"AN ECONOMIC APPRAISAL OF ARGICULTURAL DEVELOPMENT OF KOLHAPUR DISTRICT IN MAHARASHTRA"

A thesis submitted to the

Mahatma Phule Krishi Vidyapeeth, Rahuri- 413 722
Dist. Ahmednagar, Maharashtra State, India

By

Mr. NARENDR KUMAR MEENA

(Reg. No. 13/323)

in partial fulfillment of the requirements for the degree

of

MASTER OF SCIENCE (Agriculture)

In

AGRICULTURAL ECONOMICS

AGRICULTURAL ECONOMICS SECTION
COLLEGE OF AGRICULTURE,
KOLHAPUR-416004
MAHARASHTRA (INDIA)
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MAHARASHTRA (INDIA)

2015

CANDIDATE'S DECLARATION

I hereby declare that this thesis or part thereof has not been submitted by me or any other person to any other University or Institute for Degree or Diploma

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Date : /0/2015

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C E R T I F I C A T E

This is to certify that the thesis entitled, **"AN ECONOMIC APPRAISAL OF AGRICULTURAL DEVELOPMENT OF KOLHAPUR DISTRICT IN MAHARASHTRA"** submitted to the Faculty of Agriculture, College of Agriculture, Kolhapur, Mahatma Phule Krishi Vidyapeeth, Rahuri, Dist. Ahmednagar, Maharashtra State, India in partial fulfillment of the requirements for the degree of **MASTER OF SCIENCE (AGRICULTURE)** in **AGRICULTURAL ECONOMICS**, embodies the results of a piece of *bonafide* research work carried out by **Mr. NARENDR KUMAR MEENA** under my guidance and supervision and that no part of this thesis has been submitted for any other degree or diploma in any other.

Place : Kolhapur **(B. B. Gawade)**

Date : / /2015 Chairman and Research Guide

Dr. G. G. Khot,
Associate Dean,
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Place : Kolhapur **(G. G. Khot)**

Date : /0 /2015 Associate Dean

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Place: Kolhapur
Date : /0 /2015 (**N. K. Meena**)

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ABSTRACT

"AN ECONOMIC APPRAISAL OF AGRICULTURAL DEVELOPMENT OF KOLHAPUR DISTRICT IN MAHARASHTRA"

by

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A Candidate for the degree

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MASTER OF SCIENCE (AGRICULTURE)

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2015

Research Guide : **Prof. B. B. Gawade**

Department : **Agricultural Economics**

An attempt was made in this investigation to evaluate the process of agricultural development by way of studying the changes in the land use and cropping pattern, growth rates in area, production and productivity of major crops and to identify infrastructure facilities, factors influencing agricultural production and SWOT analysis during the period from 1980-81 to 2011-12 in Kolhapur district of Maharashtra. The time series data covering the above period relating to the aspects of other study were collected from relevant sources.

The data were analysed by adopting suitable analytical tools to arrive at the following results.

The area under forest had declined by 4.22 per cent during the period under study in Kolhapur district. The area under barren and uncultivable land, cultivable waste, current

fallow, and other fallow declined over a period under study. While land under non agricultural use, permanent pastures, miscellaneous trees, net sown area, area under irrigation, area sown more than once, and gross cropped area Land under non-agriculture use is increasing steadily. The irrigated area increased by 79.77 per cent during the study period, which is an important achievement in the district.

The area under wheat, bajra, gram, red gram declined. The area under rice, kharif jowar, Rabi jowar, green gram, black gram, fruits and vegetables, soybean sugarcane, and groundnut was increased while area under total cereal, and total pulse was declined. The area under total oilseeds showed increasing trend over the study period in Kolhapur district.

The average productivity of total cereal, total pulses, total oilseeds and total foodrains increased 66.22, 8.68, 76.64 and 58.67 per cent in 2011-12 respectively over the base year 1980-81. The productivity of sugarcane, soybean and groundnut also increased considerably by 10.79, 154.40, and 45.87 per cent respectively. during the span of last 32 years in Kolhapur district. The consumption of fertilizers (NPK) is also increased.

The agriculture in Kolhapur district showed significant increase in the use of iron-plough, tractors and electric motors indicating there by large partial mechanization. The population of cattle and poultry declined during the study

period while, the population of total livestock, buffaloes, sheeps and goats showed increasing trend.

The multiple linear regression analysis indicated that the factors *viz.* percentage of gross irrigated area to gross sown area *(X_1),* consumption of total fertilizer (NPK) per ha of gross irrigated area *(X_2),* Percentage of area of high yielding variety seeds to gross sown area (X_4), percentage of area under commercial crops to gross sown area (X_5), amount of loan (Short and Medium term) disbursed through KDCCB per year in Lakh of rupess (X_6), Number of milch animals (X_9), have showed their importance in the process of agricultural development in Kolhapur District.

Strengths of Kolhapur district are assured rainfall, Co-operative network, well drained soils. Weakness are heavy soil erosion, interrupted power supply, mono cropping. And Opportunities are scope for increasing cropping intensity, Scope for diverting towards cash crops, scope for increasing area under vegetables. Threats are decrease in crop area, limitation for promoting micro-irrigation & processing, soil health problem due to mono cropping.

The important policy implications made on the basis of the present investigations are maintaining forest area, expansion and proper use of irrigation facility.

1. INTRODUCTION

General

"Imagine the world without an Agriculture". Indian economy is known as agricultural economy. Agriculture is the main occupation in developing countries like India. The development of agricultural sector determines growth of other sectors of the economy. Agriculture is not merely an occupation but way of life, which for centuries has shaped the thoughts and outlooks of many millions of people. Among the whole world Indian economy ranks fourth position, it indicates importance of agriculture.

Five year plans started since 1950-51 for the rapid development of country, but by knowing the importance of agriculture planners gave top priority for agriculture sector and paid attention purposively in each plan towards agricultural development. The scenario of Indian agriculture has been changed after mid sixties as a result of green revolution. Dr. M. S. Swaminathan introduced green revolution in our country and has generated a climate of confidence in our agricultural capabilities and very first time Agriculture came at top level of importance. Due to the green revolution country became self sufficient and it has given to general economic development through its forward and backward linkages.

Though the share of agriculture in Indian economy is decreasing but not the population dependent on it. The problem of 121.70 crores peoples hunger, the problem of

employment, India's social problems, development of India's 6 lakh villages and therefore development of country etc. Problems can be solved through agriculture. The land is the fixed and limiting factor of production. Therefore it is necessary to increase production by adopting new improved technologies. But still due to regional imbalances we are not fully utilizing natural and human economic resources.

1.1 Agricultural Development

The development of agriculture is a process through which the shift takes place from stage of traditional agriculture to the stage of modernized agriculture resulting in increased production and productivity per unit of resource due to use of modern technology. During the process of transformation, the position of original equilibrium changes and production function shifts to a higher level and occupies a new equilibrium position, where the profits are maximum. The process of agricultural development includes use of high yielding varieties, adoption of improved package of practices including use of fertilizers, plant protection measures, irrigation and use of modern machinery, etc., for increasing productivity of farm enterprises. The process aims at getting the maximum advantage of the available resources *viz.,* land, labour and capital etc., on the farm and finally depicts the prominent changes in resource use and allocation, productivity of crops over a period of time in region. The process of agricultural development is thus, important from the point of view increasing agricultural production in the country.

1.2 Agricultural Development in India

Recognizing the important role of agriculture in the economic development of country, five-year plans assigned high priority to agricultural development. Agriculture has been the major source of livelihood in India. Invent of Moghuls followed by British did not change the situation to the desired level. Agriculture remained totally primitive, deteriorative and turbulent. The deficiency of foodgrains has lead to witnessing of a number of horrible families. The agriculture sector in many developing countries could not move ahead because of a large number of physical, natural, economical, social, political and human factors (Hopper, 1965).

Since, the post-independence period, several measures have taken to swing-up agricultural sector. The First Five Year Plan allotted 31 per cent of its total investment on agriculture and allied activities. The agriculture sector has however, shown a mixed type of performance during the post-independence period. During the fifties and early sixties the growth in agricultural output was largely contributed by the expansion in land area sown under different crops and not by any major technological change. As the agriculture sector in some of the developing countries has shown the signs of development today, it was almost of traditional type till very recently as the output from agriculture was mainly derived from land (of whose supply remained mostly fixed) and labour (of whose marginal productivity was almost equal to zero) inputs (Mellor, 1969).

The conditions did not remain the same and since 1966-67 with the onset of the process of agricultural development involving technological change with the introduction of high yielding varieties of seeds during mid sixties and increase in availability of chemical fertilizers and irrigation facilities, Indian agriculture no longer continued to be traditional one as it was during the fifties. The increased agricultural production enabled India to become self sufficient in foodgrains. The production of other crops such as cotton, sugarcane, oilseeds, fruits and vegetables as well has increased during the seventies and eighties.

Many efforts were taken in improving the agricultural situation in India, the growth in agricultural output was however, not smooth over all the years as well as over different states and regions in India. It is seen that technological change was specific to the crops such as wheat, cotton, paddy and groundnut, all of which were grown under irrigated conditions in Haryana, Western Uttar Pradesh (Uttaranchal), Punjab, few pockets of Gujarat, Maharashtra, Tamil Nadu and Andhra Pradesh. Many of the pulses and oilseed crops as well as commercially important crops such as sugarcane, tobacco and chilli remained outside the phenomenon of technological change for a long time.

The development of agriculture sector determines growth of other sectors of the economy and hence prosperity of nation, always depends upon the growth and development of Agriculture. It constitutes the single largest economic activity in India which contributes the nearly about 13.9 per cent

gross domestic production in year 2012-13. The agriculture is not merely an occupation but way of life, which for centuries has shaped the thought and outlooks of many millions of people.

The contribution of agricultural sector to GDP has continued to decline over the years. In 1970-71 agriculture contributed about 44 per cent of GDP which declined to 14.1 per cent and 13.7 per cent in 2009-10 and 2012-13 respectively. Indian agriculture has registered impression growth over last few decades. The foodgrain production has increased from 51 million tonnes in 1950-51 to 259 million tonnes during 2012-13.

During the Eleventh Plan period, foodgrains production in the country recorded an increasing trend, except in 2009-10 when total foodgrains production declined to 218.1 million tonnes due to severe drought experienced in various parts of the country. During 2011-12, total foodgrains production reached an all-time high of 259.32 million tonnes. However, the production of 2012-13 kharif crops is likely to be adversely affected by deficiency in the south-west monsoon and the resultant acreage losses. The overall area coverage at 665.0 *lakh* hectare under foodgrains during kharif 2012-13 shows a decline of 55.8 *lakh* hectare compared to 720.86 *lakh* hectare during kharif 2011-12.

1.3 Agricultural Development in Maharashtra

Maharashtra plays a major role in economical development of India. In India 9.29 per cent of the total population which occupied by Maharashtra is currently 11.24

crores people with the literacy rate 82.9 per cent. The geographical area of Maharashtra is 307713 km^2, approximately 140-145 *lakh* hectare of land is cultivated in the Kharif season and 60-65 *lakh* hectare in rabi season. The foodgrains production was decreased by 23 per cent with the production of 118.09 *lakh* metric tone in the year 2012-13 as against 154.19 *lakh* metric tonne during the previous year i.e 2011-12.

In Maharashtra all possible efforts have been made for increasing agriculture production and thereby to involve in the national campaign of development of agriculture which commenced during the post independence period. The development scheme *viz.*, NHAM, RKVY, M.G. NAREGA, CADA, DPAP, SFDA, MFAL etc. have been launched in the state Maharashtra resulted in food production and other farm products higher income and better standard of living for farm families have been archived. When agriculture sector grows, the impact of its development is felt in other sector of the economy and it accelerates the overall economy of region. Maharashtra could be considered to be one of the heterogeneous state in the Indian Union as far the varying agro-climatic conditions are concerned. The state comprises four region viz.; Konkan, Western Maharashtra, Marathwada and Vidarabha region with represent varying types of natural, physical, social and economical condition, quite distinct from each other. The variabilities in topography, soil and climatic factors bear significant impact on crop and land use pattern, use of production inputs and adoption of technological innovation of crop production among the region. The inter-

regional comparison of the performance of agriculture has revealed that the technological advances in agriculture could not make much progress in their contribution to increase production and productivities of various crops in different regions. Because of the these variabilities, there existed significant imbalance and dispariaties in income level of farm family in the regions to be much satisfactory during the plan periods.

The development of agriculture in Maharashtra did not prove to be much satisfactory during the plan periods. As a matter of fact, the state government was quite progressive with regard to planning and implementation of a variety of agricultural development programmes with a view to gear up natural resources conservation and development activities, supply of farm inputs including credit, development of other infrastructural facilities, strengthening of research and extension education, efforts to evolve and disseminate new agricultural technologies and expansion of adequate institutional base conducive for transformation of agriculture in the state. However, because of the limitations of irrigation facilities, regional variations in natural resource endowments and excessive dependence of agricultural sector could not make much headway throughout the entire planned period. In effect there existed great disparities in the spread of biochemical and mechanical innovation among different regions and among individual crops within the regions of Maharashtra.

1.4 The Problems

The introduction of new agricultural strategy i.e. green revolution during 1966 has helped farmers to come out from their traditional agriculture and boosted towards advanced one. They have now realized the importance of use of crucial inputs *viz.,* irrigation, credit, fertilizer, high yielding variety seeds, plant protection measures etc., for increasing agricultural production. It appears that the above said inputs along with the new technology in agriculture have propounded effects in influencing the productivity and as a result production in Agriculture. The agriculture in Maharashtra underwent several changes on account of the national campaigns for agricultural development since mid-sixties. The need was felt to undertake a scientific assessment of the process of agricultural development in a well-defined area over a period of time.

A study of this kind may have a detailed probe in examining the trend of changes in the land use, cropping pattern, growth rates in area, production and productivity of important crops and identification of major factors influencing the agricultural production. The examination of changes in growth rates of area, production and yield of major crops at decadal interval periods would be useful to know the performance of crops. It is in this context, the present study of development of agriculture in a well defined area mostly the district, would help us to know the growth patterns of cultivated crops, productivity, infrastructural facilities and

measures to be taken to overcome the hurdles in the way of development.

The growth of the Kolhapur district in modern times is fascinating. Chhatrapati Shahu Maharaja is an architect and founder of modern Kolhapur. The Kolhapur is not only one of the most agriculturally advanced districts of Maharashtra but also of India. It is also a fast becoming industrialized district and already a front runner in agro-based industries. Kolhapur district is one of the leading and shining examples in the co-operative movement of India. It has an area of 7765.00 sq.kms. which is about 2.5 per cent of total area of the state and it ranks 24th in the state as far as area is concerned.

The Kolhapur district is pioneer in trade and commerce. Chhatrapati Shahu Maharaj established a jaggery (gur) market at Shahupuri in 1895. The market is now shifted to 'Shahu Market Yard' which is a Regulated Agricultural Produce Market. It is well known for jaggery trading in India. The district had 12 regulated market yards consisting of four main market yards and eight sub-market yards. In these Market Yards paddy, Jaggery, groundnut, maize, jowar, wheat and chillies etc. are brought for sale. The first sugar factory was started under the leadership of Shri. Madhan Mohan Lohia in 1939. The chief exports of the district are rice, sugar, chilli powder, tobacco, gur (Jaggery), and gur from Malkapur. Among them Kolhapur jaggery is outstanding. Its fame and taste have crossed the boundaries of the nation and reached the countries like U.K., U.S.A., Pakistan and Gulf Countries.

It is observed that Kolhapur district in Western Maharashtra is one of the developed districts in agricultural development activities. In view of this it was decided to undertake a study *viz.,* "An Economic Appraisal of Agricultural development of Kolhapur District" covering a period from 1980-81 to 2011-12 in Western Maharashtra region.

1.5 Objectives

The study was undertaken with the following specific objectives.

i) To study the changes in land use and cropping pattern of Kolhapur District.

ii) To study the growth rates in area, production and productivity of major crops of Kolhapur District.

iii) To study infrastructural development for agriculture over a period of time of Kolhapur District.

iv) To identify the important factors responsible for agricultural development of Kolhapur District.

v) To identify Strengths, Weakness, Opportunities and Threats (SWOT) and suggested measures.

1.6 Scope and utility of the study

The present study is restricted to Kolhapur district of Maharashtra with reference to above objectives only. However, the findings of the study can be projected to wider area having similar agro-climatic conditions. The study will focus a light on important parameters of agricultural development in a

district, which can be further studied under varied situations in the state for knowing their significance.

The important conclusions, which were drawn from this study will help for planning and execution of agricultural development programmes in the district. The changes in the land use, cropping pattern, area, production and productivity of crops would indicate certain trends, which could be corrected for balanced agricultural growth in the district.

1.7 Limitations of the study

The present study is based on the secondary data obtained from published sources as well as from development agencies in the Kolhapur district. The findings are based on the availability as well as reliability of the data on different aspects of the study. The data collected from District Statistical abstracts, Epitomes published by Department of agriculture. As the data is secondary one has to go forward by considering this data, its reliability is the only limitation of the study. However, the attempt is made to have an in depth analysis of the data to accomplish the objectives with meaningful conclusions.

2. REVIEW OF LITERATURE

This chapter has been devoted to take reviews of previous studies, which are identical to the present one. The basic purpose of this chapter is to understand the methodology adopted and the trend of conclusions derived in the earlier related studies so that a suitable methodological framework could be developed for the present study. The basic objectives of the present study were to examine the process of agricultural development in terms of changes in several parameters of agricultural growth and development in Kolhapur district. The reviews drawn from various sources have been categorized into five groups based upon the aspects of the present study.

i) Changes in land use and cropping pattern

ii) Growth rates in area, production and productivity of major crops

iii) Infrastructural development for Agriculture

iv) Factors responsible for Agricultural development

v) Strengths, Weakness, Opportunities and Threats (SWOT) of Agriculture

2.1 Changes in land use and cropping pattern

Over a period of time, the structural composition of land use and cropping patterns have undergone several changes in response to a large number of factors, such as development in resource endowments, adaptability of crop varieties to new environmental set up, relative economics of production

activities, changes in relative prices of output and input-mix, technological advancement etc. The shifts in land use and cropping patterns are therefore of significant importance in the process of agricultural development.

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

Desai (1977) analyzed the cropping pattern of farm families in Surat district and tried to demonstrate the importance of non price variables such as irrigation, wealth (a proxy of risk) in explaining the cropping pattern of a set of farmers in Surat District. He concluded that increasing the availability of net irrigable land would shift the cropping pattern in favour of more remunerative and also labour intensive crops such as sugarcane, banana, HYV's of paddy. This shift in turn would increase the net income of an average farmer.

Rath (1980) estimated the compound growth rates of area, production and productivity of the major crops in India for the period 1949-50 to 1977-78. He found that the total agricultural production of India grew at an average rate of 2.48 per cent per annum. With the advent of new HYV's the pattern changed only for wheat during the period of post 1965.

Singh and Singh (1981) attempted a study on soil erosion hazards in North Eastern Hilly region and concluded that nearly 18.6 million tonnes of soil, 0.6 million tonnes of organic carbon, 9.7 tonnes of phosphorous and 5,690 tonnes of potassium are lost annually due to shifting cultivation in the North Eastern Hilly Region.

Subramanian *et al.* (1980-83) analysed the area under different crops in the four representative districts *viz.,* Chengale Pattue, Salem, Thunjavar and Madurai in Tamil Nadu and concluded that the relative productivity of crop variety and the rainfall were the factors responsible for the changes in cropping pattern.

Awasthi (1986) evaluated the performance of important cropping patterns in Meghalaya on rainfed terraces during 1984 and 1985. The cost and return analysis showed that double cropping of rice and turnip could be more remunerative cropping pattern followed by rice-radish, ricepea, maize + red gram, maize + tur, maize + soyabean and rice-linseed.

Mandar and Sharma (1995) studied the production performance of cereal crops in India through Districtwise

analysis. They found that wheat production increased because of intensive and extensive utilization of land and input use. In the case of jowar except Maharashtra all other Districts registered negative growth rates indicating more profitable superior food crops have replaced this coarse cereal in those Districts. In the case of bajra, production had not changed significantly over study period except Punjab due to decline in area under this crop.

Maheshwari (1996) studied agricultural growth in semi arid area in Karnataka state and concluded that there was growth in the period prior of the green revolution which continued in period - II (1967 - 68 to 1979 - 80). In period - I (1955 - 56 to 1966-67), the gross irrigated area rose by 3.10 per cent per annum, while in period - II (1967-68 to 1979-80) the gross irrigated area has increased at the rate of 1.70 per cent per annum. The per hectare fertilizer consumption was 2.22 kg. in period- I 19.08 kg in period-II and 47.38 kg. in period III (1980-81 to 1989-90).

Jha (1997) studied the agricultural growth in North East alluvial plains of Bihar and reported that compound growth rates of area, production and productivity of paddy, wheat, maize, jute and oilseeds were found to be positive. The study of growth performance of major factors of production namely gross cropped area under major crops, area under high yielding varieties, fertilizer consumption and rainfall pattern showed an increasing trend. Irrigated area however, showed a declining trend after 1974 - 75 in the zone possibly because of

the problem of silting and water logging in Kari command area.

Anonymous (1998) studied economic appraisal of agricultural development in Jalgaon District. It was concluded that the cereals predominated cropping pattern. The area under total pulses and total oilseeds declined and increased under cash crops such as cotton, banana and sugarcane. The net irrigated and gross irrigated area increased significantly over a period of time. Except rice almost all the cereal crops indicated significant increase in production. The productivity of sugarcane and cotton increased significantly. There was an increase in total livestock, poultry, HYV use and fertilizer use. However, the infrastructure facilities for agriculture and agro-based industries based on banana production need to be developed on priority basis in the district.

Anonymous (1999) studied economic appraisal of agricultural development in Pune district and reported that, land put to agricultural use increased to 91.61 per cent and cropping intensity of crop decreased to 9 per cent. The area under paddy, rabi jowar, wheat, sugarcane, groundnut, fruits and vegetables increased. The area under *kharif* jowar, bajra and cotton, decreased. Improvement in productivity of paddy and *kharif* jowar was recorded. During the period of study livestock position increased substantially. Strengthening of infrastructural facilities for agricultural development in the district was also suggested.

Kunjilal (2001) studied regional disparities in agricultural development in Maharashtra and concluded that

land use patterns and area shares of major crops in the gross cropped area remained more or less stable in all the regions of Maharashtra. Rate of adoption of HYV's has been accelerated after mid seventies. The performance of cereal crops improved after mid seventies. There was an increase in the productivity of pulse crops after mid seventies. Technological changes in agriculture had to improvement in productivities of conventional form of inputs after 1972.

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Gopalkrishanan (2001) conducted a study on land tenure system in Garo Hill districts of Meghalaya. Resubelpara development block was the largest in area then comes Songsak block and the third is Rongjeng and Dambuk Aza block. The highest per centage of net area sown in 1986- 87 was found in Rongjeng and Zikzak blocks (i. e. 33.25 per cent and 33.66 per cent) followed by Rongram and Selsella blocks (i. e. 24.11 per cent and 21.66 per cent) and all other blocks were ranging between 5 to 10 per cent only. Permanent pastures and miscellaneous lands per centage is very high in

Betasing block (36.53 per cent) because that area has more or less plain, people use the land for grazing of their domestic animals and is used for other purposes.

Bobade (2003) appraised the agricultural development in Satara district in Maharashtra and concluded that the area under forests had declined by 4.09 per cent during the period under study in Satara district. The area under barren and uncultivable land and land under cultivable waste showed increasing trend in the district. The net sown area decreased over a period of time mainly due to increase in barren and uncultivable land and land under cultivable waste. The cropping pattern of the district dominated by cereals has been tilted towards commercial crops.

Semwal *et al.* (2004) analyzed the changes in spatial patterns of agricultural land use and crop diversity and dependence of agro ecosystems on forests, during the period of 1963-1993 in a small watershed in central Himalaya, India. Their study revealed that the increment of agricultural land by 30 per cent at the cost of decrease in 5 per cent of forest land. The changes in land use pattern had increased household income at the cost of high intensity of biomass removal from forest. They concluded that the continued depletion of forest resources would result in poor economic returns from agriculture to local people.

The reviews on changes in land use and cropping pattern have thus indicated that the relative productivity of crop and rainfall were the factors responsible for changes in cropping patterns, the land put to non-agricultural use has been

increased and due to increased population pressure on land and decrease in productivity leads to utilization of more area under shifting cultivation in North-Eastern Districts. Also the area under forests rapidly declined at higher altitudes.

2.2 Growth rates in area, production and productivity of major crops

Pawar and Patil (1975) estimated the growth rates of commercial crops in Maharashtra for the period 1961-62 to 1971-72 and observed that the area and production of sugarcane increased at an accelerated rate, whereas those of cotton and groundnut decreased. The productivity of these crops remained almost stagnant.

Pachrupe (1977) studied region wise growth rates of area, production and productivity of major food grain crops in Maharashtra during the period 1950-51 to 1975-76. He observed that low and even negative production growth rates for major food grain crops for the entire period in almost all the regions. The performance of food grain crops during the period of post green revolution was, however, extremely good in the state.

Goel and Agrawal (1979) revealed that both area and productivity played a significant role in boosting up the production of rice, wheat, bajra and American cotton in Haryana during 1960-61 to 1977-78 period. They found that the area and productivity of Deshi cotton increased significantly, whereas the production of gram declined due to significant reduction in the area. The area and productivity

trends of sugarcane were not significant during the period under consideration.

Rath (1980) estimated the compound growth rates of area, production and productivity of the major crops in India for the period 1949-50 to 1977-78. He found that the total agricultural production of India grew at an average rate of 2.48 per cent per annum. With the advent of the new HYV's the pattern changed only for wheat during the period of post 1965.

Pal Suresh and Sirohi (1988) estimated compound growth rates of area, production and productivity of commercial crops in India for the time periods 1949-50 to 1964-65 and 1967-68 to 1984-85. At the all India level, there was a substantial decline in the growth rate of area caused by decrease in the production of all the commercial crops except potato in the post-technological change period. An appreciable improvement in the productivity of potato leads to comparatively higher growth in production. The rate of growth in productivity increased in case of groundnut, cotton and jute but decreased in sugarcane. The production and productivity of groundnut in Gujarat and cotton and groundnut in Maharashtra were highly unstable in both the periods.

Hanumantha Rao (1989) studied the state-wise production growth rates for rice and foodgrain for the periods 1961-62 to 1977-78 and 1977- 78 to 1988-89. There was improvement in the growth rate of production of foodgrains in second period when compared to the first period. Crops such as paddy and pulses, showed higher growth rates. There were

clear indications that the major inter crop imbalances in growth witnessed in the early years of green revolution were getting redressed to some extent in the recent period.

Mitra and Jena (1991) conducted a study on growth rates of groundnut production in Orissa. The objective was to evaluate the growth rates of area, production and productivity of the crop. For this purpose, the entire period of thirty-six years was divided into two parts *viz.*, period- I (1950-51 to 1962-63) and Period II (1967-68 to 1985-86). Growth rates of the entire period i.e. from 1950-51 to 1985-86 were also studied. The study revealed that the growth in area and production of groundnut during the study period was significant. However, the rates of compound growth in productivity were observed to be low and nonsignificant.

Singh (1991) studied the trends in area, production and productivity of fibre crops in Orissa. The study revealed that the growth rates of area and production of total fibre crops over the period 1972-73 to 1981-82 were not statistically significant. The area and production of jute in the state remained stagnant over the period. A significant negative growth in productivity of fibre crops during the period was recorded. This declining trend in performance of fibre crops was attributed to the lack of market structure.

Pawar *et al.* (1991) examined the regional variations in the performance of major cereals, pulses, oilseeds, fruits and vegetables in Maharashtra during the period 1956-57 to 1987-88 on the basis of the estimated - compound growth rates in area, production and productivity of individual crops. Based

on the empirical evidences, it was concluded that the performance of almost all the cereals was unsatisfactory during the pre-green revolution period. However, the situation improved a lot with the great strides of green revolution. The increase in the production of total cereals was contributed largely by significant improvement in the productivity of most of the cereal crops. The performance of all the pulses together was satisfactory during the period 1956-57 to 1987-88. The increase in production of pulses was primarily attributed to the significant increase in area under pulses. The performance of pulses, however, varied greatly among the regions and during different time periods. Similar picture was depicted in the case of the oilseeds. The gains of productivity improvement of some of the vegetable crops have been outweighed by the acreage contraction effect during recent years. The overall performance of the fruit crops was satisfactory among the regions in Maharashtra. The performance of sugarcane was of mixed type. There existed regional variabilities in acreage expansion and production increase in sugarcane. The production increase of sugarcane was contributed exclusively by area expansion, as there was continuous decline in its productivity.

Rahane and Joshi (1993) had estimated compound growth rates in area, production and productivity of some important oilseed and pulse crops in Maharashtra. The study was based on secondary data for groundnut (1966-67 to 1991-92), sesamum (1966-67 to 1988-89), safflower (1968-69 to 1989-90), gram and tur (1966-67 to 1990-91). The study revealed that, the area, production and productivity of

sesamum, safflower, gram and tur has increased significantly. But in case of groundnut, there was an increase in its production and productivity only. Among the various oilseeds and pulse crops, the highest growth rates in area was observed for sesamum 2.97 per cent, while the growth rates in production 8.26 per cent and productivity 5.74 per cent were higher in case of safflower. The area under groundnut has declined significantly throughout the period while there was increase in production mainly due to increase in productivity. The production of sesamum also increased significantly due to increase in area and a slight increase in its productivity. There was a tremendous increase in the production of safflower mainly due to the increase in productivity and due to a slight increase in area. The production of tur has increased significantly but the major contribution was on account of a significant increase in area 2.05 per cent as compared to productivity. The production of gram has increased significantly at the rate of 4.18 per cent per annum, while it was equally contributed by a significant increase in area and productivity, mainly due to the introduction of irrigation facilities, improved technology and high yielding varieties.

Kumar (1994) studied the cross breeding policy of Indian Government and envisaged that a shift in milk producing technology from local cows to crossbred cows will lead to a growth in milk output. Empirical studies from various parts of the country reported economic superiority of the crossbred cows over local cattle and hence, accrual of sizeable gains from adoption of this technology.

Kumar (1996) found that area, production and productivity of pulses had reminded almost static in India over the past three decades. Suggestions were made to utilize pesticides and fertilizers to increase productivity of the areas under pulse cultivation.

Jagannathan (1998) reported the trends and patterns of agricultural growth of different crops in India. The study revealed that there was an increase in yield and thereby production of all crops at an increasing rate in the early phase of green revolution. The study concluded that the public investment had to play a major role in the technological and infrastructural development for agricultural growth. Moreover, sustained and accelerated growth in agricultural production would not only contain reducing rural urban income disparities but also help in achieving higher reduction in rural poverty.

Maibangsa (1998) studied the growth of Hill agriculture in Meghalaya and observed the trends in area, production and yield of the study area. The study concluded that wheat recorded a remarkable increase in area, production and productivity during the above period and was followed by Mesta. The area, production and yield of maize, oilseeds, pulses and potato also showed a significant increase. The yield of rice however declined by 6.12 per cent. Jute and cotton were the two fibre crops which showed a declining trend in terms of area and production. Price fluctuations, lack of proper marketing, processing and storage facilities were the main constraints which resulted in the shift of area under

these crops to other food crops. Technological changes such as uses of high yielding varieties of crops, fertilizers, pesticides and irrigation might have influence the increased in production and productivity of other crops in the District.

Tadakhe (1999) studied the district wise growth rate of agriculture in the Konkan region and concluded that the positive growth rates were observed in terms of area under irrigation, consumption of nitrogenous and phosphatic fertilizers, production and productivity of important crops grown in the Konkan region. The study concluded that the agricultural development was taking place in the desired direction. In most of the studies relative to the growth rates, the researchers

Anonymous (1999) studied the growth in agricultural production in India. The growth in agriculture production was about 3.9 per cent in 1998-99 as against a drop of 6 per cent in preceding year. Food grain 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 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 to self-sufficiency was marked by the revolutionary changes in the seed technology that pushed up productivity levels first in wheat and later rice in the eighties. An annual growth of 3.5 per cent in foodgrains in eighties was hallmark of the green revolution that enabled India to become self-sufficiency in food grains and even an exporter.

Singh *et al.* (2001) observed that the production of milk increased significantly in all North Eastern Hilly Region with highest growth was in Mizoram (21.6 per cent), followed by Nagaland (19.40 per cent), Tripura (5.83 per cent), Sikkim (3.88 per cent) and Arunachal Pradesh (1.45 per cent). There was significant gain in egg production in North Eastern Region. Out of 8 districts, 4 Districts *viz.,* Nagaland, Mizoram, Manipur and Meghalaya recorded growth rate more than national average of 6.16 per cent per annum. They further added that the fish production in NE Districts could increase significantly in 3 districts, *viz.,* Arunachal Pradesh, Manipur and Meghalaya.

Anonymous (2003) estimated that the production of milk in Meghalaya was 0.40 lakh tonnes in 1983-84 gradually increased from one year to another and the production of milk in 1999-2000 was 0.62 lakh tonnes. The target expected to be achieved in 2001-02 is estimated to be 0.66 lakh tonnes. As the District population is comprised with more than 75 per cent of non-vegetarians, the meat production in the District which was only 0.124 lakh tonnes in 1983-84 jumped to 0.316 lakh tonnes in 1999-2000, registering an increase of over 150 per cent. It was estimated that meat production by 2001-02 would go upto 0.34 lakh tonnes. As regards egg production, it was estimated that 51.4 million eggs production in 1983-84 which was expected to reach 90.2 million number during 1999-2000.

Anonymous (2004) reported that the predominant livestock species in the North Eastern Hilly Region was the

bovines, comprising 11.48 million cattle, 0.8 million buffaloes and 0.27 million mithuns. The dairy animals primarily comprise low producing cattle with average productivity of 1.34 litres/day in the North Eastern Hilly Region as against the all India daily milk yield of 2.77 litres.

Sharma *et al.* (2005) reported that the livestock farming is a way of life of hilly and tribal farming community. It is a profitable venture in North Eastern Hilly Region in view of conducive agro-climatic conditions prevailing in the region. The production of milk increased significantly which ranged from 1.49 to 21.6 per cent. The significant increase in milk production in Tripura was mostly attributed to improvement in milk breed. The increase in cattle population varied from 18.9 per cent in Sikkim to 256.99 per cent in Nagaland. There was significant gain in egg production in Nagaland, Manipur, Mizoram and Meghalaya, the growth being more than 6.16 per cent.

Anonymous (2006) carried out the study in Tripura as there exist good potential for dairy farming in the District, signified by utilization of 8 per cent of the operated land area in rural areas for rearing of animals which is the highest among all the North Eastern Hilly Districts.

Basnet (2006) studied the agricultural development in Nepal and concluded that in livestock sector, the growth rates of population of milking cow and buffalo, pigs, fowl and lay hen were positive while sheep population had negative growth rate during study period. The growth rates of production of

cow milk, pig meat, hen eggs and fishes were quite satisfactory.

In most of the studies, the researchers have attempted to understand the pattern of growth of agriculture production and livestock population. Some of the researchers have made use of the study results for prediction purpose. Most of the studies suggested that the future requirement for increasing population must come from yield rather than from area expansion.

2.3 Infrastructural Development for Agriculture

Fertilizer Association of India (1982) reported that fertilizer consumption in India increased at a compound annual growth rate of 9.3 per cent per annum during the year 1971-1981. The violent fluctuations in fertilizer consumption from year to year as well as amongst regions and states were noted. Punjab, Haryana and Uttar Pradesh recorded a highest growth rate in fertilizer consumption. Bihar and Gujarat indicated lower rates of growth.

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Diwakar (1988) reported that the infrastructural and organisational facilities are very much essential for adoption of modern technology in Meghalaya. Analysis of secondary data revealed that the transport facilities continue to be a serious bottleneck for adoption of modern technology.

Alshi *et al.* (1992) studied trends in area, production and yield of fruit crops in Maharashtra District and concluded that there was an increase in the total fruit production by 6.98 per cent per annum. Provision of quality sampling of fruit crops, irrigation facilities, transport facilities for quick marketing, co-operative marketing and establishment of fruit processing units are some of the issues which call for an immediate attention for development of horticulture crops.

Anonymous (1993) studied the agricultural development and distribution of grains through inter-regional and intra-regional analysis in Uttar Pradesh. The average consumption of fertilizers in all the districts as well as regions of the District 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 had increased.

Narain *et al.* (1993) evaluated the economic development of different districts of Orissa District. For this study the district level data for the year 1990-91 on forty six different indicators depicting various facts of development of different sectors of economy were utilized. The study concluded that the agricultural and industrial developments were found to be mutually associated. The indicators like irrigation, fertilizers,

foodgrains production, medical facilities, decadal growth rate of population, literacy, banking facilities, etc. needed improvement of varying magnitude.

Singh and Tyagi (1995) studied the impact on agriculture in one of the blocks of Basti district in Eastern U.P. Analysis indicated that the cooperatives by providing adequate and timely credit can create a favourable impact on agricultural development even in a backward region. However, to make such impact significant, it would be necessary to further expand the services of cooperatives and increase their efficiency.

Satpute *et al.* (1997) undertook a study on district wise development in Marathwada region and concluded that during 1982-83, net irrigated area was the highest in Osmanabad district. However, during 1983-84 Nanded district ranked first in net irrigated area. The cooperative movement was prominent in Aurangabad and Nanded districts. It was suggested that the balanced development, mobilization of resources to the underdeveloped districts was essential.

Rahane and Kasar (1999) had studied the trends not only in the growth of irrigation but also in allocation of irrigated area among different crops during the last 36 years in the State of Maharashtra, i.e. from 1961-62 to 1995-96 have been used for this study. Both simple method of analysis and regression analysis were used to arrive at the results explained below.

The study revealed that both net and gross irrigated area have been significantly increased by the linear growth rate of

4.5 and *6.06* per cent per annum, respectively during the period 1960-61 to 1995-96 in Maharashtra. The rate of growth in irrigation was significantly higher in period I (1960-61 to 1977-78) than period II (1978-79 to 1995-96). The wells have appeared to be the major source of irrigation. The development of irrigation is quite conspicuous in Western Maharashtra followed by Marathwada and Vidarbha while it was poor in Konkan region. Of the total irrigable area during the year 1995-96, the share of these regions is 51.27, 26.05, 21.08 and 1.50 per cent respectively in the state.

The significant increase in allocation of irrigated area was noted in the case of wheat, pulses, sugarcane, groundnut, fruits and vegetables, while the proportionate decline in allocation of irrigated area was noted in case of paddy, jowar (rabi), jowar *(kharif)* bajra, maize and cotton in the state of Maharashtra during the period under study.

Dodkey and Kuchhadiya (2001) studied the flow of institutional finance of agriculture sector in Junagadh district of Gujarat state. The linear growth rates were computed for the 10-year time series data (1985-86 to 1994-95). They noted that the total agricultural loans had a growth rate of 17.38 per cent per annum in the district. They further concluded that the flow of institutional finance to agriculture sector had been significantly increasing over the years i.e. in accordance with the goal set for institutionalization of rural credit.

Dhar (2005) studied the economy of North East India and observed that the lack of infrastructure development was due to its peculiar geographical features of the entire North

Eastern Hilly Region which was neglected from the very early period. The NE Districts were lagging behind most of the other Districts of our country in respect of transportation, communication, electrification, credit facilities etc.

Sharma *et al.* (2005) studied the infrastructure development and input use analysis in relation to output gains and pointed out that the development of irrigation had been quite uneven across the North Eastern Hilly Districts. An organized effort to harness water resources was not upto the mark in all the Districts. In Manipur and Tripura, where per centage of net irrigated to cultivated area was high, foodgrains productivity was also more.

Shreeranjan (2006) studied the problems of over dues in Meghalaya and concluded that the Meghalaya has been consistently showing poor recovery levels both in the priority sector as well as in other poverty alleviation programmed. In fact, these advances have largely turned into chronic over dues and non-performing assets (NPA) of the banking industry regaining considerable sum of provisions to be made by the bank as per the Reserve Bank of India norms. Meanwhile, with almost all the over dues turning assets into loss during the last 5-7 years, the banks are not in a position to open the credit channel at the grass root level. The District Co-op. Bank, SBI and the RRB have larger presence in the rural areas. These banks are finding it difficult to issues fresh credit as majority of the societies and the borrowers have become defaulters pilling up huge over dues.

Kumar *et al.* (2007) studied the livestock sector in North Eastern Region in India and observed that the credit flow in North Eastern Hilly Region was very low. The credit availability was Rs. 650/- per ha of net sown area, which was much lower than the national average of Rs. 3450/- per ha. The lack of institutional credit is a severe constraint to development of livestock as the flow of credit to livestock is even worse than that of agriculture.

Souvik *et al.* (2010) Studied that irrigation and agricultural sector performance in Orissa and their influence on economic development of the district. Inspite of increase in irrigation potential over the years, foodgrains production in Orissa has showed slower growth; however, assured irrigation supply has increased paddy area during dry season by 60 per cent.

Kapil Bhatt (2012) Studied that the use of tractors, wheat threshers, rice threshers and maize shellers was increased considerably over the peroid under study. At the district level, the annual consumption of total fertilizer increased. This shows that the farmers in the district have become aware of the use of chemical fertilizers for improving productivity of crops.

The studies on infrastructural development for agriculture have reported that the infrastructural and organizational facilities are essential for adoption of modern technology. The North Eastern Districts are lagging behind most of the other districts of our country in respect of transportation, communication, electrification and credit

facilities. Also the development of irrigation has been uneven across North Eastern Districts and organized efforts to harness water resources were not up to the marks in all the districts. The credit availability in North Eastern districts was very low and institutional credit was a severe constraint in the development of agriculture.

2.4. Factors responsible for agricultural Development

Sagar (1978) studied the contribution of individual technological factors in agricultural growth of Rajasthan. In this case an attempt has been made to measure the contribution of three technological factors viz., high yielding varieties of seed, fertilizer and irrigation in the growth of agricultural productivity in Rajasthan during 1967 to 1974. He noted that wheat registered 40 per cent yield increase on account of above technological factors. On examination of their contribution, he observed that high yielding varieties contributed 26 per cent of the yield growth while the share of other two factors was 74 per cent. At the overall level, the share of the new varieties of seed was 15 per cent. The share of fertilizer and irrigation was 30 per cent and 18 per cent, respectively.

Naikwadi (1980) studied the development of agriculture in Sangli district of Maharashtra and concluded that the agricultural production was positively and significantly influenced by the net irrigated area, quantity of fertilizer disbursed and average annual rainfall, whereas amount of credit disbursed showed negative association with the agricultural production in the district. He suggested the need

of expansion of irrigation facilities and supply of fertilizer in the dry areas of the district for agriculture development.

Bhagat (1983) studied the inter-regional disparities in agricultural infrastructure in Bihar. He found that Bihar plain regions were sufficiently endowed with the infrastructural facilities and hence using new agricultural practices also the level of agricultural productivity was also high, whereas these facilities were lacking very much in the Chotanagpur plateau region. Study further revealed that availability of infrastructure indicates the farmers to go for widespread use of new agricultural practices leading to higher level of agricultural productivity.

Borah (1993) initially promoted as alternative to shifting cultivation in the hills of North-East was plantation of Coffee and Rubber. Apart from problem associated with commercial crops, plantation crops had the added complication of a longer gestation period. Yet the area affected by shifting cultivation still remains significant and interventions to win the remaining shifting cultivators away to more sustainable ways of life needed to be continued. The programmes and packages tried out as alternative to Jhum cultivation has so far met with limited success.

Sarkar (1993) studied technology and agricultural development; a case study in tribal Bihar. This paper investigated the level of adoption of new technology and constraints on the diffusion of new agricultural technology in tribal areas of Bihar district, India. New agricultural technology has not made an effective impact in the area.

Diffusion of new technology was found to be lower in the upland zone than in the lowland area and relatively higher for wheat than other crops. Among the constraints identified were lack of assured irrigation, lack of capital, lack of awareness of the recommended packages of practice, high cost of HYV seeds and related inputs, lack of timely availability of HYV seeds and credits high risk, lack of HYV technology suited to rainfed condition; poor infrastructure and week administrative arrangement.

Pokharkar *et al.* (2002) carried out an investigation to know the impact of technology on agricultural development in Maharashtra. By the use of exponential type of production function, they computed the compound growth rates of area, production and productivity of major crops and important inputs over a period of time from 1960-61 to 1997- 98. The study revealed that a growth in production due to improvement in the productivity in all crops, except sugarcane and kharif. Jowar was due to the use of modern technology in agriculture, use of high yielding and hybrid seeds, increase in irrigation facilities, increase in per hectare use of chemical fertilizers etc. The production of sugarcane and kharif jowar was increased by increase in both area and productivity during overall period of time. Thus, growth in total agricultural production and increase in use of major inputs indicated the impact of technology on agricultural development in the district, which was a good sign for agricultural development.

Mamatzakis (2003) assessed the effect of public infrastructure on economic performance in Greek agriculture. The result showed that over the period 1960-95, the impact of public infrastructure on productivity growth in livestock and crop production was found to be positive, although it had been declining since the late 1970s. Thus a decline in public infrastructure investment could partly explain the observed decline in the productivity growth of Greek agriculture during 1980s.

Birthal *et al.* (2005) studied the vertical coordination in high value food commodities and reported that the high value agriculture requires more capital, improved technologies, quality inputs and better support service. Lack of access to these may constraint small farm diversification. Most high value commodities are perishable and need immediate transportation from production to consumption centres and markets. Rural markets for high value commodities are thin and marketed surplus of small holders is usually too small to economically trade in distant urban markets due to high transportation costs.

Jabir Ali (2007) studied livestock sector development and implications for rural poverty alleviation in India and reported that livestock sector in India experienced remarkable growth during the last two decades in terms of production, value of output from livestock and trade. It contributes nearly 25 per cent to the gross value of agricultural output at the national level and more towards poverty reduction.

To sum up the above reviews, it appears that both institutional and technological factors are responsible for agricultural growth. The technological factors are inclusive of technical skills, research, education and use of modern techniques while institutional factors include the conditions that are useful for creating suitable infrastructure for development of agriculture. The availability of crucial inputs is the major component of this aspect which has significant influence in improving farm productivity.

2.5. Strengths, Weaknesses, Opportunities and Threats (SWOT) of Agriculture:

Swot analysis techniques used in economic appraisal of agricultural development of district.

Renuka, C. Kumari (2003) reported Indian agricultures strengths, weakness, opportunities, threats or analysed in the context of government. Dismantling of the system of quantitative restriction on export and it is announcement of strategy to promote the agricultural export as a step towards achieving 1% share in global threats.

K.N. R. Lakshmi, K.S. Kumar (2004) reported (SWOT) analysis of andhra pradesh agriculture is presesnted in the context of agriculture export potenntial. Indicate that farmer should concentrate more on profitability rather than on productivity.

Jungho Suh and nick F.Emtage (2005). Studied on survey was undertaken during a workshop to identify the strengths, weaknesses, opportunities and threats (SWOT) of

Community-based Forest Management in Leyte Province, the Philippines. A form with open-ended questions, rather than oral discussion sessions traditionally associated with the SWOT analysis, was presented to each member of the group simultaneously. The survey method with a questionnaire was aimed at minimising the time requirement, preventing the data from being biased by a few dominant players, and obtaining relative frequencies. The greatest strength of the forestry program is seen to be the empowerment given to rural communities to plant and manage trees on publicly controlled lands. Other strengths include the resources and training provided to support the program, and fostering cooperation between community members. Lack of foreign and local funding to support the program were viewed as the most important weakness. The possible withdrawal or depletion of foreign funding was seen as a major potential threat. Respondents are also concerned about whether communities can find markets for their timber and non-timber forest products. Other challenges include the lack of timber processing facilities in Leyte and instability and complexity of government regulations. With regard to opportunities, respondents tended to report what they would like to see done to improve performance of the program, rather than program innovations probably because as yet little timber harvesting has taken place.

H.V. Chavan, S.K. Sharma (2007) reported The increasing awareness on important of trees for economical environmental benefits is the strong driving force behind adoption of agroforestrty. The analysis of (SWOT) of the

technology offers constructive outlook on building strength, converting weakness into strength, encash opportunity and minimize threats.

3. METHODOLOGY

This chapter deals with the plan of investigation and sources of data. It is intended to describe clearly the methodology adopted to accomplish the objectives under study. The chapter has been therefore, designed to explain sampling design, sources of data and method of data collection and techniques of analysis adopted to accomplish each of the objectives defined the present study.

3.1 Basic Approach of the Study

The main objectives of the present investigation have been to evaluate the agricultural development that has been achieved so far during the thirty two years in Kolhapur district. This is done by studying the important aspects of the process of agricultural development. It is believed that agricultural development in a specific region cause significant changes in the land use and cropping pattern due to rational aptitude of the farmers to make investments in land development and to allocate their resources for high rewarding enterprises. The adoption of new techniques of production result in improving productivity of a crop. The new techniques of production involve the use of crucial inputs having significant effect on the agricultural production. The study is aimed at evaluation of agricultural development by examining changes in the land use and cropping pattern, area, production and productivity of major crops grown, infrastructural development in terms of provision of crucial inputs, market value addition system and also to identify the

factors influencing agricultural development in Kolhapur district to a greater extent.

Specifically, the present study attempts to analysed the changes in the land use and cropping pattern for thirty two years starting from 1980-81 to 2011-12 for knowing the trend of farmers in resource allocation and product mix as a result of agricultural development in Kolhapur district. The changes are measured by estimating proportions to the respective totals at the selected points of time.

The impact of new technology i.e. Green Revolution which has been introduced since mid-sixties, on agricultural production has been assessed by estimating compound growth rates in area, production and productivity of major crops grown in Kolhapur district for three different periods *viz.,* 1980-81 to 1994-95, 1995-1996 to 2011-12, and also for the whole period of 1980-81 to 2011-12. This became useful to compare the growth rates of the selected crops for the above said periods and knowing their performance in Kolhapur district. The attempt is also made to identify the factors influencing agricultural development by way of multiple regression analysis. This is done by taking total agricultural production of Kolhapur district in monetary term as a dependent variable and the independent factors *viz.,* percentage of gross irrigated area to gross sown area *(X_1),* consumption of total fertilizer (NPK) per ha of gross irrigated area *(X_2),* Percentage of area of high yielding variety seeds to gross sown area (X_4), Percentage of area under commercial crop to gross sown area (X_5), amount of loan (Short and

Medium term) disbursed through KDCCB per year in *Lakh* of rupess (X_6), average rainfall in the district (mm) (X_7), area under fruit crops in hectare (X_8) and Number of milch animals (X_9). The research procedure adopted for studying the above aspects of the study has been explained in the discussion that follows.

3.2 Location of the Study

Kolhapur district is a fairly compact area of 2,794.4 Sq. miles, this district is bounded by Ratnagiri district on the west, the Varana river (N. Satara) on the north, the South Satara and Belgaum districts on the east and Belgaum and Ratnagiri on the south. Traverse of Sahyadris in the west region, raises the height of this part at places up to 3,000' above sea level. The height of eastern part which is rather flat varies between 1,900 and 2,000 feet above sea level.

3.3. Sources of the Data

The study is based on the time series data obtained from various sources *viz.,* published statistical literature and by contacting officials of the Zilla Parishad, Cooperative and District Statistical Office Of the Kolhapur district, www. agricoop.nic.in, district census hand book, season and crop report published by department of Agriculture Maharashtra, Epitome of Agriculture, ministry of Agriculture govt. of India, Lead bank report bank of India, annual credit plan (Kolhapur district), www.kolhapur.nic in. The data on the land use and cropping pattern for the selected thirty two years, area, production and productivity of selected crops covering the period from 1980-81 to 2011-12 in respect of Kolhapur district

were obtained by referring the Season and Crop Reports published by the Directorate of Agriculture, Maharashtra State. Some other reports *viz.,* Statistical Abstract of Maharashtra Socio-Economic Review and District Statistical Abstract of Kolhapur were also scanned for getting relevant information.

This information became useful for studying the land use and cropping pattern as well as estimation of growth rates of area, production and productivity of selected crops for the period under study in Kolhapur district. The information on disbursement of credit through cooperatives, distribution of fertilizers, improved seeds, average annual rainfall, agricultural production etc., in Kolhapur district during the period from 1980-81 to 2011-12 was obtained by contacting Co-operative Banks, District Co-operative Sales and Purchase Union, Zilla Parishad and District Statistical Office, Kolhapur. This information became useful for identifying the important variables influencing agricultural production in the Kolhapur district.

3.4 Method of Analysis

The method of analysis adopted in the present investigation has been explained below by keeping in view the objectives of the study.

3.4.1 Structural Changes in the Land use, Cropping Pattern and Input use

The data obtained on the land use and cropping pattern of Kolhapur district for the thirty two years divided into three

period *viz.,* 1980-81 to 1994-95, 1995-1996 to 2011-12, and also for the whole period of 1980-81 to 2011-12. were analysed by simple tabular method. The proportions were estimated for each of the above years to know the changes in the land use, cropping pattern and input use of district over the period under study.

3.4.2 The Growth Rates in Area, Production and Productivity of Major Crops

The data obtained on area, production and productivity of major crops *viz.,* paddy, kharif jowar, rabi jowar, wheat, gram, tur, groundnut, cotton, bajra, red gram, green gram, black gram, fruits and vegetables, sesamum, soybean, and sugarcane for the period from 1980-81 to 2011- 2012 in respect of Kolhapur district were used for estimation of compound growth rates. The data were analysed to have compound growth rates in area, production and productivity of the above said crops for three different periods *viz.,* Period-I 1980-81 to 1994-95, Period II 1995-96 to 2011-12 and Period-III 1980-81 to 2011-12, This became useful for studying the changes in the performance of the selected crops during the above periods in Kolhapur district.

Compound growth rates

The compound growth rates were worked out by fitting exponential function of the following type to the data for three periods explained above

$$\mathbf{Y= ab^t}$$

Or

$$\log Y = \log a + t \log b$$

Where,

Y= Area in hectares, production in quintals and yield in quintals per hectare,

a = Intercept,

b = regression coefficient,

t = time period in years.

Finally the annual rate of compound growth in area, production and productivity of the crops was worked out by using the formula.

$$r = (\text{Antilog } b\text{-}l) \times l00$$

The significance of the estimated compound growth rates were tested with the help of Students' t test.

3.4.3 Factors Responsible for Agricultural Development

The information regarding total agricultural production, percentage of gross irrigated area to gross sown area, consumption of total fertilizer (NPK) per hectare of gross irrigated area, percentage of gross sown area to net sown area, percentage of area of high yielding variety seeds to gross sown area, percentage of area under commercial crop to gross sown area, amount of loan (short term and medium term) disbursed through KDCCB per year in lakhs of rupees and average annual rainfall area under fruits crops and number of milch

animal in the district during the study period i.e. 1980-81 to 2011-12 was used for fitting a multiple linear regression equation of the following type. This was done for identifying the important variables and their role in influencing agricultural production in the district.

$Y= a+b_1X_1+b_2X_2+b_3X_3+b_4X_4+b_5X_5+b_6X_6+b_7X_7+b_8X_8+b_9X_9+u^t$

Where,

Y = Total value of agricultural production of Kolhapur district in crores of rupees.

a = intercept

b_1's = Regression coefficient

X_1 = Percentage of gross irrigated area to gross sown area.

X_2 = Consumption of total fertilizer (NPK) per hectare of gross irrigated area in kilogram.

X_3 = Percentage of gross sown area to net sown area.

X_4 = Percentage of area of HYV seeds to gross sown area.

X_5 = Percentage of area under commercial crops to gross sown area.

X_6 = Amount of loan (short term and medium term) disbursed through State Co-operative Bank per year in *lakh* of rupees.

X_7 = Average annual rain fall in the Kolhapur.

X_8 = Area under fruits crops (ha)

X_9 = Number of milch animals.

u^t = error term.

Dependent variable

Total agricultural production in Kolhapur district (Y).

The total agricultural production obtained in Kolhapur district during the period 1980-81 to 2011-12 has been obtained and converted into monetary form by multiplying the physical output of each of the crop with their farm harvest prices for a specific year. The aggregate value of total agricultural production for a specific year was then worked out by adding the values of physical output of various crops. The actual values of aggregate total output are shown in Appendix.

Independent variables

1. Percentage of gross irrigated area to gross sown area (X_1)

The percentage of gross irrigated area to gross sown area was worked out for each of the year under study and thus the variable was constructed. It was expected that the increase in this percentage of gross irrigated area to gross sown area would boost the agricultural output of the district.

2. Consumption of total fertilizer (NPK) per hectare of gross irrigated area in Kilogram (X_2). This variable was constructed in order to know the effects of fertilizer use on aggregate crop output.

3. Percentage of gross sown area to net sown area (X_3). It was expected that the increase in percentage of gross sown area to net sown area would have a positive effect on farm output of the district and therefore this variable was considered.

4. Percentage of area under HYV seeds to gross sown area (X_4)

This variable was developed in order to assess the effects of HYV seeds on the aggregate farm output of the district.

5. Percentage of area under commercial crops to gross sown area (X_5) Three major crops *viz.,* Sugarcane, cotton and soybean were considered for present analysis.

6. Amount of loan (short term and medium term) disbursed through KDCCB in Kolhapur district in lakhs of rupees (X_6).

7. Average annual rainfall in mm in the District (X_7). The data available on annual average rainfall in the district were used to develop this variable. The purpose was to examine the effect of average annual rainfall on aggregate farm output in the district.

8. Area under fruits crops (X_8)

9. Number of milch animals (X_9)

The usual statistical procedure was adopted for testing the significance of the estimates of parameters. The coefficients in multiple regressions were tested as follows,

$$t = \frac{bi}{SE\ (bi)}$$

bi ⟶ Estimate of Regression Coefficient for i^{th} character under consideration

SE (bi) Standard error of regression coefficient for I character

Statistical method by Snedecor and Cochra.

4. SALIENT FEATURES OF KOLHAPUR DISTRICT

4.1 General

The purpose of this chapter is to explain briefly the background information of Kolhapur district. This helps in understanding the salient features of the district as well as the results obtained from the study. It's very clear that agriculture field is not totally depends upon man made process only but it depends upon soil and climatic conditions of the area such as soil type, rainfall, temperature, etc. Every time an agriculturist has to manage his farming with all these factors for doing efficient and fruitful farming. In addition to these factors the economic factors like marketing facilities, banking facilities, transport and communication facilities, education, irrigation projects, electricity and the availability of sufficient and timely credit at cheaper rate also determine the crop to be grown and affect the farmer's economy. This true particularly in case of perishable commodities which faces transport problems, cash crops which fights for availability of credits, for quick transport facilities. Taking all these points in consideration, the general information of the tract under study is described below.

4.2 Location

The Kolhapur district situated in the extreme southern part of Maharashtra State. It lies between 150 43' north to 170 17' north latitude and 730 40' east to 740 42' east longitude. It is surrounded by Sangli district to the north, Belgaum district of Karnataka state to the east and south, and Ratnagiri and Sindhudurg districts to the west.

MAP OF KOLHAPUR DISTRICT

4.3 Topography

4.3.1 Soil

The soils of Kolhapur district can be divided in to three major geographical regions. The Western region comprises of hilly region with red soils covering the areas of Shahuwadi, Radhanagari, Gagan Bawada, Bhudargad, Ajra and Chandgad tahsils. The middle region is the area of fertile soils comprising Karveer and Kagal tahsil and the eastern region is made up of medium soils comprising Hatkalangle and Shirol tahsils. The area along Bhogawati, Kumbhi, Kasari, Panchaganga, Hiranyakeshi, Vedgana are fertile with alluvial soils.

4.3.2 Rivers

This is one of the most important sources of irrigation in Kolhapur district. The major rivers in Kolhapur district Krishna, Warna, Panchaganga, Dadhaganga, Vedaganga, Hiranyakeshi and Ghatprabha. Krishna rushes along the North-East boarder. Warna, Panchaganga, Dadhaganga, Vedaganga, Hiranyakeshi enriches the soils from North-West to South-West. Warna is out pouring along the boundaries of Kolhapur district and Sangli district covering a distance of 120 km. Kasari, Kumbhi, Talashi and Bhogawati unite to Panchaganga. Dudhaganga is the main river to the west and vedganga is the subsidar. Panchganga and Dudhganga meet Krishna at Narsobawadi and on the outskirts of Kolhapur district respectively. A river in the south, Tilari, is only westward flowing river.

4.3.3 Physical Setting

The district interior has a varied economical culture. The ranges of mountain Sayhadri have spread their wings mainly

in the western region of the district and this has converted part of the district with Konkan type soil and ecology and partly with Deccan type. Although the major portion of the district is 390 to 600 meters above the mean sea level. Some of the points are as high as 900 meters above mean sea level.

4.3.4 Climate and Rainfall

Kolhapur's climate is a blend of coastal and inland climate of Maharashtra. The temperature has a relatively narrow range between 10°C to 35°C. Summer in Kolhapur is comparatively cooler, but much more humid, compared to neighboring inland cities. Maximum temperatures rarely exceed 38°C and typically range between 33 to 35°C. Lows during this season are around 24°C to 26°C.

The city receives abundant rainfall from June to September due to its proximity to the Western Ghats. The total average rainfall and total no. of rainy days of the district is 1247.50 (mm) and 90 respectively. Humidity is low in this season making weather much more pleasant.

4.5 Area and Demography

The district has an area of 7765 square km which consist of 2.5 per cent of the total area of the state. According to 2011 census population of the district is 3876001 out of which 1980658 are males and 1895343 are females. The density of population is 500 persons per square km. The sex ratio is 957 females per 1000 males. Out of total population 2645992 i.e. 68.26 per cent population is in rural area as against 1230009 i.e. 31.74 per cent of Urban. Literacy of the district is 82.90 per cent. There are 74.18 literate females per 100 males according to 2011 census. (Male -91.33 per cent).

Rural literacy percentage is 78.35. Out of which 89 per cent are males and 72 per cent females. Kolhapur ranks fourteenth in the state.

4.6 Agriculture

Land use and crop pattern in respect of Kolhapur district for the year 2011-12 is explained below to have brief idea of the mode of agriculture in the district.

4.6.1 Land Use

Total geographical area of the district is 7.765 *lakh* hectares. The land use pattern of the Kolhapur district in the year 2011-12 is presented in Table 4.1

The area under forest was 1.469 *lakh* hectares and 18.11 per cent to the total geographical area. The area under non agricultural use was increasing. The area under cultivable waste, other fallow land and current fallow were 0.369, 0.208 and 0.107, *lakh* hectares respectively during the year 2011-12. The net sown area for the year 2011-12 was 4.306 *lakh* hectares which formed 55.45 per cent of the total geographical area.

The area sown more than once was 2.344 hundred hectares, which contributes 30.19 per cent to the total geographical area. The gross cropped area was 6.650 *lakh* hectares with the cropping intensity 154.43 percent.

Table 4.1.Land use pattern of Kolhapur district

(Area '00' ha)

Sr. No.	Particulars	Area	Percentage to the total area
1	Total geographical area	7765	100
2	Area under forest	1407	18.11
3	Barren and uncultivable land	438	05.64
4	Land put to non-agricultural use	382	04.92
5	Permanent pasture and grazing land	414	05.33
6	Area under orchards and miscellaneous trees	72	00.92
7	Cultivable waste	369	04.76
8	Other fallow land	208	02.68
9	Current fallow	107	01.38
10	Net sown area	4306	55.45
11	Area sown more than once	2344	30.19
12	Gross cropped area	6650	85.64
13	Cropping Intencity (%)		154.43

Source :- Season and Crop Report published by Department of Agriculture, Maharashtra State.

4.6.2 Irrigation Resources

Among all the inputs irrigation is important one. Due to irrigation more area with more production can be possible. In Kolhapur district agriculturists are alert about the importance of irrigation. The Panchaganga, the Krishna and the Warna are main rivers in this region. During last few years

many irrigation projects like Tulsi, Kalammawadi Irrigation project and Warna Irrigation project and hydrolic electric Irrigation project are coming into existence. The details regarding the sources of irrigation and area irrigated in Kolhapur district are presented in Table 4.2.

Table 4.2:- Area irrigated by various sources in Kolhapur district (Area '00' ha)

Sr. No.	Particulars	Area 2011-12
1	Surface irrigation other than wells	806 (63.00)
2	Well irrigation	474 (37.00)
3	Net area irrigated	1280 (100.00)

(Figures in the parentheses indicate percentages to the net irrigated area)

Source:- Season and Crop Reports published by Department of Agriculture, Maharashtra state.

It can be seen from the Table 4.2 that the Net irrigated area of Kolhapur district is about 1.280 *lakh* hectares which represents 19.24 per cent to gross cropped area. Of the net area irrigated 37.00 per cent area was under well irrigation and 63.00 per cent area was irrigated by surface irrigation other than wells viz., lift and canal.

4.6.3 Cropping Pattern

By studying the cropping pattern of Kolhapur district it is seen that, the gross cropped area of the district was 6.650 *lakh* hectares for the year 2011-12. The proportion of area occupied by cereals was 26.85 per cent while that of pulses was only 3.27 per cent. Thus, foodgrain crops have predominance in the cropping pattern of Kolhapur district, since these crops alone account for 30.13 per cent of the total

cropped area. The total oilseed crop contributes about 16.90 per cent area out of which 8.76 per cent area occupied by groundnut. The area under fruit and vegetable crops was 0.153 *lakh* hectares. The area under sugarcane was 1.399 *lakh* hectares.

Table 4.3: Cropping Pattern of Kolhapur district

(Area '00' ha)

Sr. No.	Crops	Area	Percentage to the gross cropped area
1	Rice	1115	16.76
2	Wheat	86	1.29
3	Kh. Jowar	80	1.20
4	R. jowar	140	2.10
5	Bajra	24	0.36
	Total cereals	1786	26.85
6	Gram	85	1.27
7	Redgram	24	0.27
8	Green gram	30	0.45
9	Black gram	25	0.37
	Total pulses	218	3.27
	Total foodgrains	2004	30.13
10	Sugarcane	1399	21.03
11	Fruits and vegetable	153	2.30
12	Cotton	2	0.03
13	Groundnut	583	8.76
14	Soybean	485	7.29
	Other	56	0.84
	Total oilseeds	1124	16.90
15	Other crops	1970	27.62
	Gross Cropped Areas	6650	100

(Figures in the parentheses indicate percentages to the gross cropped area)
Source:-Season and Crop Reports published by Department of Agriculture, Maharashtra state.

4.6.4 Animal Husbandry

The main purpose of cattle in the district is for draft and milch purpose. Seasonally migratory agricultural labourers require indigeneous bullocks for carring sugarcane from field to factory. As per 2007 livestock census total livestock in Kolhapur district was 1215010, Out of this cows and bullocks together were 253347, total buffaloes were 646217, Total sheep and goats were 357127, Total poultry birds were 868319. Out of total livestock, cows and bullocks were 11.92 per cent, buffaloes were 30.41 per cent, sheep and goats were 16.80 per cent, and other livestock 3 per cent. Milk co-operatives increased more than 2 times in only 7 to 8 years. At the end of 2011-12 daily milk production was 310543 thousand litres and eight refrigeration centres were available in the district.

Table 4.4 Livestock in Kolhapur district according to 2007 Census

Sr. No.	Particulars	Numbers
1	Cow	253347
2	Buffalo	646217
3	Goat	191459
4	Sheep	165668
5	Total	1215010
6	Poultry	868319

Source :- Season and Crop Reports published by Department of Agriculture, M.S.

4.6.5 Agricultural Machinery

It seems that the cultivators in the district are enthusiastic about the use of modern machinery and implements. The number of oil engines and electric pumps for

irrigation was 8062 and 23498, respectively. But the number of tractors increased from 2184 tractors in 1980-81 to 5932 tractors in 2011. There are 67625 ploughs which included 45007 wooden ploughs and 22618 iron ploughs.

Table 4.5 Changes in the Uses of implements and machineries in the Kolhapur district

Sr. No.	Items	Number
1	Wooden plough	45007
2	Iron plough	22618
3	Sugarcane crushers	1264
4	Oil engines	8062
5	Electric motor	23498
6	Tractor	5932

Source :- Season and Crop Reports published by Department of Agriculture, M.S.

4.7 Agro Industries

The number of registered industries are 19523, out of which only 1799 are in working condition. There are 17 co-operative sugar factories in Kolhapur district and sugar production is about 135.50 *Lakh* MT. There are number of oil mills in the district. There are also 44 cotton mills, Khadi Udhyog, etc, are presently in the district.

4.8 Infrastructural Facilities

Under consideration of the natural resources and its exploitation, irrigation, fertilizers, modern implements, other inputs like seeds, etc., have been studied during period under study. The performance of individual crops in respect of area, production and productivity was of mixed type.

4.8.1 District Administration

For the administrative purpose, the Kolhapur district is divided into twelve talukas and four sub-divisions known as presents; such sub-divisions are - a) Gadhinglaj - Covering Ajara, Chandgad, Shahuwadi and Kagal tahasils. b) Karveer - Covering Karveer, Panhala and Shahuwadi and Kagal tahasil. c) Ichalkaranji - Covering Hatkanangale and Shirol tahasil. d) Radhanagari - Covering Bhudargad, Radhanagari and Gaganbavada tahsils.

4.8.2 Banking

Banking is blood line in the economic development. There are in all 418 Bank branches, of which, Kolhapur District Central Co-operative Bank Ltd. (KDCC) alone has 182 branches, 17 nationalized banks of total 20 and 3 from SBI group represent at 148 places all over the district under the lead bank stewardship of Bank of India. The district has been assured with full credit support for all banking activities. The villages in the district have been divided into 168 service areas and allocated to 220 branches of commercial banks

4.8.3 Transport and Communication.

In Kolhapur district buses and railway are the significant means of transportation. The state transport buses, corporation buses, trucks, tempos, private jeeps and autos are the major means of transportation.

Total road length 9,299 kms (2011-12) and railway track length of 35.67 (2011-12). Kolhapur-Bangalore (NH-4) highway passes through this district.

Post offices (560) and telephone facilities i.e. landline 1,50,269 are available in almost all the villages. The Radio, television and internet means of communication are also spreading in the district.

(Source: Socio-economic review and statistical abstract of Kolhapur district-2011)

4.8.4 Education and Health

The literacy percentage of the district is 82.90. In the year 2011-12 there were 2597 primary schools, 892 secondary school, 237 higher secondary education organizations. There are 54 colleges. In literacy Kolhapur ranks fourteen in the state.

The medical facilities in the district are expanding day by day. At the end of year 2011-2012, 29 hospitals, 63 dispensaries, 83 maternity hospitals and 72 Public Health Centers. Death rate was 9 per thousand in 2011. To restrict population, 140 family planning centers are available today and 54357 family planning operations were conducted.

4.9 Irrigation Projects

At the end of year 2011, net irrigated area was 128000 hectares. It is 19.24 per cent of the total area under crops. At the end of 2011-2012 there are big irrigation projects *viz.,* Radhanagri, Tulsi, Doodhganga, Warna, 10 medium and 54 small irrigation projects in the district.

4.10 Electricity:

Up to 2011-12, the electricity was provided to only 1216 villages. The total use of electricity in the year 2011 was

2978115 (000kw/hr). Of the total electricity use household use was per cent, Industrial use was 381710 (000kw/hr) Commercial use 130409 (000kw/hr) and other use 98080 (000kw/hr). Electricity supply is provided to 366975 (000kw/hr) agricultural pumps.

4.11 Rural Development Programmes

For the improvement of BPL line many plans are implemented until now and continuous efforts are made to bring welfare of rural people. Employment Guarantee Scheme provides gainful and productive employment on approved works to all unemployed persons in the rural areas. The type of work in the scheme is *viz.,* minor irrigation tanks, percolation tanks, contour bunding, nala bunding, etc. biased towards agricultural development have been completed under this scheme. It has given 6.63 *lakh* man days employment at the end of 2011-2012 (Money spent under this plan is Rs. 351.28 *lakh*). The other schemes are like Drought Prone Area Programme, Training to Rural Youth for Self Employment Programme (TRYSEM), Development of Women and Children in Rural Area (DWCRA), Indira Awas Yojna given benefit to the beneficiaries. At the end of 2011-2012 under (SGSY) Swaranjayanti Gram Swarojgar Yojna 1725 families got benefited.

5. Results and Discussion

The development process is a continuous process. It is boosted after adoption of new strategy of agricultural development i.e. green revolution in 1966 and structural changes in the land use and cropping pattern of the farms took place. The first major direct effect of the green revolution that there is increase in agricultural production. Adoption of new modern technology caused a shift from traditional agriculture to modern agriculture, subsistence to commercial, extensive cultivation to intensive cultivation and from low income enterprises to high income enterprises. It gives new idea, views to farmers so that they become conscious about the development of basic assets i.e. land and other diverted resources.

The study is primarily centered on the changes in the area, production and productivity of major crops in Kolhapur district to find out a change in agriculture over period of time. The present chapter has been, therefore, organized to explain the processed facts regarding structural changes in the land use and cropping pattern as a result of agricultural development during the period from 1980-81 to 2011-12 in Kolhapur district. The data on the above aspects collected for decadal years starting from 1980-81 to 2011-12 in respect of Kolhapur district were analysed and results so obtained are explained as below.

5.1 Changes in land Use Pattern

It can be seen from Table 5.1 that the total geographical area was 7.859 *lakh* hectares in 1980-81 and it is decreased up to 7.765 *lakh* hectares in 2011-12. It decreased during the year 1995-96 and 2011-12. This variation in the total geographical area of Kolhapur district decreased due to transfer of villages to the Kolhapur district during new tahsil formation for administrative purpose.

The area under forest was 1.469 *lakh* hectares i.e. 18.69 per cent of the total geographical area in 1980-81, which declined to 1.407 *lakh* hectares in 2011-12, i.e. by 4.22 per cent over the base year. The decrease in area under forest may be due to the problems like industrialization, population, it is not desirable change for maintaining ecological balance in Kolhapur district.

The share of barren and uncultivable land decreased from 5.34 per cent to 5.15 per cent in total geographical area. Land under non-agricultural use was increased from 0.317 *lakh* hectares to 0.382 *lakh* hectares during the period from 1980-81 to 2011-12. It is used for buildings, industries and other non-agricultural purposes. The cultivable waste land area showed decline, it was 0.657 *lakh* hectare, in 1980-81 and decreased up to 0.369 *lakh* hectares i.e. 4.75 per cent of the total geographical area in 2011-12. There is more need to minimize cultivable waste land. The area under permanent pastures and land under miscellaneous trees increased over a period of time. Permanent pastures increased from 0.415 *lakh* hectare to 0.418 *lakh* hectare.

Table 5.1 Changes in the land Use Pattern of Kolhapur district

(Area in '00'ha)

Sr. No.	Particulars	1980-81	1995-96	2011-12	Change in land use pattern over base year	
					1995-96	2011-12
1	Geographical area	7859	7765	7765	-1.19	-1.19
2	Forest	1469 (18.69)	1466 (18.31)	1407 (18.11)	-0.20	-4.22
3	Barren and uncultivable Land	422 (5.34)	403 (5.00)	400 (5.15)	-4.50	-5.21
4	Land under non agril. Use	317 (4.03)	328 (3.27)	382 (4.91)	3.47	20.50
5	Cultivable Waste	657 (8.35)	367 (4.84)	369 (4.75)	-25.57	-43.83
6	Permanent Pastures	415 (5.28)	305 (3.47)	418 (5.33)	-26.50	0.72
7	Land under Miscellaneous trees	43 (0.53)	47 (0.61)	72 (0.92)	9.30	67.44
8	Current fallow	241 (3.06)	107 (1.39)	107 (1.37)	-55.60	-55.60
9	Other fallow	364 (4.63)	162 (2.11)	208 (2.67)	-55.49	-42.85
10	Net sown area	4254 (54.12)	4628 (60.22)	4306 (55.45)	8.79	1.22
11	Irrigated area	712 (9.05)	1125 (14.63)	1280 (16.48)	58.00	79.77
12	Area sown more than Once	202 (2.57)	734 (9.55)	2344 (30.18)	263.36	1060.39
13	Gross cropped area	4456 (56.69)	5362 (69.77)	6650 (85.64)	20.33	49.23
14	Cropping intensity (per cent)	104.69	115.85	154.43	10.66	47.51

(Figures in parentheses indicate the percentage to geographical area)
Source:- Season and Crop Reports published by the Department of Agriculture, Maharashtra State.

The land under miscellaneous trees showed increasing trend continuously over the period of time. The proportion of permanent pastures to the total geographical area increasing in 2011-12 and showed declined trend in 1995-96 over the base year 1980-81.

Current fallow showed decreasing trend as compared to base year 1980-81, it was 0.241 *lakh* hectare in 1980-81 and in 2011-12 it decreased up to 0.107 *lakh* hectares.

The area under other fallow decreased from 0.364 *lakh* hectares to 0.208 *lakh* hectares in 2011-12. There is variation in the other fallow land it was 0.364 *lakh* hectares in 1980-81, which was decreased to 0.162 *lakh* hectares in 1995-96 and again increase to 0.208 *lakh* hectares in 2011-12 i.e. 2.67 per cent of the total geographical area, decreased by 42.85 per cent over the base year.

The net sown area was 4.254 *lakh* hectares i.e. 54.12 per cent in 1980-81, which increased significantly in the second, and but decrease in third period. It was 4.628 *lakh* hectares in 1995-96 i.e. 60.22 per cent to the geographical area and it declined to 4.306 *lakh* hectares i.e. 55.45 per cent to the total geographical area in 2011-12.

The irrigated area is increasing considerable during entire period from 1980-81 to 2011-2012, it is increased by 79.77 per cent over the base year. In 1980-81, irrigated area was 0.712 *lakh* hectares. Due to increasing irrigation facilities and utilizing cultivable waste land for cultivation purpose the proportion of unirrigated area to irrigated area was decreased. It could be seen from the Table 5.1 that the area sown more

than once increased from 0.202 *lakh* hectares in 1980-81 to 0.734 *lakh* hectares in 1995-96. It was tremendously increased up to 2.344 *lakh* hectares in 2011-12.

The gross cropped area was increased from 56.69 per cent to 85.64 per cent in the study period, it was increased in 1995-96 i.e. 5.362 *lakh* hectares i.e. 69.77 per cent and in 2011-12 increased up to 6.650 *lakh* hectares i.e. 85.61 per cent to the total geographical area. It was increased significantly and is a good indication of agricultural development.

The cropping intensity which is measure of land use efficiency did show much change during 1980-81 to 2011-12. The range of cropping intensity was 104.69 to 154.43 per cent. It was increased in 1995-96 and in 2011-12. It was 115.85 and 154.43 per cent respectively.

To sum up it can be said that the area under forests, barren and uncultivable land, cultivable waste, current fallow, other fallow showed decreased. While Land under non-agricultural use, permanent pastures, land under miscellaneous trees, net sown area, irrigated area and gross cropped area showed increasing trend.

5.2 Expansion in Irrigated Area

The changes in net irrigated area and gross irrigated area in Kolhapur district during 1980-81 to 2011-12 have been presented in Table 5.2.

Table 5.2 Changes in Irrigated area in Kolhapur district

(area in '00'ha)

Sr. No.	Particulars	1980-81	1995-96	2011-12
1	Net sown area	4254	4467	4306
2	Net irrigated area	625	1154	1280
3	Percentage of net irrigated to net sown area	14.69	25.83	29.72
4	Area sown more than once	202	728	2344
5	Gross irrigated area	712	1219	1350
6	Percentage of gross irrigated area to gross cropped area	15.98	22.73	20.30

Source:- Season and Crop Report published by the Department of Agriculture, Maharashtra State.

It is apparent from the Table 5.2 that the net irrigated area increased from 0.625 *lakh* hectares in 1980-81 to 1.280 *lakh* hectares in 2011-2012. The proportion of net irrigated to net sown area had increased from 14.69 to 29.72 per cent during the study period from 1980-81 to 2011-2012. The gross irrigated area also showed a similar trend. This means that the irrigated area has been significantly increased in the land use pattern of Kolhapur district during the period under study.

Similar results were obtained by Maheshwari (1996), Anonymous (1998) and Rahane and Kasar (1999).

5.3. Sources of Irrigation

There are different sources of irrigation *viz.,* canal**,** river, lift, well in the district. But the major sources of irrigation is well irrigation, which are depicted in Table 5.3

Table 5.3 Change in the area irrigated by various sources in Kolhapur district

(Area in '00' ha)

Sr. No.	Particulars	1980-81	1995-96	2011-12
1	Surface irrigation other than wells	440 (70.4)	779 (67.50)	806 (63.00)
2	Well irrigation	185 (29.16)	375 (32.49)	473 (37.00)
3	Total	625 (100)	1154 (100)	1280 (100)

Source:- Season and crop report published by the department of agriculture, Maharashtra state.

It can be observed from the Table 5.3 that surface irrigation other than wells was the principal source of irrigation covering 0.440 *lakh* hectares of land was about 70.4 per cent of the net irrigated area in the year 1980-81, and declined from 70.4 per cent to 63 per cent during the period from 1980-81 to 2011-2012. The area irrigated by well irrigation increased significantly from 29.16 per cent to 37 per cent during the year 1980-81 to 2011-12. At the end of 2011-12 well irrigation was 37 per cent of the net area irrigated and principal source of covering 0.473 *lakh* hectares of area today. It is noted that irrigation lifts installed on rivers and canals are important source of irrigation next to well in the Kolhapur district.

5.4 Changes in the Cropping Pattern of Food Grains and Non-food Grain Crops

The details regarding the changes in the cropping pattern of Kolhapur district presented in Table 5.4.

It can be seen from the Table 5.4 that the area under rice increased from 1.051 *lakh* hectares in 1980-81 to the 1.115 *lakh* hectares in 2011-2012. But it showed increasing over time period, in 1995-96 it was increased 1.074 *lakh* hectares similarly it was increased 1.115 *lakh* in 2011-12. The area under wheat decreased from 0.118 *lakh* hectares in 1980-81 to 0.086 *lakh* hectares in 2011-12 i.e. from 2.64 per cent to 1.29 per cent of the Gross cropped area. The area under kharif Jowar increased in second, third period as compared to base year. Similarly the area under rabi Jowar showed fluctuations. It was 0.009, 0.003, and 0.140, *lakh* hectares in 1980-81, 1995-96 and 2011-12 respectively. Area under Bajra showed decreasing trend except in 1995-96, it increased over base year. The total cereals showed declining in second and third period of study.

Area under Gram was 0.089 *lakh* hectares in 1980-81 and decreased up to 0.086 *lakh* hectares in 2011-12 i.e. from 1.99 per cent to 1.27 per cent and area under red gram declined over base year because area of gram and redgram was shifted for cash crops.

Green gram increased from 0.004 *lakh* hectares to 0.030 *lakh* hectares from 1980-81 to 2011-12 i.e. from 0.08 per cent to 0.45 per cent.

Table 5.4 Changes in the cropping pattern of Kolhapur district (area in '00' ha)

Sr. No.	Particulars	1980-81	1995-96	2011-12	Percent change in cropping pattern over base year 1980-81	
					1995-96	2011-12
1	Rice	1051 (23.58)	1074 (20.02)	1115 (16.76)	2.1	6.08
2	Wheat	118 (2.64)	94 (1.75)	86 (1.29)	-20.33	-27.11
3	Kharif-Jowar	34 (0.76)	96 (1.79)	80 (1.20)	182.35	135.29
4	Rabi- Jowar	9 (0.20)	3 (0.05)	14 (0.21)	-66.66	55.55
5	Bajra	26 (0.58)	58 (1.08)	24 (0.36)	123.07	-7.6
6	Other	907 (20.35)	512 (9.54)	465 (5.78)	-43.55	-48.73
	Total Cereals	2145 (48.13)	1837 (34.25)	1786 (26.85)	-14.35	-16.73
7	Gram	89 (1.99)	86 (1.60)	85 (1.27)	-3.37	-4.49
8	Red Gram	49 (1.09)	29 (0.54)	24 (0.36)	-40.8	-51.02
9	Green Gram	4.00 (0.08)	16 (0.29)	30 (0.45)	300	650
10	Black Gram	10 (0.22)	34 (0.63)	25 (0.37)	240	150
	Total Pulses	288 (6.46)	257 (4.79)	218 (3.28)	10.76	-24.30
	Total Foodgrains	2433 (54.60)	2094 (39.05)	2004 (30.13)	-13.93	-17.63
11	Sugarcane	500 (11.22)	900 (16.78)	1399 (21.03)	80	179.8
12	Fruits and Vegetables	29 (0.65)	81 (1.51)	153 (2.3)	179.3	427.58
13	Cotton	5	3	2	-40	-60
14	Groundnut	500 (11.22)	610 (11.37)	583 (8.76)	-22	16.6
15	Soybean	200 (4.48)	440 (8.20)	485 (7.29)	120	142.5
	Other	16 (0.35)	92 (1.71)	56 (0.84)	475	250
	Total Oilseeds	716 (11.57)	1142 (21.29)	1124 (16.90)	59.49	56.98
16	Other Crops	978 (21.94)	1145 (21.35)	1952 (29.53)	17.07	99.59
17	Gross Cropped Area.	4456	5362	6650	20.33	49.23

(Figures in parentheses indicate percentage to gross cropped area)

Source :- Season and Crop Reports published by the Department of Agriculture, Maharashtra State.

Area under total pulses decreased from 0.288 *lakh* hectares to 0.218 *lakh* hectares i.e. 6.46 per cent to 3.28 percent from 1980-81 to 2011-12. Area under total food grains also decreased from 2.433 *lakh* hectares to 2.004 *lakh* hactares from 1980-81 to 2011-12.

Area under sugarcane showed tremendous increase in area due to increase in number of sugar industry and jaggery making unit. It was 0.500 *lakh* hectare in 1980-81 and increased up to 1.399 *lakh* hectares in 2011-2012. Area under fruits and vegetables increased from 0.029 *lakh* hectares to 0.153 *lakh* hectares due to Maharashtra Governments launched orchard plantation programme. Area under cotton showed decreasing.

Another crops among oilseeds, groundnut showed fluctuations in area. Total oilseeds showed increasing trend from 0.516 *lakh* hectares to 1.124 *lakh* hectares from 1980-81 to 2011-12. It was seen from the table that the area under commercial crops is increasing *viz.,* sugarcane except cotton.

Area under soybean crop increased 10.20 percent in 2011-12 over the base year take 1995-96.

To sum up it can be said that the area under total cereals, total pulses and total foodgrains showed declined trend. While area under total oilseed crops showed increasing trend over the entire study period. Area under fruits and vegetables, sugarcane, groundnut and soybean also showed increasing trend under entire study period.

Similar results were obtained by Johl and Sing (1966), Naikawadi (1980) and Pawar *et. al.* (1991).

5.5 Changes in Consumption of N, P, K

Table 5.5 gives the details on the changes in the total consumption of fertilizers in Kolhapur district during 1980-81 to 2011-2012.

Table 5.5 Total consumption of fertilizers in Kolhapur district (metric tonnes)

Year	N	P	K	Total
1980-81	25808	13913	10038	49759
1995-96	61965 (140.09)	21032 (51.16)	19934 (98.58)	102931 (106.85)
2011-12	190850 (639.49)	40241 (189.23)	39358 (292.09)	270449 (443.51)

(Figures in parentheses indicate percentage change over the base year.)
Source:- Season and Crop Report Published by Department of Agricultural Maharashtra State.

It is seen from the Table 5.5 that the total consumption of fertilizers in Kolhapur district was 49759 MT. in the year 1980-81, which had increased to 270449 M.T. in the year 2011-2012. The per hectare N, P and K consumption showed an increasing trend during the entire period under study, especially in the last three decades. It was also noted that during the span of last two decades, the consumption of N and P increased as compared to K. It was mainly due to the farmers awareness towards use of chemical fertilizers for improving the productivity of crops and the governments incentives and subsidy to phosphatic fertilizers

Similar results were obtained by fertilizer Association of India (1982) and Naikawadi (1980).

5.6 Changes in the Productivities of Major Crops

In the previous section, an attempt has been made to study the agricultural development in terms of changes in the land use and cropping pattern during the last 32 years in Kolhapur district. It is believed that the process of agricultural development has pronounced effects on productivity of agriculture and as a result higher level of agricultural production is achieved per unit of available resources. Table 5.6 indicates the changes average productivity of major crops in Kolhapur district.

It is observed from the Table 5.6 that the productivity of all cereals have increased over the base year. The productivity of rice was 1122 kg/ha in the year 1980-81 which increased to 2880 kg/ha during the year 2011-12. Among the cereals the productivity of rice had maximum 156.68 per cent over the base year. In the case of wheat, productivity had increased from 1584 kg/ha in 1980-81 to 2650 kg/ha in 2011-12.

The productivity of kharif jowar and rabi jowar increased by 16.16 and 221.16 per cent respectively, over the base year. In case of bajra, average productivity had increased during the span of last thirty two years in Kolhapur district. In case of gram and green gram productivity increased by 62.69 and 152 per cent over the base year. However, maximum productivity increase of 62.69 per cent in gram during the Period-III and on green gram 152 per cent during the Period-III.

Table 5.6 Changes in the productivities of major crops

(Kg/ha)

Sr. No.	Particulars	1980-81	1995-96	2011-12	Percent change over base year 1980-81	
					1995-96	2011-12
1	Rice	1122	1145	2880	2.04	156.68
2	Wheat	1584	2074	2650	30.93	67.29
3	Kharif-Jowar	1627	1819	1890	11.80	16.16
4	Rabi-Jowar	411	229	1320	-44.28	221.16
5	Bajra	222	333	307	50	38.28
	Total cereal	1643	2064	2731	25.38	66.22
6	Gram	516	779	840	50.96	62.69
7	Redgram	959	517	330	-46.08	-65.58
8	Black Gram	500	500	840	0	68
9	Green Gram	250	500	630	100	152
	Total Pulses	579	571	631	-1.38	8.98
	Total Food grains	2222	2636	3363	18.63	50.67
10	Sugarcane	81230	82837	90000	1.97	10.79
11	Soybean	1000	1470	2544	47	154.4
12	Groundnut	1042	1629	1520	56.33	45.87
	Other	259	44	25	-83.01	-90.34
	Total oilseeds	2300	3143	4064	36.65	76.64

(Figures in parentheses indicate per cent age change over the base year.)

Source :- Season and Crop Report Published by Department of Agricultural Maharashtra State.

In case of red gram, the average productivity had decreased during the span of last thirty two years in Kolhapur district. The productivity of red gram decreased by 65.58 per cent over the base year. In the case of total pulses the average

productivity had increased from 579 kg/ha in 1980-81 to 631 kg/ha in 2011-12. In the case of total foodgrains the average productivity increased from 2232 kg/ha in 1980-81 to 3363 kg/ha in 2011-12. The productivity of sugarcane was 81230 kg/ha in the year 1980-81 which was increased to 90,000 kg/ha in the year 2011-12.The productivity of soybean increased by 73 per cent in the year 2011-12 over the base year 1995-96.

It is noted that the average productivity of groundnut had increased from 1042 kg/ha in 1980-81 to 1520 kg/ha in 2011-2012.

In the case of total oilseeds, the average productivity had increased from 2300 kg/ha in 1980-81 to 4064 kg/ha in 2011-12. Thus, the increase in the average productivity of major crops in Kolhapur district is a good sign of agricultural development in the district.

5.7 Growth rates in area, production and productivity of cereals and pulses

The period wise annual compound growth rates in area, production and productivity of cereal crops for the period 1980-81 to 2011-12 are presented in Table 5.7.The compound growth rates of area, production and productivity of all cereals, pulses, oilseed and sugarcane fluctuated widely during the period under consideration. The production and productivity of cereals like maize, kharif jowar and wheat is positive and highly significant for the entire period of thirty two years. The production and productivity of total cereals increased 0.20 and 1.26 per cent per annum, It clearly showed for Kolhapur district the production of total cereals during the

span of thirty two years had increased mostly by improving in the productivity of cereals and less by increase in area under cereals. The area, production and productivity of total cereals had increased at higher rates (0.24,1.31 and 1.26 per cent) during period II (1995-96 to 2011-12) as compared to period I (1980-81 to 1994-95) and period III (1995-96 to 2011-12).

Among different cereals, the annual growth rates in area, production and productivity of wheat, rice, kharif and rabi jowar for period II, III was positive and highly significant except productivity of kharif jowar in period II negative. The growth rates for bajra were negatively highly significant during II and III study period. In general, the annual growth rates of area, production and productivity of cereals *viz.,* wheat, kharif jowar, rice, rabi jowar showed an increase at higher rates in period II (1995-96 to 2011-12) and period III (1980-81 to 2011-12) as compared to period I (1980-81 to 1994-95) except productivity of kharif jowar at period II is negative. The annual compound growth rates in area, production and productivity of pulses in Kolhapur district have turned out to be positive and highly significant during the entire period (1980-81 to 2011-12) except area in period II and III negative. The production and productivity of total pulses in Kolhapur district had increased at the rate of 0.68, and 1.34. The growth rates for area seems to be almost negative. Thus growth in production primarily attributed to productivity of HYV. As far as different periods are concerned, all the periods except I showed negative growth rates for area, because area of pulse crops shift for commercial crops. The annual growth rates in area, production and productivity of total pulses have

increased at the rate (1.21,2.71, and 1.43 per cent) during period I as compared to period II (-0.11, 1.05, 1.20) and period III (-O.67, 0.68 and 1.34 per cent). In general, it is indicated that there is great scope to increase the area and production of total pulses in Kolhapur district.

Among pulses studied for the Kolhapur district, total pulses growth rates for overall period were positive and highly significant. Black gram, green gram and red gram had positive and significantly higher growth rates over entire period thirty two years of study. Red gram productivity decreasing in period III but its area, and production had positive and significant growth rates over period II and III. The total food grain area, production and productivity fluctuate over study period. The production and productivity of food grain increasing positively and highly significant during period I (1980-81 to 1994-95) compare to period II (1995-96 to 2011-12) and period III (1980-81 to 2011-12).

Table 5.7: Growth rates in area, production and productivity of cereals and pulses in Kolhapur district

Sr. No.	Crops	Period I (1980-81to 1995-96)			Period II (1995-96to2011-12)			Over all period (1980-81to2011-12)		
		A	P	Y	A	P	Y	A	P	Y
1	Rice	-0.17	1.10	0.24	23.4*	24.00**	3.87***	21.80***	22.76***	4.14***
2	Kh.Jowar	4.96***	17.04***	1.44	20.22*	18.69*	-0.72	25.05***	30.85***	1.17**
3	Rabi jowar	-6.96***	-2.20	2.90	56.87***	68.95***	7.16***	40.42***	53.27***	4.71***
4	Bajra	4.39	22.43**	5.11*	-19.02***	-28.11***	-29.52***	-14.05***	-20.59***	-22.54***
5	Wheat	-3.82**	-1.70	2.19***	24.79**	28.74**	2.05***	3.05***	20.91***	2.0***
6	Maize	-3.14***	1.39	1.59	16.68*	69.47***	3.68***	13.13***	53.47***	1.31
7	Total cereals	1.05***	1.01*	-2.86	0.24**	1.31**	1.26*	-0.85***	0.24	1.26
8	Red gram	3.62	-1.27	-0.52	21.76	21.51*	2.80	21.03***	18.50***	-0.56
9	Gram	8.04	12.28**	0.56	21.57*	23.24*	1.39**	24.56***	26.74***	-0.11
9	Green Gram	21.82***	27.20***	4.59**	31.15**	32.06**	0.35	31.34***	35.14***	2.04***
10	Black gram	12.84***	14.27***	1.23	21.64*	21.35*	0.16	27.83***	29.99***	1.69**
11	Total pulses	1.21	2.71*	1.43*	-0.11	1.05	1.20**	-0.67*	0.68**	1.34***
12	Total food grains	-0.72*	1.073*	1.85***	0.004	1.20*	-1.84**	-0.88***	0.21	-0.70**

*,**,*** significant at 10, 5 and 1 per cent level of significance A- Area P- Production Y- Productivity

5.8 Growth Rate in Area, Production and Productivity of Total Oilseeds and Commercial Crops

The area, production and productivity of total oilseeds, cotton and sugarcane crop had fluctuated widely during the period under study in Kolhapur district. The growth rates in area, production and productivity of oilseeds for entire period have turned out to be positive and increased at the rate of 2.02, 3.65 and 1.43. The growth rates for period III (1980-81 to 2011-12) were 2.02, 3.65 and 1.43, which were positive and highly significant showing satisfactory growth rate. However it decreased in period II.

The crop of groundnut is the important oilseed crop in Kolhapur district. The area production and productivity of groundnut had positively and highly significant during period I, II and III, except productivity of groundnut in period III negatively significant.

The growth of soybean area, production and productivity positive and highly significant during period of study. The growth rates in area production and productivity of soybean crop increased at (56.80, 61.39 and 33.37) in entire period of study.

Among the different cash crops cotton was positive and highly significant in period II, and III, except productivity in period III negatively significant. Sugarcane had a positive and significant growth rates for area, production and productivity as 25.98, 31.71 and 5.07 per cent, respectively. This may be attributed growth of sugar factory increased.

From the above analysis, it can be concluded that there exist wide variabilities in the performance of individual crops in terms of changes in their performance, total production, productivity in the district over a period under study.

Thus, it clearly indicated that progress of agricultural development in Kolhapur district and its positive effect.

Table 5. 8 : Growth rates in area, production productivity of oilseeds and commercial crops in Kolhapur district

Sr. No.	Crops	Period I (1980-81 to 1995-96)			Period II (1995-96 to 2011-12)			Over all period (1980-81 to 2011-12)		
		A	P	Y	A	P	Y	A	P	Y
1	Groundnut	3.30***	7.22***	4.05***	28.28**	16.17	-1.78	24.17***	23.15***	-2.14*
2	Safflower	-11.44**	-11.66**	8.55***	-3.80**	3.22***	-2.2***	-22.54***	23.1**	9.5***
3	Soybean	68.75***	80.35***	106.09***	22.55*	29.40**	1.54	56.80***	61.39***	33.37***
4	Total oilseed	-0.22	0.193	0.42	-0.02	2.33	0.74	2.02***	3.65***	1.43***
5	Cotton	-11.24***	-6.60	3.57**	22.52*	26.09***	7.55	17.08***	22.01***	-6.64*
6	Sugarcane	3.25***	25.53***	20.64***	27.80**	23.01*	0.51	25.98***	31.71***	5.07**

*,**,*** significant at 10, 5 and 1 per cent level of significance A- Area P- Production Y- Productivity

5.9 Development in the Infrastructure Facilities

Under consideration of the natural resources and its exploitation, irrigation, fertilizers, modern implements, other inputs like seeds, etc., have been studied during period under study. The performance of individual crops in respect of area, production and productivity was of mixed type. In case of rice, sugarcane, groundnut, crops there was sizable increase in production whereas, the performance of wheat, soybean, gram, green gram, black gram, oilseeds showed better performance in productivity. In this process of development infrastructural facilities play direct or indirect role has been explained.

5.9.1 Changes in Area Under High Yielding Varieties

Table 5.9 Changes in area under high yielding varieties in Kolhapur district

(Area in '00' ha)

Sr.No.	Crop	1980-81	1995-96	2011-12
1	Paddy	714	935(30.95)	1027(43.83)
2	Jowar	297	500(68.35)	645(11717)
3	Wheat	300	432(44.00)	575(91.66)
	Total	1311	1867(42.41)	2247(71.39)

(Figures in the parentheses indicate percentage change over the base year.)
Source :- District wise Agricultural Statistical information Maharashtra State,

The High Yielding Variety technology was introduced after 1966-67 shortly after the introduction of High Yielding Variety, it gained momentum during the years and area under High Yielding Variety, had gained increased drastically. As compared to the base year the adoption of High yielding Variety`s of paddy, jowar and wheat had increased over the

entire period. This has naturally affected the agricultural development in Kolhapur district.

5.9.2 Changes in the Average Annual Rainfall

Table 5.10 Changes in the average annual rainfall in Kolhapur district.

Period	Rainy days	Rainfall (mm)	Per cent change over the base year	Per cent change Over previous decade
1980-81	78	1157	100	-
1995-96	95	1420	22.73	22.73
2011-12	73	1033	-10.71	-27.25

(Source : Season and Crop Reports published by Department of Agriculture, M.S.

It is seen that the rainfall in Kolhapur district showed a varying nature throughout the entire period under study. It was observed that the rainfall in period II, had increased by 22.73, per cent And III period decreased by 10.71 respectively to the base year. Due to such variation in rainfall during the span of 32 years, the water availability also varied leading to the variation in agricultural production.

Fluctuations in the per cent change of rainfall to previous period the validity of the above quoted statements, where we see both positive and negative per cent changes in the rainfall over the periods.

5.9.3 Changes in the Use of Implements and Machinery

It is observed from the Table 5.11 that, the use of wooden ploughs, sugarcane crushers and oil engine had declined, whereas the use of electric pump, iron plough and

tractors had increased considerably over the period under study. The detailed observation revealed that the use of wooden ploughs was replaced by iron ploughs and tractors. It was interesting to note that the use of iron ploughs increased and use of wooden ploughs had decreased. It is indicated the shift from wooden plough to iron plough and use of tractors, which were tremendously increased over the base year.

The use of sugarcane crushers in Kolhapur district had continuously declined over a period of time. It was mainly due to the decrease in gur producing units and increasing sugar factory units in the district. The most noticeable change was in the case of electric motors, which showed an increase by 56.76 per cent over the base year. It was mainly due to the increase in area under well irrigation.

Table 5.11 Changes in the use of implements and machinery in Kolhapur district.

Year	Wooden Plough	Iron Plough	Oil Engine	Electric Motors	Sugarcane Crusher	Tractors	Wet and Puddler
1980-81	96249	17289	13225	149.89	1337	2194	100
1995-96	89514 (-6.99)	27272 (57.74)	9699 (-26.66)	21279 (41.96)	833 (-37.69)	3809 (73.60)	1390 (1290)
2011-12	45007 (-53.23)	22618 (30.82)	8062 (-39.03)	23498 (56.76)	1264 (-5.45)	5932 (170.37)	2232 (2132)

(Figures in the parentheses indicate percentage change over the base year, 1980-81)

Source : Agricultural Census of respective years, Season and Crop Reports published by Department of Agriculture, M.S.

It is thus clear that use of tractors and electric motors had increased considerably in the district over a period of time

contributing significantly in the development of agriculture in the district.

5.9.4 Changes in the Livestock Population

Table 5.12, depicts the changes in livestock population which indicated that the population of cows and poultry had decreased whereas that of buffaloes, sheep, goats and total livestock had increased over a period of time.

The main reason for increase in number of buffaloes were the high rate for buffalo milk yield obtained from them as compared to cows. It is seen that the total livestock population had been increased by 6.88 per cent over the base year. The populations of buffaloes, sheep and goats had also increased by 34.22, 8.19 and 11.11 per cent respectively over the base year.

Table 5.12 Changes in the livestock population in Kolhapur district

Year	Cattle	Buffaloes	Poultry	Sheep	Goats	Total Livestock
1992	254797	481438	1382797	153116	172313	1136722
1997	260728 (2.32)	575568 (19.55)	1582940 (14.47)	184343 (20.39)	175232 (1.70)	1281929 (12.77)
2007	253347 (-0.56)	646217 (34.22)	868319 (-37.20)	165668 (8.19)	191459 (11.11)	1215010 (6.88)

(Figures in the parentheses indicate per cent change over the base year)

Source :- Socio-Economic Survey of Kolhapur district for the respective years

5.9.5 Changes in the Development of Road Length

Roads are the very important and basic infrastructural facility. It is needed for development of any sector of the economy. Its development gives better transport and communication of rural area to town. As agricultural produce is seasonal and regional in nature, it requires quick transport for marketing. It can be observed from the Table 5.13 that the road length in Kolhapur district has been increased from 4375 km in 1980-81 to 9363 km in 2011-2012. The railway 39.68 km remain same in 1980-81 to 2011-2012 period. There is need for development of railway, national and state highway because it helps to improve marketing, which in turn will lead to the development of agriculture in the district as a whole.

Table 5.13 Changes in the development of road length in Kolhapur district

(Distance in km)

Year	National Highway	Main and other state highway	Major district Roads	Village roads	Others	Total	Railway
1980-81	47	640	1089	1345	1254	4375	39.68
1995-96	112 (138.29)	912 (42.05)	1449 (33.05)	1697 (26.17)	1588 (26.63)	5653 (222.73)	39.68
2011-12	112 (138.29)	1960 (206.25)	1644 (50.96)	3630 (169.88)	2112 (68.42)	9363 (430.78)	39.68

(Figures in the parentheses indicate per cent change over the base year)

Source :- Socio-Economic Survey of Kolhapur district for the respective years

5.9.6 Changes in Credit Disbursement through KDCCB

Credit is also important one input needed to the farmer for development of agriculture. As Indian farmers are poor so

authentic and timely supply of credit gives boost to the agricultural production. It is revealed from the Table 5.14 that, the credit disbursed through KDCCBs in Kolhapur district had been continuously increasing during the period under study. The credit disbursed by KDCCB increased from Rs. 3123 *lakh* to as 124445.56 *lakh* during the period from 1980-81 to 2011-12. The tremendous increase in credit disbursement reveals that the farmers of Kolhapur district are taking advantage of institutional finance for overcoming their financial needs, is a significant change.

Table 5.14 Changes in credit disbursed through KDCCB in Kolhapur District.

(*Lakh* rupees)

Year	Credit disbursed through KDCCB	Percent change over base year
1980-81	3123	-
1995-96	7284	133.21
2011-12	124445.56	3884.08

(Figures in the parentheses indicate per cent change over the base year)

Source:- Socio-Economic Survey of Kolhapur district for the respective years

5.10 Factors Responsible For Agricultural Development

In the earlier part of this chapter we have discussed the change in land use pattern, cropping pattern, input use, change in the infrastructural facilities, annual compound growth rates in area, production and productivity of major crops grown in Kolhapur district. This analysis mostly relied on the sample mean, percentage and proportion of individual items in the total of respective variates. The type of analysis deployed for the purpose, however had certain limitations of

its own as it could not measure the relative contribution of individual variables in combination of other variables in influencing total agricultural development of Kolhapur district.

The factors responsible for agricultural production in Kolhapur district are very important. Therefore, the multiple linear regression equation was fitted to the data to obtain the factors responsible for agricultural production in Kolhapur district.

Multiple Linear Regression Analysis

The details regarding the specification of the multiple linear regression model and measurement of variables have already been given in the chapter of methodology. The following variables were selected for estimating the multiple linear regression equation.

The production function analysis with above variables was carried out for the macro level time series data of agricultural development in Kolhapur district. The regression coefficient of the variables *viz.,* percentage of gross irrigated area to gross sown area *(X_1),* consumption of total fertilizer (NPK) per ha of gross irrigated area *(X_2),* Percentage of area of high yielding variety seeds to gross sown area (X_4), Percentage of area under commercial crop to gross sown area (X_5), amount of loan (Short and Medium term) disbursed through KDCCB per year in *Lakh* of rupess (X_6) and number of milch animals (X_9), turned out to be positive and highly significant at 1, 5 and 10 per cent level of significance indicating thereby that, the agricultural production of Kolhapur district is highly responsive to these important variables. The regression

coefficient of per cent age of gross sown area to net sown area (*X3*), average rainfall in the district (mm) (*X_7)* and area under fruit crops in hectare (X_8).

Table 5.15 Regression coefficients of multiple determination for agricultural development in Kolhapur district

Sr. No.	Variables	Regression Coefficients
1	Constant/intercept	11.94
2	Percentage of gross irrigated area to gross sown area (X_1)	0.57**
3	Consumption of total fertilizer (NPK) per hectare of gross irrigated area in kilograms(X_2)	0.428*
4	Percentage of gross sown area to net sown area (X_3)	0.02
5	Percentage of area of high yielding variety seeds to gross sown area (X_4)	0.09**
6	Percentage of area under commercial crops to gross sown area (X_5)	0.008*
7	Amount of loan (short term and medium term) disbursed through KDCCB per year in *lakh* of rupees (X_6)	1.15***
8	Average annual rainfall in the district (mm) (X_7)	0.007
9	Area under fruits crop in ha (X_8)	0.31
10	Number of milch animals (X_9)	2.05**
11	Coefficient of multiple determination (R^2)	0.92

*, ** and *** indicates 10, 5 and 1 per cent level of significance, respectively.

Was turned out to be positive association with the increase in the value of total output the regression coefficient of these factors have turned out to be non significant it is thus clear that the factors such as the regression coefficient of the variables *viz,* percentage of gross irrigated area to gross sown area *(X_1),*

Consumption of total fertilizer (NPK) per ha of gross irrigated area *(X_2),* Percentage of area of high yielding variety seeds to gross sown area (X_4), Percentage of area under commercial crop to gross sown area (X_5), amount of loan (Short and Medium term) disbursed through KDCCB per year in *Lakh* of rupess (X_6), Number of milch animals (X_9), have importance in the process of agricultural development in Kolhapur District.

5.11 Strengths, Weakness, Opportunities and Threats (SWOT) of Agriculture

SWOT analysis is simple but effective tool of analysis which helps in policy formulation. It visualizes the future on the basis of present status. The strengths of the sector are the result of successful strategies of the past and the opportunities can be reaped with blend of new and old strategies. The weaknesses and threats are the hurdles for development may be due to past mistakes and newly emerging trends. The present chapter devotes its attention to the SWOT analysis of Kolhapur District with focus on agriculture and allied sectors.

First overall strengths and weaknesses as well as opportunities and threats are presented here.

STRENGTHS

1) Assured Rainfall:

The district is well placed from rainfall point of view. The total average rainfall and total no. of rainy days of the district is 1247.50 (mm) and 90 respectively.

2) Co-operative Network:

The cooperative sector is well diversified and well developed due to the efforts made by successful cooperators like Hon Ratanappa Kumbhar, Late Shri Tatayasaheb Kore, Balasaheb Mane, Kalapana Awade and others. The spread of cooperatives helped the farmers to receive remunerative price for their product and receive basic inputs required for agriculture through Vikas Society. At present the no. of co-operative societies are 2374 in the Kolhapur district.

3) Irrigation Facilities:

The blessings of nature and the efforts by the farming community collectively resulted into the spread of irrigation facilities. The irrigation facilities in the district help in raising the productivity. The Kolhapur Type irrigation pattern is now well accepted pattern known as KT Weirs. In the Kolhapur district total no. of tanks, open wells, and lift irrigation were 104, 17045, and 19605 respectively.

4) Connectivity and Transport Facility:

In modern era the role of connectivity and transport facility needs no elaboration. The district is well connected with major cities by rail and road. The villages in the district are connected with all season roads. The modern transport

facilities such as travels, and other transport vehicles are available and tractors are used in the agricultural operations. The use of internet and mobile phones is also increasing at exponential growth rate.

5) Well Drained Soils:

The topography of the region shows that the water logging does not occur. The well drained soil is another important feature and merit of the district.

6) Availability of Green Fodder throughout the Year:

The prudent use of irrigation has lead to increase the area under sugarcane. The Kolhapur district is the sugar bowl of Maharashtra. This has resulted in availability of green fodder to the animal husbandry.

7) Women Participation:

The role of women in the agriculture sector in general and for farm activities in particular is very important. The entire rural household economy is dominated by women as they are anchoring various economic activities. The work done by social reformers like Rajshree Shahu and Karmveer Bhaurao Patil has spread the education in the women community who are capable to understand and undertake various economic activities.

8) Dairy Network:

The rural economy of Kolhapur district is more resilient to the economic shocks due to its diversification in other gainful activities such as dairy. The spread of sugarcane helped the marginal farmers and agricultural laborers to utilize their savings and skill for dairy business.

9) Good Network of Input Supply:

The availability of adequate and timely inputs is a pre condition for success in any sector. The district posses the good net work of cooperative and private suppliers of agricultural inputs. The service centers plays an important role. The total no. of service centres, seed/fertilizers, irrigation systems, and Agricultural consultancy are 2142, 1774, 197 and 152 respectively in the Kolhapur district.

10) Good Research and Extension Infrastructure:

The productivity of the crop depends largely on the research and extension activities. The district offers these services to the farmers through the regional training centers and field workers. The demonstration of new seeds new practices by these extension centers has increased the adoption rate for new technology resulting in productivity growth.

11) Maximum No. of SHGs:

The Self Help Groups are now becoming contact points for providing institutional support. The efforts done by NABARD has resulted into spread of SHGs. The district has shown its lead in this new form and now the district has maximum numbers of SHG.

12) High Percentage of Innovative Farmers:

The response of the farmers and their initiative plays very crucial role in determining the shape and growth of the region. The adoption of new practices, search for better farming practices has lead to higher income of the farmers and of the region.

- **WEAKNESS**

1) Occurrence of Floods:

The Almatti dam in Karnataka has created the problem of floods in recent years. The occurrence of floods in the year 2005-06, 2006-07 and 2007-08 which affect the area 74639.69, 46144.68 and 9231 hectare respectively in the district.

2) Heavy Soil Erosion:

The topography of the district acts adversely for soil quality. The recurrence of the flood in the recent years has caused heavy damage to the soil quality. The excessive use of water and chemicals also resulted in deterioration in quality of soil.

3) Interrupted Power Supply:

The modernization of agriculture has resulted in dependence on electric power. But the erratic and irregular supply of electricity has caused immense problems to the farmers. The load shading for agriculture resulted in delay or non availability of water to the crops. Moreover the erratic fluctuations in electric power have caused damage to the electric pump sets and other instruments. The agriculture sector gets lowest priority in the distribution of electricity and blamed for the theft.

4) Dairy for Livelihood:

As the land available to majority of the farmers is uneconomic and with lower yield due to sub standard quality of land it has made the farmers to find out an alternative to

support the agricultural income. This has lead to dairy development in the region. The spread of cooperative pattern for dairy also helped spread of agriculture. The rising cost of inputs has caused pressure on the small farmers even for diary business. This calls for diversification in agricultural activities and income generation.

5) Non Cultivation of Fodder for Dairy:

The dairy sector heavily depends on sugarcane for the fodder. The fluctuations in sugarcane production lead to fluctuation in supply of fodder. Moreover the quality of fodder due to sole dependence of sugarcane is also a problematic feature. The absence of fodder cultivation is limiting factor for healthy growth of dairy sector.

6) Mono Cropping:

The cropping pattern suffers from the defect of mono cropping. The farmers follow the success story of one farmers and turns to the same crop. For traditional crops like paddy the problem of mono cropping is more serious.

7) Imbalance Use of Water and Fertilizers:

The basic inputs of agriculture like water and fertilizers are being excessively used due many misconceptions and wrong practices. As the electric supply is irregular the farmer tries to exploit maximum water from the available sources. This causes excessive use of water and then shortage latter on. The fertilizer use is not based on soil testing which leads to unbalanced use of it.

8) Water Pollution due to Industrial Waste and City Waste:

The river Panchganga in Kolhapur district is known for its highest level of pollution. This caused by the effluents of the sugar factories and city waste drained directly in river. This causes health problems to the farmers residing on the bank of the river and pollution for crops also.

9) Limitations for Mechanical Farming:

The small size of the holding limits the use of mechanical farming. As the average farm size for 73% farmers is less than one hectare they cannot afford the rents of tractors and modern machines. This reduces the productivity.

10) Non-availability of Labour:

The recent trend of shortage of labour especially during season is one more limitation for the region. The wage rates are on rise and competition among the farmers has created wage spiral and shortage of labour.

- **OPPORTUNITIES**

The district offers various opportunities both of short term and long term in nature. The potential of the district can be exploited with the full understanding of these opportunities for attaining accelerated development.

1) Commercialization of Dairy Business:

The dairy business offers steady and ready income to the farmers. The marginal farmers have sustained his life with the support of the dairy business. Now the dairy business needs to be modernized and commercialized. This will turn the subsistence dairy to commercial dairy.

2) Scope for Improvement of Productivity Levels:

The overall productivity of various crops is low both comparatively and considering the potential of the region. The support to the framers to raise the overall productivity based on the micro analysis of the region will transform the economy of the district.

3) Scope for Marketing:

The success of agriculture depends largely on success in marketing. Hence the linkage of farm sector with marketing efficiency is another potential opportunity. The cooperative net work already exists in the district. This can be used as the base for extending for modernization and converting in e-chopals. The farmer's club can also act as facilitator for this.

4) Scope for Increasing Cropping Intensity:

The cropping intensity of the district is low which can be raised through better techniques of irrigation can increase the cropping intensity. The increase in cropping intensity contributes for attaining the targeted growth rates.

5) Scope for Diverting Towards Cash Crops:

The cropping pattern needs shift from tradition oriented to market drive pattern. The value addition determines the level of income of the framers hence, it is necessary to change the cropping pattern. This included reduction in crops consuming more inputs and adding less to the income. The major growth driver for the region is the diversion of low yield low value added crop to high yield and high value added crops.

6) Scope for Increasing Area under Vegetables:

The vegetable production is labour intensive and high value addition activity. The large number marginal farmers can effectively use their land for vegetable cultivation. The urbanization in the district adding growing demands for the vegetables.

7) Scope for Increasing Area under Pulses and Oil Seeds:

The reduction on dependence on cereals and increasing the area for pulses and oilseeds also helps to increase the income of the farmers.

8) Diversification of Farming Enterprises:

The agricultural risk both in terms of over production as well as crop failure causes heavy loss to the farmers. This can be reduced through diversification of farming activities.

9) Scope for Contract Farming:

The new institutional arrangement to reduce the risk in agriculture and bring the corporate expertise to the farm level is the contract farming. The risk is shared between the framer and the contracting company. The district has demonstrated the success of contract framing in baby-corns and can be used for other crops too.

10) Scope for Harvesting of excess Rain:

The district receives sufficient rain but it is not properly stored and used. The farm ponds and other mechanisms will result in rational use of water and contribution for irrigation potential.

11) Scope for Horticulture Plantation:

The horticulture plantation and income generation through it can act as another driver for the district. The additional area as well as crop diversification will lead to expansion of horticulture.

- **THREATS**

The growth potential of the district faces some threats which need to be considered while designing the policy package.

1. Over Exploitation of Natural Resources:

The fragile land is over exploited along with other inputs as it is evident from the micro nutrient status of the district.

2. Decrease in Crop Area:

The area under the crop decreased due to diversion of agricultural land for non agricultural purpose, saliniation of land. This has resulted in decrease in crop area.

3. Limitation for Promoting Micro-irrigation and Processing units due to Interrupted Power Supply:

The growth agro processing units and the spread of modern agriculture is limited due to the power shortage. The agricultural sector gets least priority in power allocation. The theft in electricity is wrongly blamed on agriculture and power supply is curtailed.

4. Limitations for Farm Mechanization and Intensification:

The small farmers and marginal farmers have uneconomic land holding. This makes near to impossible to use modern implements for productivity growth.

5. Under Utilization of Man Power for Dairy Business:

The man power in dairy business is underutilized. The dairy business is handled through women at household level. The dairy activity is supporting income of the small framers but the scale of operation is small and hence it can not provide full time job.

6. Under Nutrition/Malnutrition of Livestock:

The quality of the livestock in our country is poor due to nutrition /malnutrition of livestock. The fodder quality is low and the capacity of the farmer to buy good quality feedstock is limited. The animals are weak and susceptible to the diseases.

7. Soil Health problems due to Mono Cropping:

The mono cropping in the district has resulted into over exploitation of the soil and caused soil problem. The awareness of the problem is lacking.

8. Cost of Cultivation Increasing Day by Day due to Labour availability Directly Affecting Net Returns:

The price spiral in the input prices has turned the agriculture into unprofitable business. The output prices though increased they were lagging behind the cost prices. This has reduced the returns and increased the indebtedness of the farmers.

Suggested Measures

The SWOT analysis of the District provides inside for addressing the malady of the agricultural sector and the distress of the farmers. It requires all out efforts to solve the vicious circle of poverty. The strategy needs to be tuned to regional needs and aspirations. The strategy required for growth involve following important points.

1. Raising the Productivity of Major Crops:

The basic challenge for the agriculture lies in raising the productivity of major crops. The second green revolution as envisaged by Swaminathan and strongly supported by Hon. Sharad Pawar in their speeches the productivity breakthrough is the key for rural and agricultural transformation. For Kolhapur district the productivity of major crops like paddy and sorghum in cereals and for oilseeds like soybean and commercial crops like sugarcane are the key crops with challenges for raising the productivity.

2. Crops Diversification:

As the availability of land is limited the additional output can be derived from crop diversification. The crop diversification from high input consuming crops like sugarcane to value added crops like vegetables and cereals will establish the balance in the resource use. The optimum use of natural resources is possible only through crop diversification.

3. Enhancing Value Based Activities:

The increase in agricultural output and the productivity is necessary but not sufficient condition for the prosperity of

the farmers. This needs to be supported by value addition activities. The direct sale to customers and the better grading will help the farmer's better realization. Similarly agro based industries with major stake of farmers will also add to the income of the farmers.

4. Finding Support of Mechanism for Income Growth:

The agricultural sector is exposed to all types of risk where the framers are not protected at all. The failure of crop leads to pushing the farmers in financial distress. There is need to adopt diversification in the income pattern of the farmers. The small and marginal farmers needs income support schemes to maintain their basic necessities.

5. Reducing Risk in the Farming Sector:

The modern tools and techniques needs to apply to reduce the risk solely borne by the farmers. The contract farming is one mechanism where the farmers get partner for their risk. The cooperative credit and marketing institutes also need to develop micro insurance.

6. Creating off Farm Activities:

The income of the farmer heavily depends on crop yield, output and prices. The marginal farmers do not have sufficient income from agriculture. This calls for evolving a strategy to increase off farm employment. The rural sector is in great need of roads, godowns and storage facilities. Here the government and private sector should take lead.

7. Involving Female Members and Members of Weaker Section in Growth Process:

The female members are highly under employed and their potential capacity can be used for accelerating the growth. The marginal farmers and the people belonging to backward community can be brought in the main economic stream by expanding non- farm activities and skill training to the artisans.

8. Developing Linkage With SHG and NGO:

At present the NABARD has made bold experiment in liking the SHG with the banking. These people oriented institutions can be further utilized for accelerating the agricultural growth.

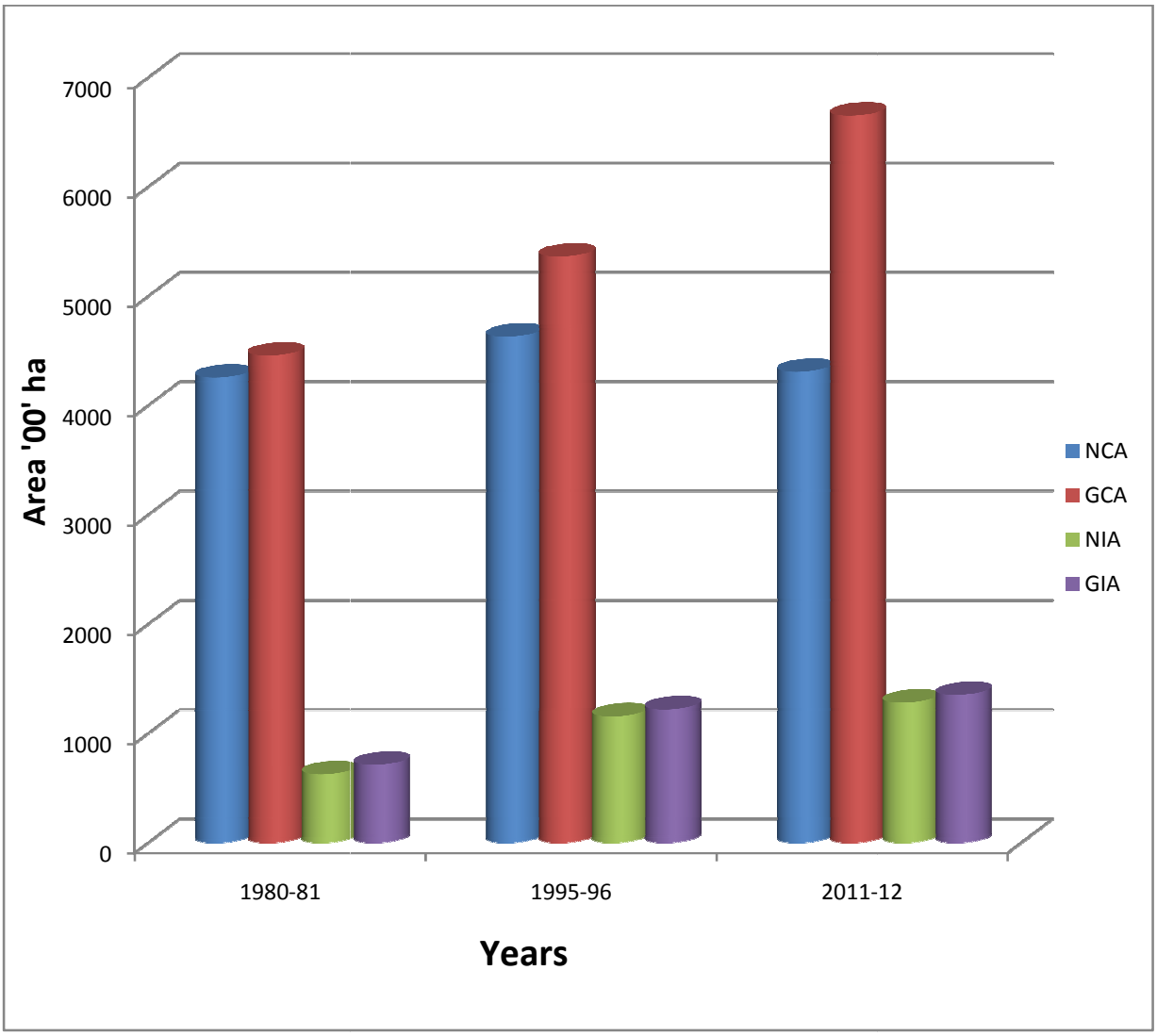

Fig. 5.1 Changes in the major components of land use pattern at selected point of time in Kolhapur district

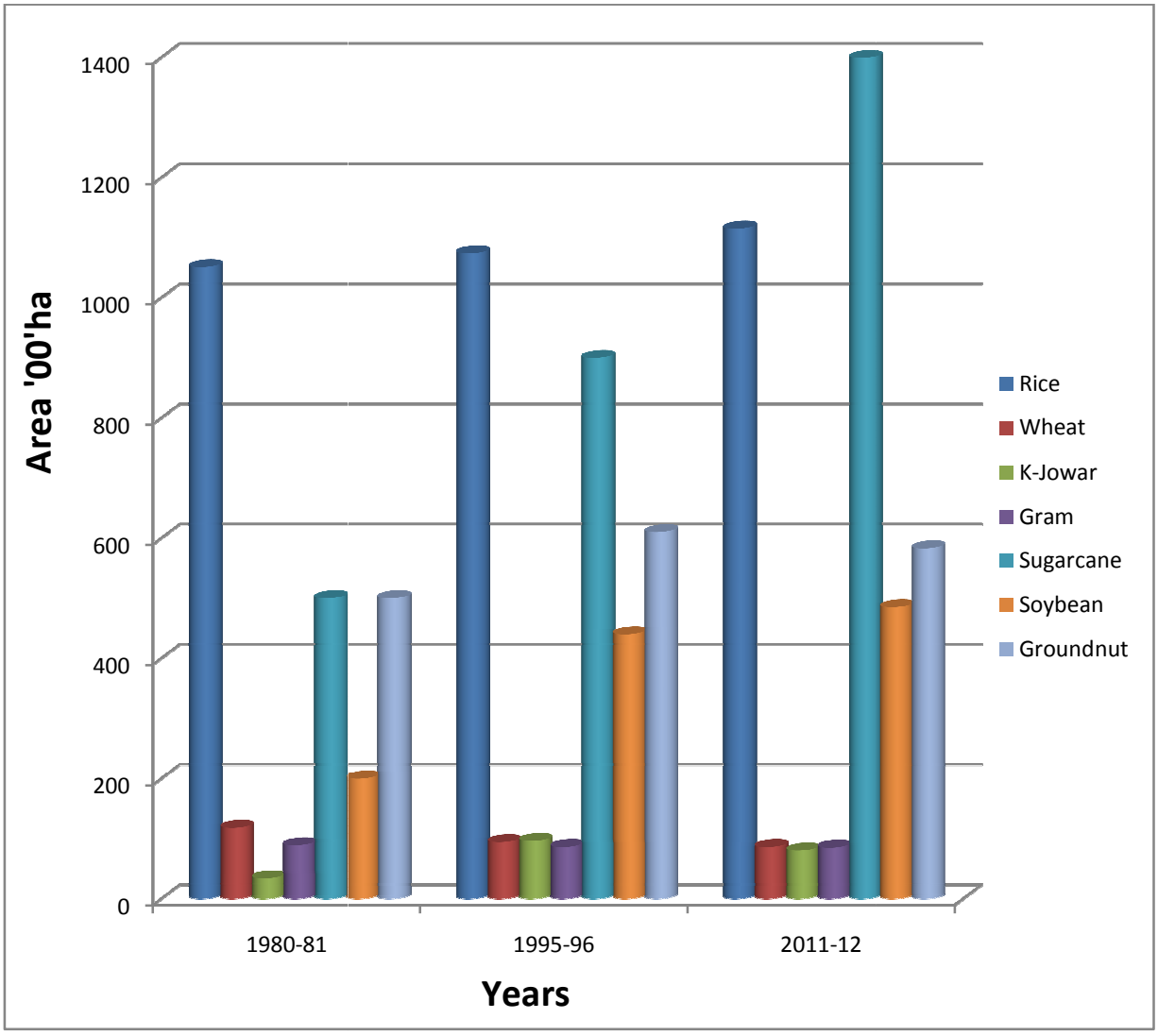

Fig. 5.2 Changes in area of major crops at selected point of time in Kolhapur district

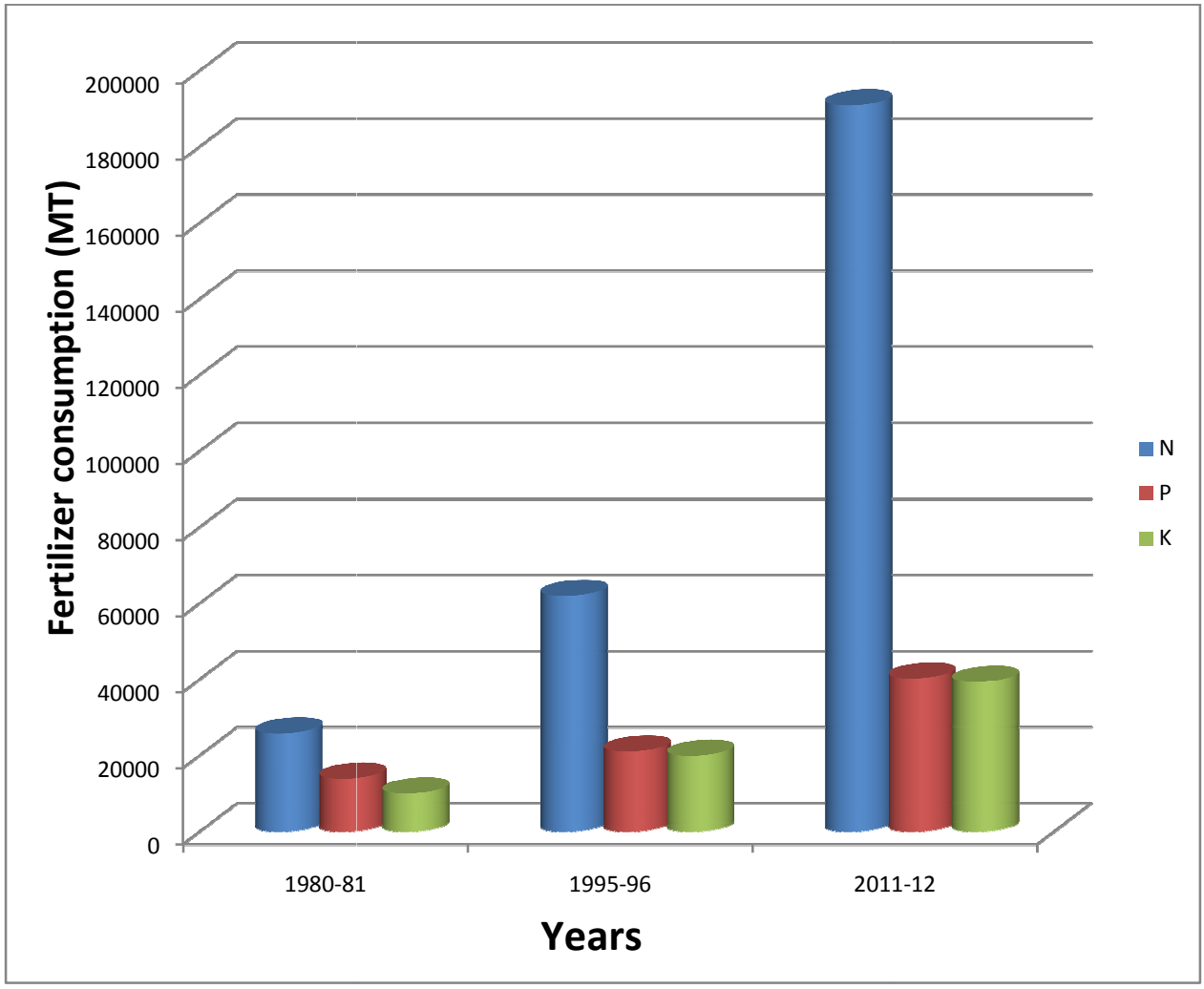

Fig 5.3 Changes in the consumption of total fertilizers (NPK) at selected point of time in Kolhapur district

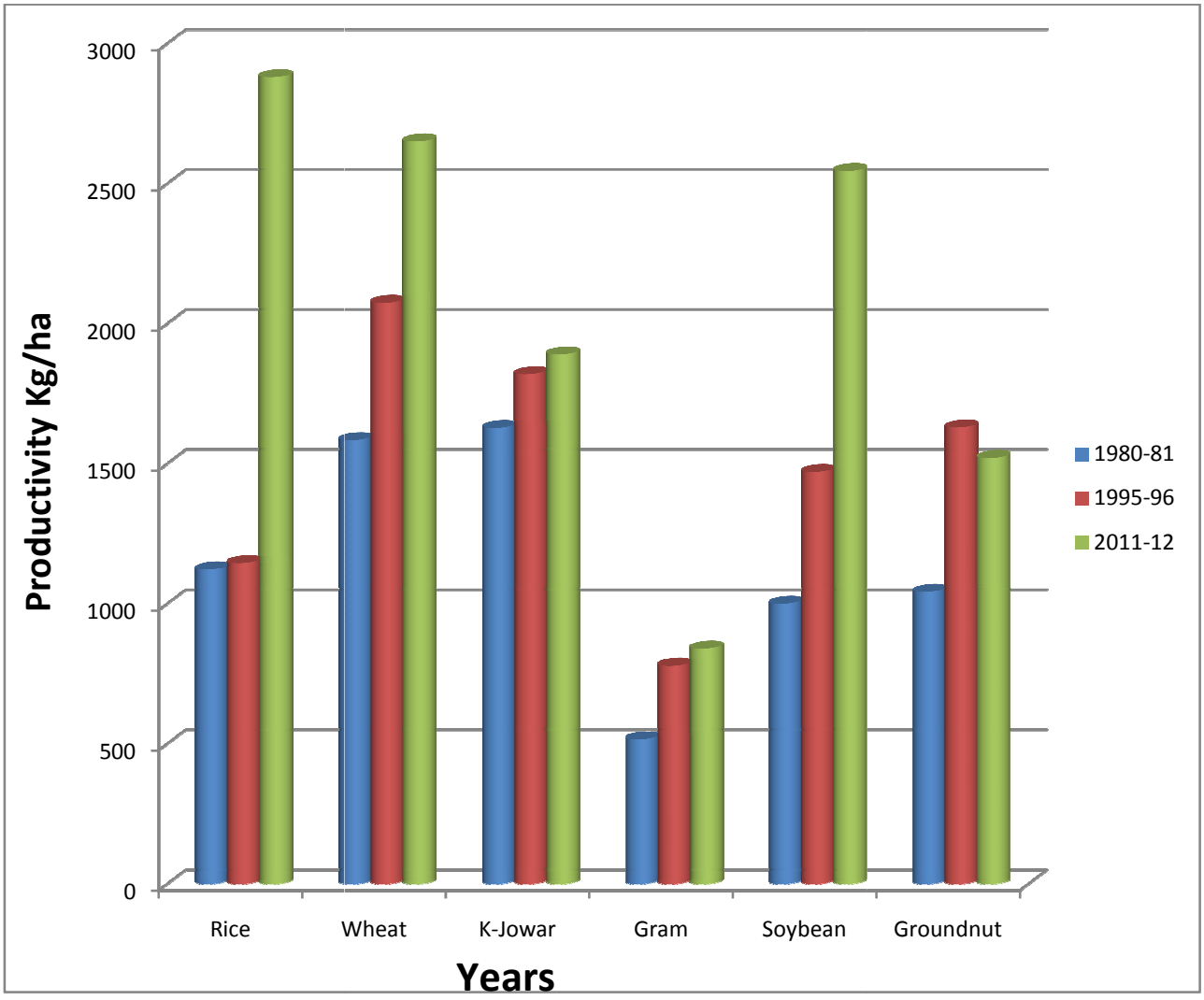

Fig. 5.4 Changes in productivities of major crops at selected point of time in Kolhapur district

6. SUMMARY AND CONCLUSIONS

Agricultural development is a strategic element in the process of economic development of a country. It has already made a significant contribution to the economic prosperity of the advanced countries. India being predominantly an agricultural and overpopulated country, the development of Agriculture with increased output and productivity would contribute substantially to an overall economic growth of a country. Agriculture is the single largest economic activity in India as it contributes 13.7 per cent GDP and give an employment to both literate and illiterate peoples. The role of Agriculture in economic development of India continue to be of great importance, as a producer of food, as an employer of about two-third of the labour force and as a source of purchasing power for much of the non-agricultural consumer goods and services in the economy. The rapid growth of Agriculture has therefore, being considered to be the basic requirement for suitable growth and development of the economy in India. The agricultural sector has however, shown a mixed type of performance during the post independence period. The rate of growth of agricultural output in general and that of foodgrains production in particular was lower than that of increase in population during the fifties and early sixties. Because of increasing pressure of population and stagnant productivity of Agriculture, the country was required to depend heavily on foodgrain imports to meet internal demand for food. During this period, the growth in agricultural output was largely contributed by the expansion

in land area sown under different crops and not by any major technological change.

Agricultural development means better standard of living for farm families. Increase in agricultural sector, impacts development in other sectors of economy. As compared with other states like Punjab, Haryana and Utter Pradesh. Development of Agriculture in Maharashtra has not been proved to be satisfactory. It is due to limited facilities for irrigation, credit, farm inputs and variation in natural resources among regions of Maharashtra.

In Western Maharashtra region, Kolhapur district is one of the forward district in agricultural development. A study is primarily centered around the trend in land use and crop pattern, growth rates of important crops, development of infrastructural facilities and identification of major variables influencing the agricultural production and identify SWOT analysis of Kolhapur. The changes in growth rates of area, production and yield of major crops due to use of modern technology was also examined. In view of this, the present study *viz.,* an economic appraisal of agricultural development of Kolhapur district has been undertaken with following specific objectives.

i) To study the changes in land use and cropping pattern
ii) To study the growth rates in area, production and productivity of major crops
iii) To study infrastructural development for agriculture
iv) To identify the important factors responsible for agricultural development

v) To identify Strengths, Weakness, Opportunities and Threats (SWOT) and suggested measures.

The secondary data on various parameters of agricultural development for the period starting from 1980-81 to 2011-12 i.e. for 32 years on the various aspects such as land use, cropping pattern, area, production and productivity of major crops, inputs, fertilizers, livestock and agricultural machinery etc. in respect of Kolhapur district. The data were collected from published statistical literature and by contacting officials of the Zilla Parishad, Cooperative and District Statistical Office Kolhapur, District census hand book, season and crop report published by Department of Agriculture Maharashtra, Epitome of Agriculture, ministry of Agriculture Govt. of India, Lead bank report bank of India, annual credit plan (Kolhapur district). www.Kolhapur.nic.in District Statistical Abstracts, Economic Survey Reports. The changes in land use, cropping pattern and inputs use were studied for the thirty two years staring from 1980-81 and ending in 2011-12 and by estimating proportions to the respective base year at the selected points of time. The impact of agricultural development on agricultural production has been assessed by estimating annual compound growth rates in area, production and productivity of crops *viz.,* paddy, kharif jowar, rabi jowar, bajra, wheat, other cereals, total cereals, gram, tur, total pulses, total foodgrains, groundnut, safflower, cotton and sugarcane in Kolhapur district for three periods *viz.,* period I 1980-81 to 1994-95, period II 1995-96 to 2011-12 and also for the entire period (1980-81 to 2011-12). The multiple linear regression equation fitted for the data for

the period from 1980-81 to 2011-2012 for studying the functional relationship existing between the aggregate value of crop output in crores of rupees in Kolhapur district as the dependent variable and selected nine independent variables *viz.,* percentage of gross irrigated area to gross sown area (X_1), consumption of fertilizer (NPK) kg per hectare of gross irrigated area (X_2), percentage of gross sown area to net sown area (X_3), percentage of area of high yielding variety seeds to gross sown area (X_4), percentage of area under commercial crops to gross sown area (X_5), amount of loan (short term and medium term) disbursed through KDCCBs per year in *lakh* of ruppes (X_6), average annual rainfall in the district in mm (X_7), Area under fruits crops in ha (X_8) and Number of milch animals (X_9).

6.1 Summary of Findings

The findings of the study have been briefly summarised as below.

1. The careful examination of the changes in land use pattern in Kolhapur district indicated that, the area under forest had declined by 4.22 per cent during the entire period under study. Also the area under barren and uncultivable land showed decreasing trend and it had declined from 5.34 per cent to 5.15 per cent of the geographical area over a period of thirty two years. The area under cultivable waste showed a decreasing trend from 8.35 per cent to 4.75 per cent of the geographical area during the period under study.

2. During the span of last 32 years, the net sown area of Kolhapur district had slightly increased by 1.22 per cent of the geographical area. The gross cropped area had increased by

49.23 per cent during the same period. It was due to increase in area sown more than once. The net irrigated area of district was 0.712 *lakh* hectares in the year 1980-81 which was increased up to 1.280 *lakh* hectares i.e. by 79.77 per cent in the year 2011-12.

3. The growth in the area irrigated by various sources in Kolhapur district during the period under study indicated that, the percentage of surface irrigation other than well to net irrigated area had declined from 70.04 per cent to 63 per cent in respective thirty two years had continuously increased. The percentage of well irrigated area to net irrigated area was 29.16 per cent in the year 1980-81 and it rose to 37 per cent in the year 2011-12.

4. Rice occupied a dominant position in the cropping pattern in all the periods in Kolhapur district sharing to 1.29 per cent of the gross cropped area during the period under study. During the span of last thirty two years the area under total cereals and total foodgrains had decreased. The area under total pulses also decreased over the period of time however the area under total oilseeds and sugarcane had considerably increased during the period under study. It is interesting to note that the area under black gram and green gram had increased nearly 2.5 and 6 times over the base year i.e. area under black gram was 0.010 *lakh* hectares and of green gram was 0.040 *lakh* hectares in 1980-81 and it was increased to 0.025 *lakh* hectares and 0.030 *lakh* hectares, respectively. The area under foodgrains had slightly decreased over the period under study. The area under sugarcane increased from 0.500 *lakh* hectares in 1980-81 to 1.399 *lakh*

hectares in 2011-12. The area under soybean had increased considerably 0.200 *lakh* hectares in 1980-81 to 0.485 *lakh* hectares in 2011-12. The area under total cereal showed decreased 14.35 and 16.73 per cent in 1995-96 and 2011-12 respectively over the base year 1980-81. The area under total pulses and total foodgrains showed decreased 24.30 and 17.63 per cent respectively in 2011-12 over the base year 1980-81. While The area under total oilseeds showed increased 159.49 and 56.98 per cent in 1995-96 and 2011-12 respectively over the base year 1980-81.

5. The changes in the productivities of major crops showed that except redgram, the productivities of all other crops had increased over the base year 1980-81. The productivity of few of the crops had declined during period II and then improved in period III. The average productivity of total cereal, total pulses and total foodrains showed increased 66.22, 8.68 and 58.67 per cent in 2011-12 respectively over the base year 1980-81. The productivity of total oilseeds crop also showed increased 76.64 percent in 2011-12 over the base year 1980-81. The productivity of sugarcane, soybean and groundnut also showed increased considerably by 10.79, 154.40, and 45.87 per cent, respectively during the span of last thirty two years in Kolhapur district.

6. The period wise annual compound growth rates in area, production and productivity of major crops in Kolhapur district indicated that, the area, production and productivity of all the cereals increased significantly during the period under study. The production and productivity of total cereals showed an increased from 0.24 and 1.26 per cent per annum,

respectively for the entire period. However, the area under total cereals has decreased by 0.85 per cent per annum. The area, production and productivity of total cereals had increased at significant higher rate (0.24, 1.31 and 1.26 per cent) during period II (1995-96 to 2011-12) as compared to period I (1980-81 to 1994-95). It has decreased in period (1980-81 to 2011-2012) except area in period III negatively significant.

The production and productivity of total pulses in Kolhapur district had significantly increased at the rate of 0.68 per cent and 1.34 per cent, respectively and area was negatively significant. The annual growth rates in area, production and productivity of total pulses have increased at the rate (1.21, 2.71 and 1.43 per cent) during period I as compared to period II (-0.11, 1.05, 1.20) and period III (-0.67, 0.68 and 1.34 per cent). In general it is indicated that there is a great scope to increase the area and production of total pulses in Kolhapur district.

The area, production and productivity of total oilseeds and cotton have fluctuated widely during the period under study, the growth rates in area, production and productivity of sugarcane for entire period have turned out to positive and increased significantly at the rate of 25.98, 31.71 and 5.07 per cent per annum, respectively. The total oilseed crops depicted a significant growth of 2.02, 3.65 and 1.43 per cent per annum in area, production and productivity, respectively during the entire period. The area and production of groundnut had significantly increased by 24.17 and 23.15 per cent and respectively per annum for entire period under

study. The productivity of groundnut for entire period of study was negatively significant.

7. The adoption of HYV's of Paddy, Jowar and Wheat increased by nearly two times over the base year 1980-81. Paddy increased from 0.714 *lakh* hectares to 1.027 *lakh* hectares, Jowar from 0.297 *lakh* hectares to 0.645 *lakh* hectares, wheat from 0.300 *lakh* hectares to 0.575 *lakh* hectares during the period under study.

8. The use of wooden ploughs was replaced by iron ploughs and tractors over a period of time. The wooden ploughs decreased by 53.23 per cent over the base year while the iron plough increased by 30.82 per cent. But the tremendous increase in tractors was observed and it was 170.37 per cent over the base year 1980-81. The use of sugarcane crushers showed a continuous decline over the period of time. The number of electric motors had increased by 56.76 per cent over the base year which supports the fact of increase in irrigation in the district. The use of wet land puddlers has increased 21.32 per cent over the base year 1980-81.

9. The credit disbursed through KDCCB in Kolhapur district had increased continuously from Rs. 3123 *lakh* in 1980-81 to Rs. 124445.56 *lakh* in 2011-12. The loan disbursed both short term and medium term by KDCCB was conspicuous during the last two periods.

10. The population of cows had declined while buffaloes, total livestock, sheeps and goat had increased over a period of time in Kolhapur district. The total livestock population has been increased by 6.88 per cent over the base year 1980-81.

The population of sheep and goat has also increased by 8.19 and 11.11 per cent over the base year.

11. The length of national highways, main district roads has increased substantially over the entire period. The total road length had increased by more than 2 times over the base year 1980-81.

12. The rainfall showed a variation throughout the entire period under study with ups and downs at the selected points of time for study.

13. The total consumption of fertilizers (NPK) in Kolhapur district was 49759 MT in year 1980-81 which has increased to 270449 MT in the year 2011-2012. The per hectare total NPK consumption showed an increasing trend during the period under study. It is noted that during the span of last thirty two years the consumption of N has increased more as compared to P and K consumption.

14. The critical examination of the multiple linear regression analysis for the agricultural development in Kolhapur district revealed that the regression coefficients of the variables. The production function analysis with above variables *viz.,* percentage of gross irrigated area to gross sown area *(X_1),* consumption of total fertilizer (NPK) per ha of gross irrigated area *(X_2),* percentage of area of high yielding variety seeds to gross sown area (X_4), percentage of area under commercial crop to gross sown area (X_5), amount of loan (Short and Medium term) disbursed through KDCCB per year in *Lakh* of rupess (X_6) and number of milch animals (X_9) was turned out to be positive and highly significant at 1, 5 and 10 per cent level of significance indicating thereby that the

agricultural production of Kolhapur district is highly responsive to these important variables. The regression coefficient of percentage of gross sown area to net sown area (*X3*), average rainfall in the district (mm) (X_7) and area under fruit crops (X_8) was turned out to be positive association with the increase in the value of total output the regression coefficient of these factors have turned out to be non significant it is thus clear that the factors such as The regression coefficient of the variables *viz.,* percentage of gross irrigated area to gross sown area (X_1), consumption of total fertilizer (NPK) per ha of gross irrigated area (X_2), percentage of area of high yielding variety seeds to gross sown area (X_4), percentage of area under commercial crop to gross sown area (X_5), amount of loan (Short and Medium term) disbursed through KDCCB per year in *lakh* of rupess (X_6) and number of milch animals (X_9) have importance in the process of agricultural development in Kolhapur District.

15. Strengths for Kolhapur districts are assured rainfall, Co-operative network and well drained soils. Weakness are heavy soil erosion, interrupted power supply and Mono cropping. Opportunities are Scope for increasing cropping intensity, Scope for diverting towards cash crops and Scope for increasing area under vegetables. Threats are decrease in crop area, limitation for promoting micro-irrigation and processing, Soil health problem due to Mono cropping.

It visualizes the future on the basis of present status. The strengths of the sector are the result of successful strategies of the past and the opportunities can be reaped with blend of new and old strategies. The weaknesses and threats

are the hurdles for development may be due to past mistakes and newly emerging trends.

6.2 Conclusions

The following specific conclusions can be emerged from the findings of the study.

1. The area under forest had declined by 4.22 per cent during the period under study in Kolhapur district. The area under barren and uncultivable land, cultivable waste, current fallow and other fallow declined over a period under study. While land under non agricultural use, permanent pastures, miscellaneous trees, net sown area, increased area under irrigation, area sown more than once, gross cropped area and land under non-Agriculture use is increasing steadily.

2. The area under irrigation increased significantly. In the year 2011-2012 irrigated area was 1.280 *lakh* hectares. The irrigated area increased by 79.77 per cent during the study period, which is an important achievement in the district.

3. The area under wheat, bajra, gram and red gram declined. The area under rice, kharif jowar, Rabi jowar, green gram, black gram, fruits and vegetables, soybean, sugarcane and groundnut was increased, while area under total cereals and total pulse was declined and the area under total oilseeds showed increasing trend over the study period in Kolhapur district.

4. The changes in the productivities of major crops showed that except redgram, the productivities of all other crops had increased over the base year 1980-81. The average productivity of total cereal, total pulses, total oilseeds and

total foodrains showed increased 66.22, 8.68, 76.64 and 58.67 percent in 2011-12 respectively over the base year 1980-81. The productivity of sugarcane, soybean and groundnut also showed increased considerably by 10.79, 154.40 and 45.87 per cent respectively during the span of last thirty two years in Kolhapur district.

5. The consumption of fertilizers (NPK) is increased.

6. There exist the changes of crops in area, production and productivity in the district over a period of time. The productivities of all crops fluctuate under study period. The critical observation shows that the productivity of crops declined during period II (1994-95 to 2011-12). The remaining periods I (1980-81 to 1994-95), III (1995-96 to 2011-12) indicate improved productivity of the different crops.

7. The net sown area during entire study period increased consistently to the total geographical area.

8. The agriculture in Kolhapur district showed significant increase in the use of iron-plough, tractors and electric motors indicating by their large partial mechanization.

9. The population of cattle and poultry declined during the study period while, the population of total livestock, buffalo, sheep and goat also showed increasing trend. The buffalo population increased which helped in increase in milk production in the district.

10. The multiple linear regression analysis indicated that the factors *viz.,* percentage of gross irrigated area to gross sown area *(X_1),* consumption of total fertilizer (NPK) per ha of gross irrigated area *(X_2),* percentage of area of high yielding variety seeds to gross sown area (X_4), percentage of area under

commercial crop to gross sown area (X_5), amount of loan (Short and Medium term) disbursed through KDCCB per year in *Lakh* of rupess (X_6) and number of milch animals (X_9) have importance in the process of agricultural development in Kolhapur district.

11. Strengths for Kolhapur districts are assured rainfall, Co-operative network, well drained soils. Weaknesses are heavy soil erosion, interrupted power supply and Mono cropping. Opportunities are Scope for increasing cropping intensity, Scope for diverting towards cash crops and Scope for increasing area under vegetables. Threats are Decrease in crop area, Limitation for promoting micro-irrigation and processing, Soil health problem due to mono cropping.

6.3 Policy implications

The following policy implications can be made on the basis of the study for the agricultural development in Kolhapur district.

1. There is a need for expansion of net area under cultivation. This can be done by bringing cultivable waste and other fallow land under cultivation.
2. The empirical evidence relating to the decline in the area under forest upto 4.22 per cent in Kolhapur district suggested a need for expansion of area under forest to the level of 33 per cent to the geographical area to maintain the ecological balance in Kolhapur district.
3. The expansion of area under high yielding varieties of major crops paddy, jowar and sugarcane, showed tremendous

fluctuations, which ultimately results in variation in production of the crops.

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8. Appendix

Apppendix- I Values of aggregate total output in crores of rupees in Kolhapur district

Year	Values in crores	Year	Values in crores
1980-81	223.62	1996-97	1050.91
1981-82	190.65	1997-98	954.64
1982-83	211.27	1998-99	1152.82
1983-84	212.85	1999-00	1138.72
1984-85	296.21	2000-01	1361.9
1985-86	309.16	2001-02	1488.25
1986-87	316.11	2002-03	1430.78
1987-88	386.71	2003-04	1249.14
1988-89	304.22	2004-05	1267.93
1989-90	359.05	2005-06	1212.7
1990-91	430.3	2006-07	2246.4
1991-92	528.8	2007-08	3056.8
1992-93	705.88	2008-09	3664.5
1993-94	698.73	2009-10	4984.5
1994-95	904.7	2010-11	3334.5
1995-96	1070.86	2011-12	4486.6

LIST OF ABBREVIATIONS

%	-	Per cent
/	-	Per
Agril.	-	Agriculture
q/ha	-	Quintals /hectare
e.g.	-	Exampli gratia (For example)
EA	-	Extent of adoption
Econ.	-	Economics
et al.	-	*et alia* (and others)
etc.	-	Etcetera
Fig.	-	Figure
ha	-	Hectare
i.e.	-	That is
J.	-	Journal
kgs	-	Kilogram
Maha	-	Maharashtra
M/ha	-	Million hectares
MT	-	Metric tonnes
q	-	Quintals
Qty.	-	Quantity

Res.	-	Research
Rs.	-	Rupees
Univ.	-	University
Viz.,	-	Videlicet (namely)
ACGR	-	Annual Compound Growth Rate
@	-	at the rate
Mktg	-	Marketing
Indi	-	Indian
Asso	-	Association
Vol	-	Volume
PP	-	Page Number
Co-op	-	Co-operative