindhudurg (3.5%) and Raigad (2.3%). The growth in productivity of total pulses was increased in Thane, Ratnagiri and Sindhudurg district by 4.4, 5.7 and 4.1 per cent, respectively whereas, only in Raigad district decreased in growth by 0.13 per cent.

In Konkan region, the growth rate of area under total food grain was decreased by 0.7 per cent. However the production was decreased by 9.2 per cent but increasing productivity by 1.9 per cent. In Thane and Sindhudurg district the growth in area under total food grain was negative and non-significant whereas growth in production was increased by 1.3 per cent and 2.5 per cent for both the district, respectively whereas the growth in productivity for both the districts was increased by 1.0 and 2.8 per cent. However, in Raigad and Ratnagiri district showed decreased in area under total food grain by 4.1 per cent and 2.8 per cent. The growth in production and productivity in Raigad district was increased by 0.77 and 1.86 per cent, whereas in Ratnagiri district decreased in production and productivity of total food grain by 5.8 and 1.8 per cent, respectively.

During 1980-2000, in Konkan region, the area under total oilseed was non-significant and production and productivity was increased by 5.6 and 6.4 per cent. In Thane, Raigad and Ratnagiri district area under total oil seed showed a non-significant result. Only in Sindhudurg district it was increased by 2.3 per cent. In production of total oil

seed the significant growth was observed in Sindhudurg district where as in Raigad and Ratnagiri decrease in production of total oil seed. Similar result was found in case of productivity of Total oil seed.

In Konkan region 1980-2000, the growth rate of total fertilizer consumption was increased by 4.9 per cent. In Thane Raigad, Ratnagiri and Sindhudurg it was increased by 5.8 per cent, 4.3 per cent 3.4 per cent and 5.4 per cent, respectively.

In Konkan region, the growth rate of net irrigated and gross irrigated area was 4.19 per cent and 4.23 per cent. Among the district level, except Ratnagiri district the net irrigated and gross irrigated area was increased significantly. It showed non-significant result in Ratnagiri district. In Konkan region as well as among the four district of Konkan region wage rate was increased over a study period (1980-2000). In Konkan region area under HYV was increased by 2.4 per cent. In Sindhudurg district area under (HYVs) was (5.2%) higher growth rate followed by Ratnagiri (3.7), Thane (2.1%) and Raigad (1.08%).

During 1980-81, the level of development in Sindhudurg district was (69.18%) highest and ranks first followed by Ratnagiri (61.0%) ranks second, Thane (48.56%) ranks third and Raigad (28.9%) ranks fourth. During 1990-91 the level of development of Ratnagiri and Sindhudurug district was change, Ratnagiri district was highest level of development (66.36%) and ranks first while Sindhudurg district (64.43%) and ranks second. During same period Thane (48.00%) and Raigad (48.83%) was on the same level of development to that 1980-81. In last of study period (1990-2000), Ratnagiri was highest level of development (67.72%) with ranks first followed by Sindhudurg (52.70%) ranks second, Raigad (48.00%)

ranks third and Thane (46.34%), ranks fourth. During this decade the level of development was changed in between Thane and Raigad district to that of 1990-91.

In Konkan region during 1980-90 (decade I), the growth in input index was (0.912%), high as compared to growth in output index (0.883%) as a result negative total factor productivity growth (-0.02%) during 1990-2000 (decade II), the growth in total input index was less (0.997%) than growth in total output index (1.006%) which turned out to be positive (0.009%) total factor productivity growth. At the entire period (1980-2000) the growth in total input index and total output index was 0.95 and 0.94 per cent per annum. While growth in total factor productivity index was (-0.0082%) negative.

In Thane district during 1980-90 the growth in input index was less (0.912%) than output index (0.933%). The growth in both input and output index was resulted into less (0.02%) total factor productivity growth. During 1990-2000, there was increase in total input index (0.996%) and total output index (1.012%) over the period and increasing trend was again more or less same. Therefore, total factor productivity has turned out to be (0.016%) meager. Therefore, for the entire period, the growth in total input index, total output index, total factor productivity index was 0.954, 0.973, 0.02 per cent per annum, respectively.

As regard to Raigad district during first decade (1980-90) the growth in total input index was 0.896 per cent per annum and output growth 0.934 per cent per annum. The growth in total factor productivity index was 0.038 per cent per annum. During 1990-2000 the growth in input index was (1.01%) higher as compared to total output index (0.99%) which turned out to be negative (-0.02%) total factor productivity growth. No doubt, the growth in total output index, total

input index was higher in second decade than first. For the entire period, the growth in total input index and total output index was 0.954 and 0.963 per cent per annum which was more or less same and therefore the growth in total factor productivity index has turned out to be very very low (0.008%).

During 1980-90, Ratnagiri district the growth in output index was 0.96 per cent per annum, whereas growth in total input index was 0.901 per cent per annum, consequently the positive growth in total factor productivity index to the tune of 0.05 per cent per annum. While during 1990-2000 the growth rate in total input index and total output index were 1.00 and 1.005 per cent per annum, which was more or less similar. Therefore, growth in total factor productivity index has turned out to be very very negligible (0.005%). With regards to growth rate of entire period (1980-2000) the growth in output index was higher (0.983%) to that of input index (0.950%), therefore growth in total factor productivity index was turned out to be 0.03 per cent per annum.

In Sindhudurg district during 1980-90 (first decade) the growth in total input index was (0.98%) slightly higher than that of growth in output index (0.96%) which turned to be negative (-0.02%) total factor productivity growth. During next decade (1990-2000) there was slightly decline (0.971) in total input index while slightly increase in total output index (0.975) showing negligible (0.0047%) growth in total factor productivity. The result for Sindhudurg district for entire period have shown similar growth rate in total input index (0.976%) and total output index (0.968%) resulting into almost negligible growth in total factor productivity (-0.007%).

The influence of identified variables on productivity of crops in four districts and entire Konkan region was estimated using log linear regression. For calculation of per cent contribution of significant variables contributing Total

Factor Productivity Growth (TFPG) by "Standardized regression" was carried out and the standardized coefficient are unitless and only used to estimate per cent contribution of individual variable in total factor productivity growth.

For Konkan region the value of coefficient of determination was 0.67 which indicated that 67 per cent variation in total factor productivity growth (TFPG) was explained by the factor under study. In Konkan region significant sources of TFP growth were market, credit, actual rainfall, fertilizer, net irrigated area, tractor and power tiller. The elasticity coefficients of these variables were 'market' (-0.19%), credit (-0.0096%), rainfall (0.31%), fertilizer (0.32%), net irrigated area (0.22%), tractor (1.96%), power tiller (1.27%). The contribution of these variables was 0.29, 0.17, 0.07, 0.27, 0.22, 50.18 and 48.78 per cent, respectively.

For the Thane district the functional relationship between various factors under study and total factor productivity growth has shown that the value of coefficient of multiple determination (R^2) was 0.78. It indicated that 78 per cent variation in total factor productivity was explained by variable under study. In Thane district the identified sources of TFP growth was credit (0.05%), actual rainfall (0.40%), fertilizer (0.51%), forest (9.03%), tractor (-1.82) and power tiller (0.99). The contribution of these variables in total factor productivity growth was 0.28, 0.29, 1, 7.03, 36.7 and 54.76 per cent, respectively.

For Raigad district the value of coefficient of determination (R^2) was 0.69 which implied that 69 per cent variation was explained by the factor under study. In Raigad district, significant sources of total factor productivity growth were road length (-3.9%), net irrigated area (0.87%), tractor (-0.44%), power tiller (0.44%) and high yielding variety (2.9%). The contribution of above variables in total factor productivity growth was 7.39, 2.66, 35.50, 30.41, 14.04 per cent, respectively.

As regard to Ratnagiri district, the coefficient of determination (R^2) was 0.40, it indicated that 40 per cent variation in total factor productivity was explained by the factor under study. In Ratnagiri district, forest (-1.26%), tractor (1.81) and power tiller (-0.95%) are the identified sources of total factor productivity growth. The contribution of these variables in total factor productivity growth was 20.98, 25.41 and 53.62 per cent, respectively.

For Sindhudurg district, the value of coefficient of determination was 0.70. It indicated that 70 per cent variation in total factor productivity growth was explained by identified factor under study. In Sindhudurg district, credit (0.053%), nitrogenous fertilizer (-6%), net irrigated area (1.86%), forest (-0.37%), tractor (-0.25%) and power tiller (0.21%). The contribution of these variables in total factor productivity growth was 1.90, 26.41, 6.63, 1.80, 20.61 and 42.62 per cent, respectively.

Conclusions :

Based on results and discussion of the entire study, following broad conclusions are drawn :

1. Among the four districts of Konkan region, decadal increase in population *viz.*, 1981 to 1991 and 1991-2000 was highest in Thane district (56.59% and 54.52%) followed by Raigad, Ratnagiri and Sindhudurg district. This increase in population in Thane district may be due to migration of people to this district for search of employment in nearby Mumbai metropolitan region.
2. It is broadly concluded from land utilization pattern that in Konkan region, the area under forest, barren, unculturable land and area under other fallows decreased during study period. This could be one of the reason for

increasing net sown area in Konkan region; mainly, to horticultural plantation under EGS on the lands diverted from categories mentioned earlier.

3. There was structural changes in land utilization pattern with positive growth rates of area under non-agricultural use, land under miscellaneous trees and grooves, net sown area and area sown more than once.
4. Rice is predominant crop for Konkan region but its area was decreased continuously by 0.20 per cent over the study period. In case of total cereals, total pulses and total oilseed, the growth in area of this crop was non-significant. However, the area under total foodgrain was decreased continuously which needed urgent attention.
5. The growth in production and productivity of rice crop was increased by 1.5 and 1.9 per cent. The growth in total cereals and total pulses was also increased over the study period. However, the growth for rice and pulses was low.
6. The growth in consumption of nitrogenous fertilizers was increased at the rate of 4.17 to 6.60 per cent which was higher as compared to phosphatic (0.2 to 6.06%) and potassic fertilizer (0.8 to 3.4%). However, the consumption of total NPK was increased in (3.4 to 5.8%) in Konkan region.
7. In Konkan region, the growth rate of average wages paid to male (Rs. 2 to 3.10) and female (Rs. 1.5 to 2.9) field labour was more than average wages paid to other agricultural labours male (Rs. 1.89 to 2.40) and female (1.40 to 1.90).
8. There was increase in area under HYV rice at the rate of 1.2 to 2.3 per cent in Konkan region
9. There was increase in area under gross irrigated (1.2 to 9.98%) and net irrigated area (0.87 to 9.7%) in Konkan region.

10. The agricultural development studied through composite index revealed that the level of development was maximum in Ratnagiri district (87.72%) followed by Sindhudurg district (52.70%), Raigad district (48.00%) and Thane district (46.34%) in the year 1999-2000.
11. In Konkan region, for the entire period (1980-2000) the growth in TII and TOI was 0.95 and 0.94 per cent per annum. Therefore, growth in TFPI was negative (-0.0082). During first decade TFP growth was negative (-0.02). However, in second decade the growth in TFPI was positive (0.008) but very low.
12. In Thane district, for entire period (1980-2000), the growth in TII and TOI was 0.954 to 0.973 per cent per annum, hence TFP growth was positive (0.02%). During 1980-90 to 1990-2000, the TFP growth was decreased marginally from 0.02 to 0.016 per cent per annum.
13. In case of Raigad district, the growth in TII, TOI was 0.0954 and 0.963 per cent per annum, which resulted into positive growth in TFP (0.008). For the period of 1980-90 to 1990-2000, the growth in TFP was decreased substantially from 0.038 per cent to -0.02 (negative) per cent per annum. This needed quite attention towards improving agricultural productivity.
14. As regard to Ratnagiri district, the growth in TII, TOI was 0.0950 and 0.983 per cent per annum and therefore, the TFP growth was positive (0.03%). During 1980-90 to 1990-2000, the TFP growth was decreased drastically from 0.05 to 0.005 per cent per annum.

15. In Sindhudurg district, the growth in TII and TOI was 0.976 and 0.968, respectively which resulted into negative TFP growth (-0.007%). During the period 1980-90 (First decade) the growth in TFP was negative (-0.02) where as during next decade (1990-2000) it was slightly increased (0.0047%). Though there was increase in TFP growth, the addition was low.

Policy implications :

1. The consumption of nitrogenous fertilizer was higher than phosphatic and potassic fertilizer in Konkan region. So there is need for balance application of fertilizers to different crops as per recommended levels.
2. There was declining area under rice, food grain and total pulses. There is need for checking use of land extensively for non-agricultural purposes as it was revealed from the land utilization statistics. This calls for proper monitoring on the use of land to safe-guard food security in Konkan region.
3. Large proportion of area under barren and unculturable land was decreasing in Konkan region. This is the positive sign for development of agriculture. Moreover, this area is being brought under horticultural plantation under EGS on a massive scale. Consequently, it will help to check migration of people to cities to some extent and create employment opportunities in rural area of this region.
4. Credit flow in the region is increasing at slow rate and hence credit policy in the region be re-oriented on the line of national credit policy launched by Ministry of Agriculture, Government of India, recently. It will enhance credit supply to augment input use to increase agricultural productivity of different crops.

5. Total factor productivity growth : The TFP growth in overall Konkan region was negligible. This implies that over a period of time there were no development in Konkan region in agriculture. However, the real picture of Konkan region showed that the agriculture sector in Konkan region is developing day by day. This is mainly because of horticultural development to press in the region. Due to unavailability of data on horticultural sector, only food grain crops were considered for estimating TFP growth in agriculture. Generally in Konkan region, the food grain crop are non-remunerative.

   The increasing growth rate in output is to be obtained in future. The productivity of all inputs together will have to be increased by emboding technologies or package of practices.

6. The different technologies for use of different input will have to be disseminated properly to the farmers, it is therefore suggested (a) to enhance the use of hybrid rice seed and increased area under yield yielding varieties which is only 2.1 to 5.2 per cent at present. (b) Secondly, the use of not only recommended doses of fertilizer but also the improved fertilizer application method i.e. newly introduced fertilized application method of urea brickets will have to be popularized. (c) Cultivation practices – line planting, maintain plant population more specifically to the fullest extent possible. (d) Proper irrigation and drainage to the field.

Table 5.14. Growth in population

(Population in lakh)

Year	Thane	Raigad	Ratnagiri	Sindhudurg	Konkan region

	Population	Per cent increase or decrease during previous decade	Population	Per cent increase or decrease during previous decade	Population	Per cent increase or decrease during previous decade	Population	Per cent increase or decrease during previous decade	Population	Per cent increase or decrease during previous decade
1981	**33.51**	**--**	**14.86**	**--**	**13.79**	**--**	**7.80**	**--**	**69.98**	**--**
1991	**52.60**	**56.59**	**18.24**	**22.81**	**15.44**	**11.19**	**8.30**	**6.41**	**94.55**	**35.15**
2001	**81.28**	**54.52**	**22.05**	**20.88**	**16.96**	**10.98**	**8.61**	**3.73**	**128.92**	**36.35**

Table 5.16. Growth rates of area, production and productivity for Konkan region (1980-2000)

Crops	District	Thane		Raigad		Ratnagiri		Sin
		Linear growth rate	Compound growth rate (%)	Linear growth rate	Compound growth rate (%)	Linear growth rate	Compound growth rate (%)	Linear growth rate
Rice	**Area**	**-2.4****	**-0.16****	**-8.85***	**-0.6***	**0.10^{NS}**	**0.007^{NS}**	**2.77***
	Production	**27.41^{NS}**	**0.94^{NS}**	**30.89***	**1.02***	**35.19***	**2.1***	**46.23***
	Productivity	**21.43*****	**1.1*****	**36.61***	**1.73***	**50.32***	**2.5***	**52.14***
Total cereals	**Area**	**-1.52^{NS}**	**-0.08^{NS}**	**-17.13***	**-1.02***	**-22.67***	**-1.7***	**-3.17^{NS}**
	Production	**26.25^{NS}**	**0.84^{NS}**	**23.99****	**0.74****	**24.88****	**1.2****	**39.16***
	Productivity	**16.04^{NS}**	**0.93^{NS}**	**34.44***	**1.78***	**47.37***	**2.8***	**55.56***
Total pulses	**Area**	**0.60^{NS}**	**0.01^{NS}**	**2.31^{NS}**	**1.3^{NS}**	**0.27^{NS}**	**0.43^{NS}**	**1.09^{NS}**
	Production	**13.05***	**7.1***	**1.25***	**2.3***	**0.62****	**3.8****	**0.69***
	Productivity	**18.46***	**4.4***	**-15.42***	**-0.13***	**17.33***	**5.17***	**13.65***
Total food grain	**Area**	**0.038^{NS}**	**0.001^{NS}**	**-19.41***	**4.1***	**-24.08***	**-2.8***	**0.99^{NS}**
	Production	**42.51****	**1.3****	**25.36****	**0.77****	**-9.5***	**-5.8***	**41.77***
	Productivity	**16.76****	**1.0****	**33.66***	**1.86***	**-45.97***	**-1.8***	**51.75***
Total oil seed	**Area**	**0.04^{NS}**	**0.25^{NS}**	**0.78^{NS}**	**2.2^{NS}**	**3.71^{NS}**	**0.60^{NS}**	**2.3***
	Production	**0.40****	**3.2****	**-0.14****	**-0.5****	**-0.83***	**-3.10***	**5.6***
	Productivity	**8.11***	**2.4***	**-0.25***	**-1.3***	**-8.15***	**-0.80***	**82.17***

Note – **In linear Growth rate Area in '00' ha, Production in '00' MT and Productivity in kg/ha,**

NS – Non-significant, * - Significant at 1% level, ** - Significant at 5% level, * - Significant at 10% level.**

Table 5.22. Composite index, ranks and level of development of respective districts

Years	1980-81	1990-91	1999-2000	Per cent change

										over 1980	
	Composite index	Rank	Level of development (%)	Composite index	Rank	Level of development (%)	Composite index	Rank	Level of development (%)	1990-1991	1999-2000
Thane	**0.5144 (51.44)**	**3**	**48.56**	**0.5200 (52.00)**	**3**	**48.00**	**0.5366 (53.66)**	**4**	**46.34**	**1.08**	**4.31**
Raigad	**0.7110 (71.10)**	**4**	**28.90**	**0.5817 (58.17)**	**4**	**41.83**	**0.5201 (52.01)**	**3**	**48.00**	**-19.19**	**-26.85**
Ratnagiri	**0.3900 (39.00)**	**2**	**61.00**	**0.3364 (33.64)**	**1**	**66.36**	**0.3228 (32.28)**	**1**	**67.72**	**-13.75**	**-17.24**
Sindhudurg	**0.3082 (30.82)**	**1**	**69.18**	**0.3557 (35.57)**	**2**	**64.43**	**0.4783 (47.82)**	**2**	**52.17**	**15.41**	**15.19**