ECONOMIC APPRAISAL OF AGRICULTURAL DEVELOPMENT IN JALNA DISTRICT OF MAHARASHTRA

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PARBHANI -431 402 (M.S.), INDIA
2019

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DISSERTATION

Submitted To

Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani in partial fulfilment of the requirements for the Degree of

MASTER OF SCIENCE
(Agriculture)
IN
AGRICULTURAL ECONOMICS

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MAY 2019

CANDIDATE'S DECLARATION

I hereby declare that the dissertation

Or part thereof has not been

Previously submitted by me

For a degree of any

University or

Institute

Place: Latur

Date: / /2019

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CERTIFICATE – I

This is to certify that the dissertation entitled**"ECONOMIC APPRAISAL OF AGRICULTURAL DEVELOPMENT IN JALNA DISTRICTOF MAHARASHTRA**" submitted by **Mr. KHARAT ARJUN ANANDRAO** to the Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani in partial fulfilment of the requirements for the degree of **MASTER OF SCIENCE (Agriculture)** in the subject of **AGRICULTURAL ECONOMICS** is record of original and bonafide research work carried out by him under my guidance and supervision. It is of sufficiently high standard to warrant its presentation for the award of the said degree.

I also certify that the dissertation or part thereof has not been previously submitted by him for a degree of any university.

Place: Latur
Date: / /2019

K.V. Deshmukh
Research Guide & Chairman
Advisory Committee

CERTIFICATE-II

This is to certify that, the dissertation entitled **"ECONOMIC APPRAISAL OF AGRICULTURAL DEVELOPMENT IN JALNA DISTRICT OF MAHARASHTRA"** submitted by **Mr. KHARAT ARJUN ANANDRAO (Reg.No. 2017A/59ML)** to the Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani in partial fulfilment of the requirement for the degree of **MASTER OF SCIENCE (Agriculture**) in the subject of **AGRICULTURAL ECONOMICS** has been approved by the student's advisory committee after viva-voce examination in collaboration with the external examiner.

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ACKNOWLEDGEMENT

To reach a goal, you don't need to know all the answers in advance. But you must have clear idea of the goal you want to reach. Success is possible only after involvement of many minds and hands to beautiful it. Emotions cannot be expressed in words because then emotions are transformed into mere formalities. Nevertheless formalities have to be completed. My acknowledgements are many more than what I am expressing here.

Inspirations is the best medicine which can make it possible run for crippled one and it is variable gold of mine to get the talented and inspiring will full guidance of my research guide ***Dr.K.V. Deshmukh,*** *Associate Dean and Principal,College of Agriculture,Ambajogai and chairman of my advisory committee for suggesting the research problem ,offering inspiration scholastic and versatile guidance, constructive enthusiasm during the course of investigation pain taking thise efforts taken Work for preparing manuscript and final shaping of dissertation enabled me to complete the research project. I am indebted to him for my achievement.*

My heartful, sincere and profound gratitude to members of my advisory committee ***Dr. R.D. Shelke,*** *Associate Professor, Department of Agricultural Economics, College of Agriculture, Latur And* ***Dr.J.M.Deshmukh,*** *Assistant Professor ,Department of Agricultural Extension, Vasantrao Naik Marathwada krishi Vidyapeeth Parbhani and, for their valuable guidance and useful suggestions and continuous encouragement during the course of investigation.*

I feel tremendous gratitude towards ***Dr. A. S. Dhawan****, Hon. Vice-Chancellor,VNMKV, Parbhani,* ***Dr.P.G.Ingole*** *Dean (F/A),VNMKV,Parbhani ,****Dr. V. D. Patil,*** *Ex.Dean (F/A) VNMKV, Parbhani,,* ***Dr. D. N. Gokhale*** *Associate Dean (PG) VNMKV, Parbhani,* ***Dr. B. M. Thombre,*** *Associate Dean and Principal College of Agriculture, Latur for their timely support, cooperation and extended opportunity to complete my M.Sc. study.*

I am thankful to ***Dr. D.S.Perke*** *Head, Department of Agricultural Economics, V.N.M.K.V. Parbhani.for Providing facilities and suggestions at the time of presentation of ORW in the Department of Agricultural Economics, Parbhani. I express my sincere thanks to librarian, Mr. Dhage sir, Haranmare S.B. and Shri Dashrath mama for excavating literature from library and for their kind cooperation during my research work.*

Words are not sufficient to take account of encouraging and evergreen love of my family. Everything in my life is nothing if I ignore the all-time encouragement, evergreen affection and latent love of my Respectful father and lovable mother.

I also take this opportunity to express my sincere and heartly thanks to my batchmates Ankita,Anil,Ajaj,Shriram,Mahesh,Ganesh,Arti,Seema,SayleeandMyseniorsSushil,Nitine,Sunil,Deepak,Rajendra, Mukul.Durga,Damini,Swapanali,MyfriendLaxmanThale,Dnyneswar,Samadhan,Pradip,Bhagwat Friendship is pleasant experience most of all, my words and very special thanks to my friends who always helped me, gave

support to me, and my Junior Vishvas,Vikas,,Aniket,Aditya,Pratik ***(All M.Sc. Agri. 2018 batch)*** *for their good will and moral support.*

Date:- / /2019

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(Reg.No.2017A/59ML)

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ABBREVIATIONS/ACRONYMS AND SYMBOLS

%	-	per cent
et al	-	et alia (and others)
etc.	-	etcetera
Fig.	-	Figure
Ha	-	hectare
Kg/ha	-	kilogram per hectare
Kg	-	kilogram
i.e.	-	that is
Mm	-	millimetre
viz.	-	Namely
MT	-	Meteoric tonnes
CGR	-	Compound growth rate
LGR	-	Linear growth rate
R^2	-	Coefficient of multiple determinations
Adj R^2	-	Adjusted coefficient of multiple determination
r	-	Correlation coefficient

Introduction

Chapter- I

INTRODUCTION

General

Agriculture is an important sector of Indian economy, as it contributes about 17-18% to the total GDP and provides employment to over 60% of the population. Agriculture plays an essential role in the providing food to nation, agriculture releases labour, provides saving, contributes to market of industrial goods and earns foreign exchange. Agricultural development is an integral part of overall economic development. Agriculture is the main occupation and backbone in developing country like India and is a bottleneck in the economic development of the country. At present, Agriculture sector contributes 14.5 per cent in national income in India and it sustains 60 per cent of population for their Lively hood . The share of agriculture sector in national economy is decreasing but not the population dependent on it.

Agricultural development

The development of agriculture is a process through which the shift takes place from the stage of traditional agriculture to the stage of modernized agriculture resulting in increased productivity and production 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 the use of high yielding varieties, adoption of package of practices including the use of fertilizers, plant protection measures, irrigation, modern machinery, etc.

Agricultural development in India

Recognizing the important role of agriculture in the economic development of country, five-year plans assign high priority to agricultural development. Agriculture has been the major source of livelihood in India since the primordial age. Invent of Moghals followed by British did not change the situation to the desired level. Agriculture remained totally primitive,

deteriorative and turbulent. The deficiency of foodgrains had lead to witnessing of a number of horrible families. The agriculture sector in many developing countries could not move ahead because of large number of physical, natural, economical, social, political and human factors. 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. As a result, the trend of agricultural production has been reversed partly because of increase in the area under cultivation and partly because of adoption of the intensive method of cultivation. The Green Revolution was started in our country in around 1965-66 onwards. The development of new high yielding varieties of foodgrains viz., wheat, rice, maize, jowar and bajra was the spectacular achievement of agricultural research. The new strategy concentrated not only on high yields per unit of land but also on higher intensity of cropping. The conditions did not remain the same and since 1966-67 with the onset of the process of agricultural development involving technological changes with the introduction of high yielding varieties of seeds during mid sixties and increase in availability of chemical fertilizers and irrigation facilities, Indian agriculture will not be 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 increased during the seventies and eighties. In recent past, Government of India has been focusing on agricultural development by giving special efforts on policies, strategies and framework such as General Agreement on Tariff and Trade Agreement (1994), National Agriculture Policy (2000), National Seeds Policy (2002), Cooperative Policy, Agriculture Price Policy, Agricultural Extension Framework (2001), National Rural Employment Guarantee programme (2005), National Horticultural Mission (2005-06), National Food Security Mission (2007), Rashtriya Krishi Vikas Yojana (2007-08) etc. Overall, the total foodgrain production in the country has decreased from 4896 million tonnes in 2002-2003 to 2185 million tonnes in 2016-17. The

country has already reached a stage of self-sufficiency in foodgrain production. The total area in 2002-2003 was 1526 million hectares, which rise to 3820 million hectares in 2016-17. the total foodgrain productivity in the country has decreased from 820 kg per hectors in 2002-03 to 450 kg per hectors in 2016-17 It is thus clear that the agriculture in the country is marching on the path of development aimed at socio-economic prosperity of the people. Cropping intensity of India in 2003-2004 was 131 per cent, which rose to 142 per cent in year 2017-18 (Source: Directorate of Economics and Statistics). 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 changes was specific to the crops such as wheat, cotton, paddy, groundnut all of which were grown under irrigated conditions in Haryana, western Uttar Pradesh (Uttarakhand), 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 chilly remained outside the phenomenon of technological change for a long time.

Agricultural development in Maharashtra

Maharashtra play a major role in economic development of India. In India 9.29 per cent of the total population which occupied by Maharashtra is currently 11.24 crore with the literacy rate of 82.9 per cent. The geographical area of Maharashtra is 307713 km^2, approximately 140-145 lack ha of land is cultivated in the Kharif season and 60-65 lack ha in rabbi season. The production of food grain in 2012-2013 expected to register decrease of 23 per cent with the production of 118.09 lack metric tonnes. In Maharashtra, all possible efforts have been made for increasing agricultural production and thereby to involve in the National Campaign of development of agriculture, which commenced during post-independence period. The development scheme viz., CADA (Command Area Development Authority, DPAP (Drought Prone Areas Programme), SFDA (Small Farmers Development Agency), and MFAL (Marginal Farmers and Agricultural Laborers) are also in operation in

Maharashtra. Maharashtra is runner fore in respect of many new schemes like SFDA (Small Farmers Development Agency), pioneer in cooperatives such as Sugar factories, dairies, water user association etc. The implementation of the pilot project scheme involving the action co-ordination of development agencies for boosting the productivity of wheat in 1975-76 and of sugarcane in 1976-77 was also the unique attempt for increasing production of these crops in the state.

Due to development of agriculture higher levels of production of food and other farm products, higher income and better standard of living for farm families have been achieved. When an agricultural sector grows, the impact of its development is seen in other sectors of the economy and it accelerates the overall economic development of the region. Maharashtra could be considered to be one of the heterogeneous states in the Indian Union as far as the varying agro-climatic conditions are concerned. The state comprises four regions viz. Konkan, Western Maharashtra, Marathwada and Vidarbha region which represent varying types of natural, physical, social and economical conditions, quite distinct from each other. The variability in topography, soil and climatic factors bear significant impact on crop and land use patterns, use of production inputs and adoption of technological innovations of crop production among the region.

Agricultural development in Jalna (Maharashtra)

Jalna district is having good Industrial background, specially famous for the Seed and Steel industries. The industrial development at Jalna is widely based on Engineering, Plastic and Agriculture. Pulses mills, oil mills, refineries, steel re-rolling, plastic, tiles & cement pipe, fertilizers, insecticides, pesticides and the co-operative sugar factories are also playing important part in the industrial development of Jalna. There are also cotton ginning and pressing factories and an agricultural market produce committee handling large quantities of all kinds of agricultural produce, including cotton. In view of the overall industrial backwardness of the region, the state government has

initiated a master plan to encourage the establishment of of small and large-scale industrial units. Under this plan Maharashtra Industrial Development Corporation (MIDC) has set up an industrial area in Jalna consisting of large-scale, medium scale and..Small scale industries that is Mahyco, Mahindra, Bejo-Shital are some of the leading well known hybrid seed industries. Jalna industrial area has a large number of steel rolling mills, a unit manufacturing ball bearings, agro based units like significance. The results of the study can be made use for launching different programmes for developing agriculture in the district as result of study will help the policy makers, administrators and research worker for development of agriculture in different fields in order to plan their strategies for overall development of district. The weakness in the resource allocation can be noted with the help of changes in cropping pattern of region over a period of time as well as growth rate in important crops and finally can be removed by suggesting suitable measures for the balanced agricultural growth in the district. The major factors which affect the agricultural development can be identified; the farmers would be benefited to arrange their cropping pattern for maximizing income with available resources.

The problem.

A breakthrough in India agriculture due to introduction of green revolution during the mid-sixties has helped farmers to come out of their traditional agriculture. They have now realized the importance of the use of crucial inputs viz., irrigation, credit, fertilizer, high yielding varieties seed, plant protection measures, etc., for increasing agricultural production. It appears that the above said inputs along-with the new technology in agriculture have profound effects in influencing the productivity and the resulting production in agriculture. The agriculture in Maharashtra underwent several changes on account of the national campaigns for agriculture development since mid-sixties.

The examination of changes in growth rates of area, production and yield of major crops due to introduction of green revolution would also be useful. The studies on the above said aspects evaluating the agricultural

development in a well defined area, say a district are relatively scarce. It is observed that Jalna district in Marathwada region is one of the developed districts in agricultural development activities. In view of this it was therefore decided to undertake a study viz. “Economic Appraisal of Agricultural Development of Jalna District in Maharashtra” covering a period from 2003-04 to 2016-17 in Marathwada region.

Objectives of the study

The study was undertaken with the following specific objectives;

1. To study changes in land utilization pattern
2. To examine the cropping pattern
3. To estimate growth rates of area, production and productivity of major crops grown
4. To study the agriculture development with respect to different socio-economic indicators over a period of time

Scope and utility of the study

The scope of the study is restricted to the above said objectives only. However, the finding of the study can be projected to wider areas having similar agro-climatic conditions. The study will focus 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.

It is hoped that the study will arrive at important conclusions which could be useful for planning and execution of agricultural development programmes in the district. The weaknesses in the resource allocation can be noted with the help of the changes in crop pattern of the district over a time as well as growth rates in important crops and finally can be removed by suggesting suitable measures for the balanced agricultural growth in the district.

Limitations of the problem

The present study is based on the secondary data obtained from published sources as well as from development agencies in jalna district. The analysis is limited to the available stock of the data on the aspects of the study. The validity of the result of study is therefore, based on the degree of reliability of the secondary data. However, the attempt is made to have an in depth analysis of the data by adopting suitable analytical techniques to arrive at the meaningful conclusions.

Review of Literature

CHAPTER-II

REVIEW OF LITERATURE

2.1General

This chapter has been devoted to present reviews of previous studies, which are identical in 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 present study seeks to examine the various aspects of agricultural development in Jalna district. A limited number of scholars have tried to study Jalna agriculture and their analysis was too inadequate to provide empirical evidence relating to the development of agriculture in the State. Inspire of fact, a thorough investigation has been made in this study to achieve all the objectives. The goals, assumptions and development strategies for increasing production and productivity of land and labour in agriculture in Jalna have been very similar to various developing states of Country. Moreover, the state shares some common characteristics such as religions, socio-economic characteristics of people, tropical climate with the rainfall concentrated in a few months in the year and highly variable, major crops grown and cropping pattern, highly dependence on agriculture and the presence of tremendous diversity in cultures, farming systems, sociological and psychological characters etc. The review of literature on the development of agriculture in some other state is, therefore, useful to identity various aspects of agriculture and to decide suitable methodological frame work for the proposed study. For the sake of convenience, the reviews collected from various sources have been grouped under the following major headings.

2.1 To study Changes in the land utilization

2.2 Chenges in the cropping pattern.

2.3 Growth rate in area, production and productivity of major crops.

2.4 Agriculture development with respect to different socio- economic indicators over a period time.

2.1 Changes in the land utilization pattern

Agricultural production is influenced by physical, socio-economic, technological and organizational factors to study the crop combination in regions for different years.

Over a period of time, the structural change in land use and cropping pattern 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 setup, 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 have significant importance in the process of agricultural development.

Ramasamy et al. (2005) studied the current fallows land and other fallows land in India and have shown a positive growth trend while the area under cultivable wastes have shown a declining trend over the period 1970-71 to 1990-91. The area under current fallows in India recorded a compound growth rate of 0.84 per cent per annum while the area under other fallows has grown at the rate of 0.95 per cent per annum during this period 1996. studied the land use pattern of Maharashtra was dominated by different crops (57.34%) followed by area under forest and fallow land (7.67%). Regarding temporal changes in different land use categories, it was observed that, the proportionate area in each decade under different categories was remain more or less same with meager changes in each decade. As far as rate of growth was concerned, it was observe that, over a period of time positive and significant growth observed in case of land under non agriculture uses (1.46%), land under miscellaneous tree crop (1.65%) and both the fallow (3.24%) while negative and significant growth was observe in forest land (-0.16%) barren and uncultivable land (-0.49%) and permanent pasture land (-1.47%).

Takle et al. (2007) study showed that the land use pattern of Maharashtra was dominated by different crops (57.34%) followed by area

under forest and fallow land (7.67%). over a period of time positive and significant growth was observed in case of land under non agriculture uses (1.46%), land under miscellaneous tree crop (1.65%) and both the fallows (3.24%) while negative and significant growth was observe in forest land (-0.16%) barren and uncultivable land (-0.49%) and permanent pasture land (-1.47%).

Meenakshi and Indumathy (2009) studied land utilization and crop pattern in Tamil Nadu. The study covers eight major crops viz; paddy, cholam, cumbu, sugarcane, cotton, groundnut and tapioca, all of which constitute 61.89 per cent of total cultivated area of 6.03 million hectares. The data form 31 district which have been formed from the original thirteen districts are available for different time period. They concluded that there is considerable misuse of cultivable area based on crop yield and hence output is affected to great extent roughly 33 percent of the cultivable area was being use for growing unsuitable crop.

Wani et al. (2009) studied the land use dynamics in Jammu and Kashmir. The dynamics of shift among different land use classes has been studied for the state. A significant decline has been observed in the total reported area and area under forest. The unfavorable increasing trends in the area to non agricultural uses and barren and uncultivable area. The estimates of regression analysis have revealed that the net irrigated area, literacy and area not available for cultivation have significantly improved the cropping intensity in the state agriculture, whereas agricultural density and area under rice are significant determinants of current fallow lands.

Bardhan and Tewari (2010) reported that while there is tendency for land shifts to the agricultural sector, there was also a positive growth trend in fallow lands which ultimately tend to move into cultivable wastes. State level studies reported a diversion of common land to non-agricultural uses in Tamil Nadu.

Indian economy and despite concerted industrialization in the last five decades; agriculture occupied a pride of place. As the largest private enterprise in India, agriculture contributes, nearly one fourth to the national G.D.P,

sustains livelihood of about two third of the population and is the backbone of agro-based industries. It is paradoxical situation that on the one hand more production is required from the scare soil resources for meeting the demand of ever- expanding population, while on the other, cultivable areas are being shifted towards non-agricultural uses. To compute the compound growth rate of land use pattern, trend analysis was done. The double cropped area of Chhattisgarh increased from 664111 hectares in (2000-01) to 972729 hectares in (2009-10). Registering the significant growth rate of about 4.38 per cent at the 5 per cent level of probability. To know the dynamics of land transaction data were collected for the year 2005-06 before and 2009-10 present, from North and South direction at 10, 20 and 30 kilometres away from the Raipur town.

Adhikari, and Sekhon (2014) was conducted a study to analyze the land use dynamics in Punjab state. The compound growth rate analysis of the land use pattern for the entire period showed that, the area under forest has significantly increased at rate of 1.43 per cent per annum, while, area under barren and uncultivable land, and cultural waste have significantly decreased by 4.92 per cent, and 9.07per cent per annum respectively.

Maniyosai and Kuruvilla (2015) studied the agricultural land use pattern, of the Alappuzha district in Kerala. The study reveals that in this district, the land use pattern has changed and the area of cultivable waste has increased in the period between 2000 and 2013. But, the Net Sown area has decreased and the area under the current fallow as well as the Fallow other than the current fallow also have decreased in the same period. It has also been identified that total cropped area has gone down.

Tirlapur and Mundinamani (2015) studied the land use pattern and cropping pattern in Dharwad district of Karnataka. Results of the study revealed that, in case of land utilization pattern, forest area retained its share of 71.5 per cent and lost remaining 28.5 per cent to agriculture land (13.6 %), cultivable waste land (7.70%), fallow land (2.80 %), Cultivable waste land lost its share to land not available for cultivation (54.60 %) and forest (45.40 %).

Agriculture land lost its share to forest land (53.20 %), cultivable waste land (20.30 %) and land not available for cultivation (16.90 %).

Deka and Hazarika (2018) . studied the land use pattern and cropping pattern in Assam Location coefficient (L), Simpson Diversity Index and CGR were used as analytical tools. In the state, net area sown, total cropped area and area sown more than once had increased. On the other hand, significant negative growth was recorded for forest area, barren and unculturable land, permanent pastures and other grazing land, land under miscellaneous trees, groves and fellow land.

2.2 Changes in the cropping pattern

Different categories of sericulturists have been suggested by selecting Siddlaghatta in Kolar and Kollegaltalukas in Mysore as study areas. The model has also suggested shifting of the cropping pattern from subsistence-dominated crops like ragi to commercial crops like bivoltine sericulture in the Kolar area and crossbreed sericulture in the Musore area. The suggested cropping patterns have increased the gross income in the range of 83.55 to 388.68 per cent in the Kolar area and 2.71 to 10.70 per cent in the Kollegal area.

Dayakar and Parwez (2005) studied on the cropping pattern changes in India over two periods, viz., 1953/54 to 1961/62 and 1961/62 to 1972/73 by using They reported that low value crops such as coarse cereal grams (sorghum and pearl millet) lost a significant share of area to high value cereals like wheat. studied the cropping pattern by using Markov chain analysis and the results showed that the area under maize and chickpea showed most instability and area under cotton was most stable in period I. While in period II, except for paddy, all the crops considered in the study have shown stability and area under maize was most stable.

Mahendran et al. (2006) carried out a study on evolving optimal cropping pattern in ground water exploited region of in parambature district of tamilnadu Area under high water intensive crops namely, paddy and sugarcane declined almost in all the optimal crop plans. They referes that Area under low water intensive crops (groundnut, gingelly and tapioca) showed an increasing

trend in all optimal crop plans. The net income of the sample farms increased marginally or considerably in the optimal crop plans of both the critical and over exploited groundwater regime sample farms and semi-critical and the safe groundwater regime sample farms.

Ray (2007) repoted that West Bengal state cropping pattern has registered a rapid rate of growth of output during 1977-95. The best feature of the state's agricultural performance was that productivity has been the main contributor to output growth. While the rate of growth of foodgrains output has been very high, the cropping pattern in most of the districts has noticeably changed in favour of high-value non-food crops. The rate and pattern of output growth for most of the districts, however, suggested that the period of stagnation in West Bengal agriculture has come to an end during the Left Front Rule. Apart from the natural factors like rainfall, growth in agricultural production depends on infrastructural facilities.

Mandal and Bezbaruah (2013) examined the determinants of cropping pattern diversification, and evaluated the role of crop diversification in increasing farm income in flood affected agriculture in the plains of Assam. The results of censored regression on a cross section of 342 randomly selected farms suggested that crop diversification has been adopted as a mechanism to cope with limits imposed by flood. Moreover, the results of a linear regression led to the conclusion that crop diversification have an important role in enhancing farm income. The results reported in the study are quite interesting and useful, and offer important policy suggestions.

Dasgupta and Bhaumik (2014) examined the trend and pattern of diversification of the crop sector in West Bengal during the period 1980-81 to 2009-10. And showed the impact of crop diversification on agricultural output growth in West Bengal. The sources of growth of the crop sector that accounts for about 80 per cent of the total value of agricultural output in West Bengal. The factors contributing to diversification of the cropping pattern are also examined.

Chinky Sangral (2015). Studied cropping pattern of Jammu and Kashmir to find out the changes in cropping pattern was based on the traditional system of the subsistence farming without any surplus. But with the advent of New Agricultural Strategy, there has been the complementary relationship between the commercialization and cropping pattern of the state. The farmers are gradually diversifying to commercial crops for the sake of higher earnings. The aim of the present paper is in Jammu and Kashmir. This paper will also give some suggestion for improving the cropping pattern in Jammu and Kashmir.

Akhter and Acharya (2015) observed the changes in the cropping pattern in Jammu and Kashmir. given paper will also give some suggestion for improving the cropping pattern in Jammu and Kashmir. The Regression analysis has been done in order to see causal relationship between area and production. The cropping pattern of Jammu and Kashmir was based on the traditional system of the subsistence farming without any surplus. But with the advent of New Agricultural Strategy, there emerged the complementary relationship between the commercialization and cropping pattern of the state. The state of Jammu and Kashmir has micro- level variations in the agro-climatic conditions.

Nayak (2016) examined the structure and nature of cropping pattern, crop diversification, crop concentration, productivity level and inter-districts disparity in the state of Odisha The study has observed a reduction in inequality during the studied period and has concluded that districts in Odisha were converging as far as agricultural productivity is concerned. The study has identified the major determinants of agricultural productivity in Odisha and has suggested some policy measures for increasing agricultural productivity in the state.

Ghuncha (2016) analyzed the consumption pattern of major food items and its impact on cropping pattern in India as a whole and in the National Capital Territory (NCT) of Delhi particularly. The analysis depicts that cereal consumption/person/day in the country were declined by 11.6%, whereas the consumption of eggs, vegetables and fruits were increased by

80.41%, 41.58%, and 39.13% respectively during 1993–2013. The impact of changing consumption behavior on cropping pattern was depicted by increasing areas under fruits (14.4%), vegetables (15.37%), spices (16.9%) and plantation crops (13.16%). A similar trend was observed in the case of NCT of Delhi. Information collected from 896 farming households revealed that vegetables (28.38%), potatoes (25.32%) and cereals (23.9%) were the prime crops in the study area. Increasing demand of non-cereal crops in the city markets, ($p<0.000$), in the local market, and in commercial establishments ($p<0.05$) were determined the cropping pattern. With changing consumption pattern, more and more agricultural land may be devoted to non-grain crops. Sonawane (2017) carried out economical analysis of the cereals cropping Pattern in Dhule district. The New cropping patterns have been accepted by the farmers of the study region, due to climate change, uneven rainfall and economical factor. Natural and economical factors have boosted the cultivation and production of cereals crop. the area under cereals crops are changes in various tehsil. Cereals crops cultivation has occupied area 247051 Ha. (60.26% of NSA) in the year 2004 and occupied area decrease up to 145056 Ha. (37.16 % of NSA) in the year 2013 due to the flexibility of the rainfall.

Geetha Mohan (2017) examined changes in cropping pattern in the state of Andhra Pradesh at the aggregate and regional levels for the period 1969-71 to 2004-05. The results indicated that the Andhra Pradesh state has witnessed shifts in cropping pattern during the past three decades,and these shifts are towards cultivation of total pulses except (horse gram), fruits and vegetables,spices, drugs and narcotics and sugarcane. The fixed effect regression model was used to recognize the fundamental factors of shifts in the cropping pattern. The magnitude of these change, however, vary across the regions and also across districts within a region. These changes havebeen driven by sub-division of land holdings, mechanization, irrigation, technological change andfarmers' improved access to institutional credit and infrastructure.

Ingole and Khobarakar (2019) The paper based on studied of the changes in cropping pattern in selected tahsils of Amravati district. The present study based on secondary data collected from various government publications and pertains to a period of 13 years i.e. from 2003-04 to 2015-16. The present study has examined the trends in Cropping pattern changes.

2.3Growth rates in area, production and productivity of major crops

Lathika and Kumar (2005) examined the growth trends in coconut area, production and productivity for the past five decades. It focuses on the performance of different States in coconut production and also the relative role of area and yield in explaining the observed trend in production. About 10 million people in the country are engaged in coconut cultivation, processing, marketing and trade-related activities. It is the richest source of edible vegetable oil with oil yield of 65 per cent of the kernel weight and the contribution of the crop to the edible oil pool in India is around 6 per cent. The crop is the only one in the lauric oil groups produced in the country and provides about 75 per cent of the lauric oils.

Surya Bhushan (2005) estimated the rate of total factor productivity growth of wheat in India. The major wheat growing states in India are Uttar Pradesh, Rajasthan, Madhya Pradesh, Punjab and Haryana. The major wheat growing areas are all in the north, and therefore, unlike rice, wheat has a relatively narrow geographic land base of production.Wheat is a temperate crop requiring low temperatures, and most of the country is tropical. Even within many of these states the wheat areas are limited and overall only about 18 per cent of the net cropped area is planted under wheat. Again Uttar Pradesh contributes the largest share with 36 per cent of production, followed by Punjab with 19 per cent and Haryana with 11 per cent. These three northern states together contribute two-thirds of the production of wheat. These are followed by Madhya Pradesh 11 per cent, Rajasthan 10 per cent. All the rest contribute only 13 per cent to the estimated the rate of Total Factor Productivity Growth (TFPG) in Indian agriculture as a whole to be 0.8 per cent per year duringthe

1961 periods, a mere 0.3 per cent per year during 1961-1965, but 2.3 per cent during 1965-1971.

Dhakre and Sharma (2010) studied the growth analysis of area, production and productivity of Maize in Nagaland Maximum decrease in area under maize crop was (-) 16.02 % found in the year 1999-2000 and maximum increase in area under maize year crop was 30.23 % in the year 2000-01, where as maximum increase in production and productivity of maize crop in Nagaland was 103.05 % in the year 1988-89 and 101.26 % in the 1988-89 respectively Among area, production and productivity of maize the instability was highest for the production. Growth rates were significant at 1% level of significance.

Acharya et al. (2012) studied the growth in the area, production and productivity of different crops in Karnataka was estimated using the compound growth function. Growth rates showed a significant positive growth in area under pulses, vegetables and spices and fruits and nuts while cereals showed significant negative growth. The growth in area under oilseeds and commercial crops was negative and insignificant. Similarly the production of cereals, pulses, vegetables and fruits showed a significant positive growth. The production of oilseeds and commercial crops registered insignificant positive growth. The productivity of different crops recorded significant growth in the case of cereals, pulses and fruits. Productivity of oilseeds recorded moderately positive growth. The productivity of commercial crops registered insignificant positive growth and for vegetables the growth in productivity was insignificant and negative.

Prabakaran and Sivapragasam (2013) studied the growth rates of rice and sorghum for three distinct administrative and agro-climatic regions of Andhra Pradesh were by studied using the time series data from 1970-71 to 1999- 2000. The growth pattern in area, production and yield of rice showed an upward trend at state and regional level except in Rayalaseema region which showed a decline in area and production. Telangana region showed highest growth rates in area, production and yield during the study period. Coastal Andhra region showed highest growth rates in terms of area, production and

yield next only to Telangana region. In case of sorghum the growth rates of area and production showed a downward trend in all the regions and the state as a whole. The growth of yield in sorghum crop Rayalaseema region was highest during 1970-80 and total period followed by state as a whole and Telangana region.

Kumar et al. (2014) observed that agricultural growth have been concentrated in India's richer states, leaving the poorer states lagging further behind. The convergence process of agricultural economic growth in the context of globalisation and economic liberalisation would reveal the implications for support for or withdrawal from meconomic reform and for further opening of the Indian economy. Evidence of absolute β-convergence in per hectare net state domestic product (NSDP) agricultural levels across Indian states reveals the tendency of states to converge to identical steady states level. Bernard Jones approach confirms that convergence is conditional. Fertiliser, public finance, small-landholdings, cropping intensity, agricultural research and education, physical infrastructure, agricultural mechanisation and diversification were the discerned factors for causing conditional convergence.

Jadhav and Deshmukh (2014) estimated the growth rates of area, production and productivity of major crops grown and fertilizer consumption in Maharashtra state over a period of time. Such an analysis will help in launching different programmes for developing agriculture in the state. Result of study will help policy makers, administrators and research worker for development of agriculture in different fields to plan their strategies for overall development of state. This study revealed that the positive growth rate was noticed in area, production and productivity of majority of major crops. This indicates that the agricultural development is taking place in desired direction. In the overall period the Nitrogenous fertilizer is non significant but phosphatic and potassic fertilizers was significant in Maharashtra state.

Pichad et al. (2014) studied the performance of chickpea in Amravati district with the objectives, to study growth rates and variability in area, production, and productivity of chickpea.Examined by estimating the

growth rates and co-efficient of variation of area, production and productivity of chickpea. The results revealed that, compound growth rates for area, production and productivity for period II were found positive and significant. The co-efficient of variation indicated that, instability in chickpea area exhibited less variation than production and productivity, at overall period.

Isah et al (2015) examined trends in area, production and yield of cereals in India as well Nigera for the period 1982-2012. The average area, production and productivity in India under cereals was 99,787,727.63 ha, 215,096,746.9tonnes and 2.156 tonnes/ha respectively and from Nigeria it was 77,547,885 ha, 101,037,721 tonnes and 1.30 tonnes/ha for area, production and productivity respectively. The computed growth trend for cereals in India was negative (- 0.0750) and significant (P_0.01) for area, and production Computed growth trend was also positive (0.84) and significant (P_0.01) and growth for productivity was positive (0.94) and significant (P_0.01). However, from Nigeria the computed growth were positive (1.056), (1.247), and (0.189) and significant at degree of probabilities 1%, 1% and 5% for area, production and productivity respectively.

Muthu (2015) examined the production and growth of major crops in Indian agriculture during 11th Five - year plan period. The growth rates of production and productivity of all major crops have recorded a positive growth during the period of study whereas the growth rate of cultivation area under cereals, oil seeds and jute &mesta has witnessed as negative. The impressive growth rate in production has been made in the case of cotton, oil seeds, wheat and pulses cultivation. The yield per hectare has been maximum in the cultivation of oil seeds crops.

Kundu (2015) studied the growth of agricultural production in West Bengal using modern time series techniques allowing for endogenous structural breaks in the growth path of the series under considerations, he found the evidence of a statistically significant acceleration in the growth rate of productions of foodgrains, rice and aman rice in the 1980s, which was caused by a significant increase in the growth rate of yield of aman rice from 1980-81.

However, this increase in the agricultural growth in West Bengal was rather short lived as the growth rate of yield of aman rice declined significantly in the state from 1986-87, which leds to a subsequent decline in the growth rate of production of foodgrains in the state from 1987-88.

Patil and Yeledhalli (2016) analysed the growth and instability in area, production and productivity of different crops in Bengaluru Division. The results revealed that Bengaluru urban had the highest CAGR which was 24.26% in productivity in avare was significant at 5% level. In Bengaluru Rural the highest CAGR was 22.26% in productivity of avare (significant at 1%). Production of chrysanthemum had growth of 22.36% was the highest annual growth and 4% (area of tamarind) was found to be lowest instability for selected crops in Chitradurga, In Davanagere the highest CAGR was observed in productivity of tomato (9.12%). In Kolar district, 19.65% instability observed in production of avare& was significant at one %. In Shivamogga district highest CAGR observed in production of sunflower to an extent 29.57%. In Tumkuru area under green chillies was growing at rate of 34.46% per annum.

2.4 Agriculture development with respect to different socio- economic indicators over a period time

Sharma (2005)studied the agricultural development in the mountainous regions circumscribed by the mountain specificities, namely, inaccessibility, marginality, fragility, niche and human adaptation mechanism created by unique vertical dimensions that distinguish them from the plains and other eco-systems. While the first three specificities contribute in varying degrees, among other things, to physical isolation, distance and high transportation costs, the latter two indicate positive features and the potential for agricultural development.

Bezbaruah (2006) he on specific aspects of agriculture in the North-East states are available, attempt to deal with the problems, constraints and prospects of agriculture of the region in a comprehensive and in-depth manner were not well known. In that context the choice of ‘Agricultural

Development in the North-East: Status, Assessment and Prospects' as one of the themes for the 66th Conference of the Indian Society of Agricultural Economics is indeed a timely response to the need of the hour.

Barah (2007) studied the strategies for agricultural development in the North-East India. Therefore revitalising economies by promoting growth and rebuilding the models for agricultural development is a great challenge. In view of the coexistence of diverse ethnicity, geo-physical, socio-economic and cultural factors, the issues of developmental deficiencies are more complicated and thus require more in-depth understanding and strategies for long term economic solution. The primary aim the problems of regional agricultural economies in the changing scenario and to analyse future prospects, identify the sources of agricultural growth and the constraining factors, and suggest innovative people-centric policy interventions for agricultural development.

Kumar et al. (2011) studied the rural poverty and agricultural growth in India: implications for the twelfth five year plan. Significant decline in the incidence of poverty at thenational level in India, there are several concerns that take away the shine from thisaccomplishment. In spite of significant reduction in poverty, India is home to about315 million poor people, 74 per cent of them residing in the rural areas. Further, theconcentration of poverty is more rampant in landless agricultural labour householdsand marginal farm households which account for more than 50 per cent of the totalpoor in India. Therefore, the needs and aspirations of these vulnerable groups must betaken care of to ensure inclusive growth in agriculture.

Roy et al. (2013) tried to investigate SES of hill farmers to correlate it with their adoption of improved farm practices which were meant for higher yield, return, proper utilization of natural resources, sustainable livelihood security and food & nutritional enrichment. The average age of the respondents was 42 years and most were having medium education level (63.33%). Agriculture was the sole occupation of 25 percent farmers, whereas others had subsidiary occupations like labour, shop keeping, driving etc.

Majority had medium level of social participation (78.34%). The average landholding was 0.40 ha and most were having a medium herd size (66.67%). The respondents had an average farming experience of 19 years. Most of the farmers had medium levels of annual income (55%) and material possession (60%). In totality, the study revealed that 26.67 percent of farmers belonged to low SES category, 55 percent were belonged to medium SES category and 18.33 percent farmers belonged to high SES category.

Gharke et al. (2013) examined the level of agricultural development in Maharashtra state. In general, positive growth rate was observed in terms,of area, production and productivity of majority of important crops. This indicated that agricultural development was taking place in desired direction. It was also observed that the inequalities existed among the districts in Maharashtra.It can be suggested from the study that there is a lot of prospectus for horticultural development in the state, which can be possibly done by bringing cultivable waste land under horticultural crops. Government should undertake social forestry programme on large scale in order to increase the forest area in Maharashtra state.

Kumuda (2014) studied the Improvements in agricultural productivity to create social and economic ripple effects. With increased incomes, small farmers can better feed their families, send their children to school, provide nutrificious food for their health, and invest in their farms. This makes their communities economically stronger and more stable. Over the past 200 years, nearly every part of the developed world has seen an agricultural transformation. As farming improved, so did incomes, health, and economies. More recently, we've seen amazing progress in parts of the developing world. During the Green Revolution, which took place from the 1960s to the 1980s, improvements in staple crops such as maize, wheat, and rice helped double the amount of food produced, saved hundreds of millions of lives, and drove broader development throughout much of Asia and Latin America.

Ballabh and Batra (2015) studied the begins with a broad overview of the central India - its resources, tribal and their present socio-economic

conditions vis-a-vis rest of India. This is followed by the debate and concern for tribal development between Nehru and Elwin, a British Indian citizen whom Nehru had appointed as an anthropological advisor to the Government of India. Both of them were equally concerned about the tribals but their approach to their development vastly differed.

Ogunleye et al. (2015) examined the socio-economic factors affecting farmers' participation in cooperative societies in Surulere Local Government Area of Oyo State.The results showed that majority of the respondents were male (60%) with mean age of 44 years and married (80%). The most important cooperative societies were credit and thrift cooperative(82%), processing cooperative (17%) and producer cooperative (13%).Major benefit derived by members include Provision of input(mean=2.6), Accessibility to loan (mean=2.4) and marketing of produce (mean=2.2).Management and leadership problem (73%), Limited memberships/insufficient fund (69%) were the major problems militating against participation in cooperative activities.

Ogunmefun and Achike (2015) analyzed the socioeconomic characteristics of rural farmers and problems associated with the use of informal insurance measures in Odogbolu Local Government Area of Ogun state, Nigeria. Results showed all the measures used were found that limited their effectivenesss. Majority of the farmers (61%) identified their major problems with the use of informal insurance measures as entry constraints which was grouped into lack of credit, lack of credit facilities, Lack of working capital (assets like land) and lack of skills (education). Recommendation for this study is that farmers should be encouraged to invest more and increase their input in agriculture as to improve their output/revenue. Also, the government should give concessions to the rural farmers in various aspects which include provision of credit facilities, provision of infrastructures and inputs for rural farmers to enable them perform most of the informal insurance measures.

Ratna and Thakur (2015) studied the socioeconomic factors affecting vegetable production in Kullu district of Himachal Pradesh. The study revealed

that the female headed families were obtaining 10 to 18% higher productivities than male headed in case of cucumber, cauliflower, cabbage and pea. Families having size of more than 4 persons were obtaining higher yields in case of cauliflower, cabbage, tomato, Iceberg and cucumber. Further, higher yields in most of the vegetable crops were obtained by those households whose heads were in the age group of greater than 30 years. The educational-level of the head of the sample households was found to have a direct relationship with the productivity of all the vegetable crops. The marginal and small farmers were getting higher yield in vegetables than the farmers having more than 2 hectares of land. Regression analysis revealed that 1% increase in the area under crop would increase gross income of the farmers by 1.21% in case of pea crop. The study emphasized that the rural unemployed youth with education upto graduation should be encouraged to engage themselvesin vegetable production as a profession.

Singh (2015) examined the development of agricultural mechanisation in India is both fascinating and in many ways, quite remarkable. The country has moved forward over the past six decades from one in which it then faced severe food shortages towhere today it has become an exporter of many food commodities and a major exporter of other industrial products, including agricultural tractors. This has been achieved despite a more than three-fold increase in its population and insignificant increase to the arable land area.

Roland and Petja (2015) studied the socio-economic factors which serve as impediments to agricultural development in the Lower River Benue Basin. Significant socio-economic challenges identified include inadequate access to land, traditional methods of cultivation, inadequate access to credit, inadequate processing and storage facilities, small farm size, and inadequate access to farm inputs. The preponderance of agricultural activities had very little effect on the income of the population which was generally quite low. Factor analyses revealed that educationally developed and agriculturally literate communities have the highest potential to achieve adequate agricultural development.

Methodology

CHAPTER-III

METHODOLOGY

The success of any scientific research depend upon research methodology used it. It is necessary to adopt an appropriate method and procedure to arrive at useful conclusion there liability and validity of the result depend upon method of procedure of data collection and analytical tools used in the study.

Salient features of Jalna district

Location

Jalna district is approximately sitauated at the central part of Maharashtra state and in northen direction of Marathwada region.The Jalna district lies between 19.01º to 21.03º North Latitudes and 75.04º to 76.04º East Longitude. It covers an area of 7,612 Sq.Kms, which is 2.47% of the total state area. District boundaries are adjacent to Jalgaon at north, Parbhani & buldhana at east, beed at south and Aurangabad in west.

Soils

The Soils of the district are derived from the basaltic lava flows. Thickness of the soil cover is less in northern and western region where ground elevations are higher and consequently soil regur, gravels, murum are transported down to lower regions through gravity, water or winds. Soils in central, southern and eastern regions of the district near the banks of Godavari and Dudhna rivers are thicker. The soils ranging in depth from 1 to 2 m are black and rich in plant nutrients. These are dark black cotton soils, plastic, sticky, rich in plant nutrients and are very fertile. These soils range in thickness from 50 to 200 cm and lie over murum at 2 to 4 meters depth comprising clays, loam, lime etc.

Climate and Monsoon

The Climate of the district is characterized by a hot summer and general dryness throughout the year except during the south-west monsoon season, i.e., June to September. The temperature rises rapidly after February till May, which is the hottest month of the year. The mean daily maximum temperature

during May is 42.0°C and the mean daily minimum temperature during December is 12.0°C.

Rainfall

The normal annual rainfall (1901-1996) varies from about 600 to 800 mm. The entire district experienced moderate and severe drought conditions for more than 20% of the years and can be categorized as “drought area”.

Population

Total population of the district is 16,12,980 Male and female population is 8,26,903 and 7,86,077 respectively (As per Census 2011). The literacy rate of district is 76.99 %(as per census 2011). Jalna district population constituted **1.74 percent of total Maharashtra population .**

Sampling Design

Selection of region

Jalna District was purposively selected for present study because Jalna district has made progress in Agricultural development due to increase in irrigation facilities through major irrigation dam via. Jaykwadi and Ghanewadi dams, . It comprises 8 talukas having 17.91% of total population live in urban areas. It devotes 48% of its land for cultivation occupying 33.15% Cereals and 14.85% Pulses.

Selection of parameters for agricultural development

1 Demographic particular

A. Rural population as per cent age total population
B. Density of population
C. Literacy percentage age total population
D. Male female ratio
E. Land to man ratio
F. Co-operative industries
G. Irrigated area as per cent to total

area 2 Growth rate of land utilization

3 Growth rate of area, production, and productivity of crops 4 Growth rate of quantity of fertilizers consumed.

Collection of data

Since the major objective of the study is to examine the development of agriculture in Jalna District during last 15 years. A time series data are necessary to study the growth rates of selected parameters. Such data can be available only through secondary sources. The required secondary data will were obtained from the different records of state governments and co-operative institutions viz. Department of Agriculture, Government of Maharashtra, Socio-economic Review, Directorate of Economics and Statistics, Government of Maharashtra.

Analytical Techniques

In analytical techniques tabular analysis and functional analysis such as linear and compound growth rates were used to analyze data of present study.

Tabular analysis

Tabular analysis consisted with arithmetic mean, percentages and ratios.

Functional Analysis

To examine the performance of area, production and productivity of major crops linear and compounds growth rates were used.

A) Linear or simple growth rate

For studying the growth rate in area, production and productivity of major crops, linear growth rate were estimated by using following linear functions.

$$Y= a+bx+e$$

Where

Y = Dependent variable for which growth rate is estimated

a= Intercept/Constant

b= Regression/trend coefficient

x= Period in years

e= Error term with zero mean and constant variance.

B) Compound growth rate

Compound growth rate of area, production, productivity were worked out to know the percentage increase or decrease in selected parameters. The exponential growth function of following type was used purposively.

$Y= ab^x$

Y= Dependent variable for which growth rate is estimated

a= Intercept or constant

b= Trend / Regression coefficient

x= time Period in years

b= (1+r)

where, r = is compound growth rate

C.G.R. = logy= loga +log b

To know the average situation and variability in selected parameters of development, arithmetic mean (x) standard error (S.E), coefficient of variance (C.V.) were estimated for each parameter.

For fulfilling the objective i.e. to study agricultural development with respect to different socio-economic indicators over a period of time, percentage change was calculated over base year 2003-04

3.5 Terms and concepts used

1. **Cropping pattern**: cropping pattern indicates the proportionate area under different crops.
2. **Cropping intensity:** It is the ratio of gross cropped area to net area sown area multiplied by hundred.
3. **Production**: It is the process of transforming raw material or input into final product or output
4. **Sex ratio**: Sex ratio means number of Females per thousand male.
5. **Land man ratio**: it is the ratio of total population to the total geographical area.
6. **Standard error**: The standard deviation of sampling distribution of an estimate.

7. **Co-efficient of variance**: Co-efficient of variance is the percentage in terms of standard deviation with respect to mean. It shows variation in terms of means.

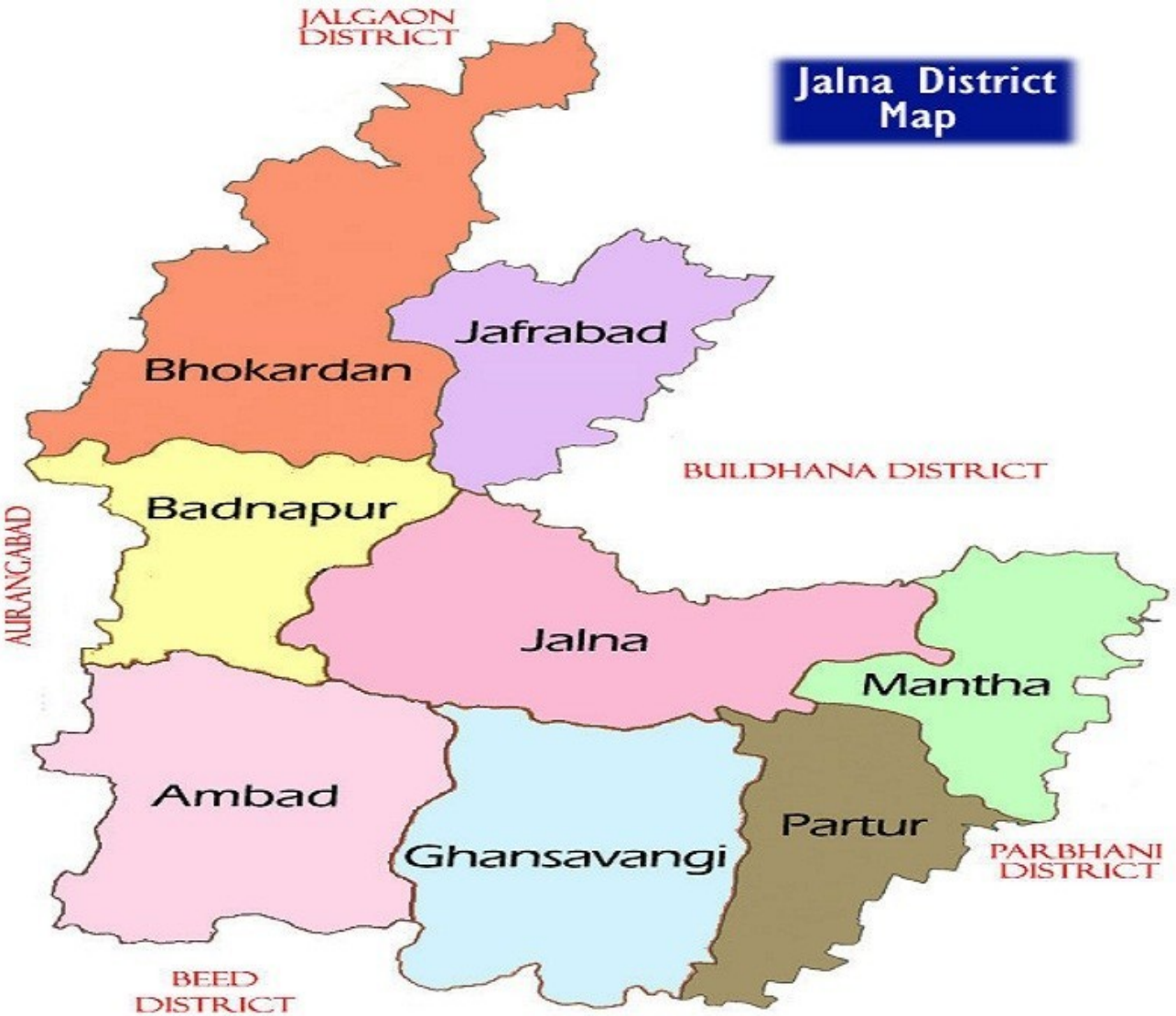

Fig. 3.1. Map of Jalna district

Results and Discussion

CHAPTER – IV
RESULTS ANDDISCUSSION

4.1 General

Agricultural development in Jalna district of Maharashtra state studied during the period of 2002-2003 to 2016-17 and results are presented in this chapter. The various selected parameters are land utilization, cropping pattern (area), production and productivity of major crops, irrigation facilities, livestock, fertilizer consumption and the socio-economic development etc. The data were analysed with suitable statistical tools. The results of the analysis is presented as below.

4.1 Changes in Land use pattern

The information about changes in land use pattern is presented in table 4.1. It can seen from table that, the total geographical area remained constant during the year viz., 2002-03 and 2016-17 and it was 773000 hectares. Area under forest was 1010 hectares i.e. 15.23 per cent of total geographical area in 2002-03, which decreased to 910 hectares in 2016-17, i.e. it decreased by 9.90 per cent over the base year.

Barren and uncultivable land increased from 1.79 per cent to 1.95 per cent during the period from 2002-03 to 2016-17. Land under non-agricultural use was decreased from 712 to 458.33 hectares during the period from 2002-03 to 2016-17 i.e.10.73 per cent to 7.5 per cent. The area under permanent pastures decreased from 41100 hectares to 32600 hectares during the period from 2002-03 to 2016-17.

The current fallow land was 840 hectare i.e. 12.66 per cent of the total geographical area in 2002-03, decreased to 450 hectare in 2016-2017 i.e. -46.42 Per cent of total geographical area. The net sown area was 5310 hectares i.e. 80.09 Per cent in 2002-03, which decreased to 4890 hectares i.e. 80.16 Per cent in 2016-17. The area sown more than once was 1320 hectares during 2002- 03 and later showed decline of 1210 ha in 2016-2017. The gross cropped area

was 6630 hectares during the year 2002-03 i.e. 85.76 per cent, which indicated significant decrease to 6100 hectares i.e. 78.91 Per cent during year 2016-17.

The changes in the major components of the land use pattern during the study in period Jalna district has graphically presented in table 4.1. To sum of whole, it can said that the area under forest barren and uncultivable land, current fallow and net sown area showed and increasing trend during the period under study. The Land under non-agricultural use declined by -35.67 Per cent and area sown more than once decreased by -8.33 per cent during the whole period of study

Table 4.1 Changes in land use pattern of Jalna district

(Area in ha 00)

Sr. No.	Particulars	2002-2003	2016-2017	Percentage change
1	Geographical area	7730 (100)	7730 (100)	0
2	Forest	1010 (15.23)	910 (14.91)	-9.90
3	Barren and uncultivable land	144 (1.79)	158 (1.95)	9.7
4	Land under non-agricultural use	712 (10.73)	458 (7.50)	-35.67
5	Cultivable waste	809 (9.38)	580 (9.50)	-28.30
6	Permanent pastures	411 (6.19)	326 (5.34)	-20.68
8	Current fallow	840 (12.66)	450 (7.37)	-46.42
9	Other fallow	485 (7.31)	400 (6.55)	-17
10	Net sown area	5310 (80.09)	4890 (80.16)	-7.70
11	Area sown more than once	1320 (19.90)	1210 (19.83)	-8.33
12	Gross cropped area	6630 (85.76)	6100 (78.91)	-7.99

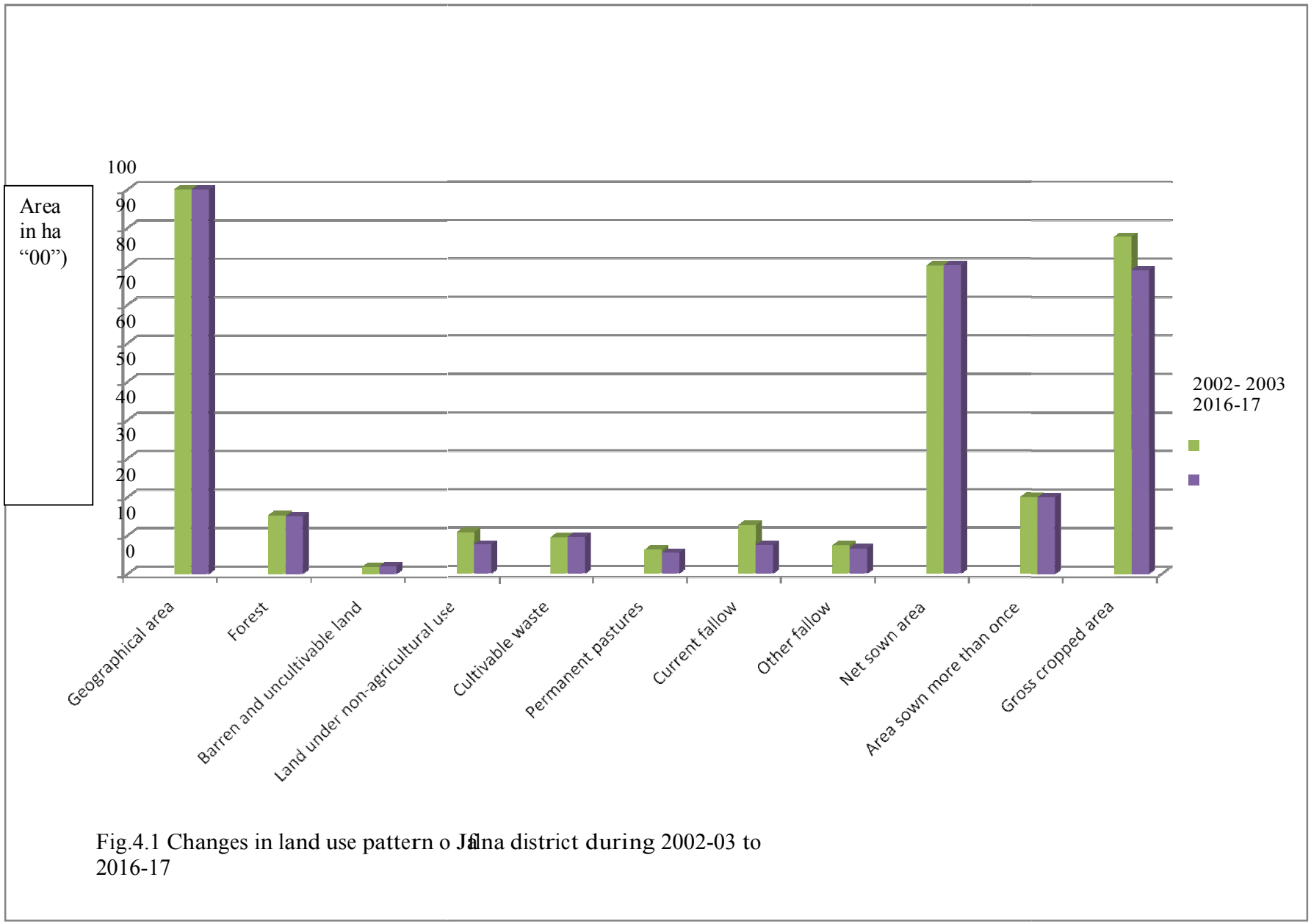

Fig.4.1 Changes in land use pattern o Jalna district during 2002-03 to 2016-17

4.2 Changes in the cropping pattern

The details related to the changes in cropping pattern of Jalna district are presented the table 4.2.

It seen from the table 4.2 that the area under Jowar decreased from 3189 hectares 2002-03 to 1690 hectares in 2016-17. The area under Wheat decreased from 383 hectares in 2002-03 to 276. hectares in 2016-17 i.e. from 5.77 per cent to 4.52 per cent of the gross cropped area.. The area under Bajra showed decreased from 864. hectares in 2002-2003 but there was drastic decrease was 550 hectares during year 2016-17. Total cereals showed increase from 2002-03 to 2016-17 it was 1551 to 3537 hectares over the base year.

Area under Red gram was 480 hectares in 2002-03 and increased up to 470 hectares in 2016-17 that is from 7.23 per cent to 7.70 per cent during the year 2002-03to 2016-17. In addition, area under Green gram decreased from 2002-03 to 2016-17 it was 542 to 415 hectares over the base year. Black gram decreased from 190 hectares to 148 hectares during 2002-03 to 2016-17 i.e. from 2.86 per cent to 2.42 per cent.

Table 4.2 Changes in the cropping pattern (Area in "00" ha)

Year	2002-2003	2016-2017	Percentage Change
Jowar	3189 (48.09)	1690 (27.70)	-47
Maize	578 (8.7)	308 (5.04)	-46.71
Wheat	383 (5.77)	276 (4.52)	-27.93
Bajra	864 (13.03)	550 (8.29)	-36.34
Total Cereal	1551 (23.39)	3537 (57.98)	128
Red gram	480 (7.23)	470 (7.70)	-2.08
Green gram	542 (8.17)	415 (6.80)	-23.43
Black gram	190 (2.86)	148 (2.42)	-22.10
Gram	157 (2.36)	341 (5.59)	117
Total Pulses	1456 (21.96)	1420 (23.27)	-2.47
Sunflower	223 (3.36)	1 (0.01)	-99.95
Soybean	115.2 (1.73)	2 (0.03)	-9.28
Soyaben	480 (7.23)	840 (13.77)	-75
Groundnut	13 (0.19)	10 (0.12)	-48
Total oilseed	491 (7.40)	1012 (16.59)	91
cotton	1449 (16.79)	3069 (37.88)	63
Sugarcane	362 (5.46)	700 (11.47)	46
Total food grain	1526 (23.01)	3820 (62.62)	-22
Grosscropped area	6630.00 (100)	6100.00 (100)	-7.99

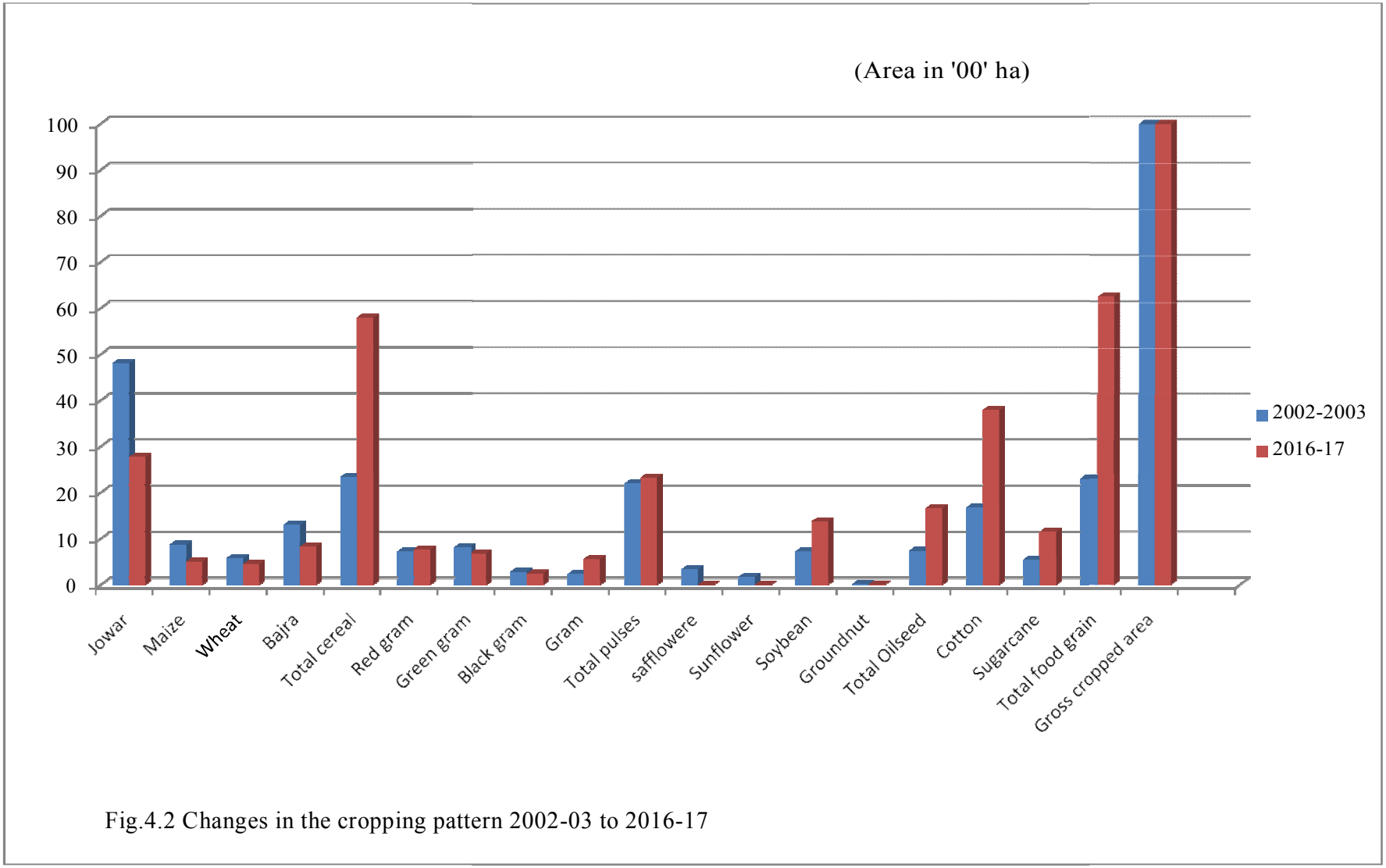

Fig.4.2 Changes in the cropping pattern 2002-03 to 2016-17

Total pulses decreased from 145600 hectares to 142000 hectares i.e. 21.96 per cent to 23.27 per cent during 2002-03 to 2016-17. Area under total food grains increased from 152600.hectares to 382000 hectares during 2002-03to 2016- 17.

Total oilseeds increased from 491 hectares to 1012 hectares during 2002-03 to 2016-17. Common oilseeds showed decreasing trend. The area under Soybean was 480 hectares in 2002-03 later on it is increased to 840 hectares in 2016-17. Area under sunflower was 115.2 hectares in 2002-03 later on it was decreased to 2 hectares in 2016-17.

Area under Sugarcane showed tremendous increased. It was 362 hectares in 2002-03 and increased up to 700 hectares in 2016-17. Area under Cotton showed, increasing trend 2002-03 to 2016-17 it was 1449 to 3069 hectares. It can be seen from the table that the area under commercial crops is increasing viz Cotton except Sugarcane. The changes in acreages under major crops during the period from 2002-03 to 2016-17 in Jalna district have been depicted by way of a line graph in figure 4.2.

4.3 Changes in Production of different crops

Development of agriculture is characterized by production of different crops which were worked out for the period i.e. 2002-03 to 2016-17 and presented in table 4.3 It shows that production of soybean , other cereals had increased significantly. There had been great decline in production of all major crops due to reduction in area and cultivation. However there was huge decline in production of cotton, gram However, increased in soybean and declining in production was observed for jowar and green gram in studied period. The information related to productivity of major crops in the district is presented in the table 4.4.

It can be concluded from the table that the production of most of the crops decreased over the base year. It has noted that average production of wheat is from 440 kg/ha. in 2002-03 to 102 kg/ha. in 2016-17. In case of Jowar it is decreased from 1667 kg/ha. in 2002-03 to 420 kg/ha. in 2016-17 and in case of Maize decreased from 1233 kg/ha. to 1012 kg/ha. during the year 2002-

03 to 2016-17 In case of Bajra it was 839kg/ha during. 2002-2003to 186kg/ha the average production decreased. However, the overall production of total cereals has decreased from 2262 kg/ha. to 345kg/ha. during the year 2002-03 to 2016-17.

The average production of pulses has decreased from 922 kg/ha. to 312 kg/ha. from 2002-03 to 2016-17. Among the pulses in Jalna district, Red gram production decreased from 303 kg/ha. in 2002-03 to 135 kg/ha. in 2016-17. The production of black gram decreased from 167 kg/ha. to 60 kg/ha during the year 2002-03to 2016-17. In case of gram it is decreased from 119 kg/ha. in 2002-03 to 90kg/ha. in 2016-17 and in case of green gram from 318 kg/ha. to 105 kg/ha during the year 2002-03to 2016-17.

Among the oilseeds, average production of oilseed has increased from 329 kg/ha. to 600 kg/ha during the year 2002-03 to 2016-17. Among the Oilseed in Jalna district, Groundnut has decreased from 11 kg/ha. in 2002-03 to 4 kg/ha. in 2016-17. The production of Sunflower decreased from 51 kg/ha. in 2002-03 to 0.1 kg/ha. in 2016-17. Soybean it showed the production 102 kg/ha. in 2002-03 and later on it increased to 675 kg/ha. in 2016-17. Also safflower showed the decreased in production it was 143 kg/ha. in 2002-03 and it is decreased to1 kg/ha. in 2016-17.Among the cash crops, Sugarcane has shown increased production it was 11200 kg/ha in 2002-03 and it is decreased to 10075 kg/ha in 2016-17 and cotton show the decreased production it was 2000 kg/ha. in 2002-03 and it was decreased to 1691 kg/ha. in 2016-17

Table 4.3 Production of different crops in Jalna district

(Production'00 tonnes)

Sr. No.	Particulars	2002-2003	2016-2017	Change
1	Jowar	1667	420	-74.20
2	Maize	1233	1012	-17.92
3	Wheat	440	102	-76.81
4	Bajra	839	186	-77.83
4	Other cereal	1	3	200
6	Total cereal	2262	345	-84.74
7	Red gram	303	135	-55.44
8	Green gram	318	105	-66.98
9	Black gram	167	60	-64.07
10	Gram	119	90	-24.36
11	Other pulses	15	2	-86.66
12	Total pulses	922	312	-66.16
13	Safflower	143	1	-99.30
14	Sunflower	51	0.1	-99.80
15	Soybean	102	675	561.1
16	Groundnut	11	4	-63.63
17	Total Oilseed	329	600	182.37
18	Cotton	2000	1691	-15.45
19	Sugarcane	11200	10075	10.04
20	Total food grain	4896	2185	-55.37

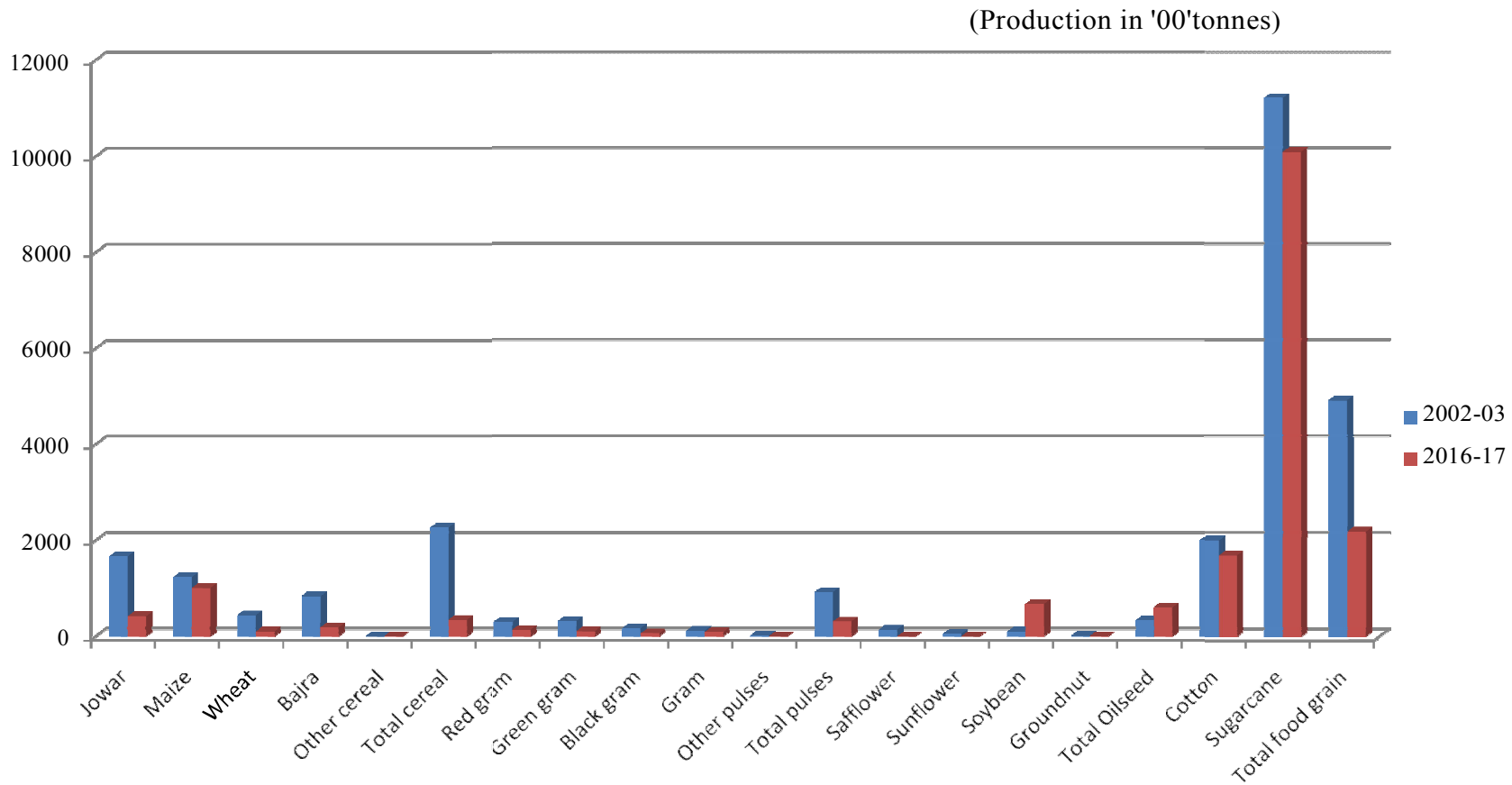

fig.4.4 Changes in Production fodifferent crops in jalna district during 2002-03 to 2016-17

4.4 Changes in Productivity of major crops

The information related to productivity of major crops in the district is presented in the table 4.4

It can be concluded from the table that the productivity of most of the crops decreased over the base year. It has noted that average productivity of wheat was increased from 716 kg/ha. in 2002-03 to 745 kg/ha. in 2016-17. In case of Jowar it is increased from 2126 kg/ha. in 2002-03 to 2032 kg/ha. in 2016-17 and in case of Maize it was increased from 1493 kg/ha. to 2470 kg/ha. during the year 2002-03 to 2016-17,1465kg/ha to 2016-17, 900kg/ha In case of Bajra, the average productivity decreased. the overall productivity of total cereals has decreased from 1985 kg/ha. to 812 kg/ha. during the year 2002-03 to 2016-17.

The average productivity of pulses has decreased from 1182 kg/ha. to 450 kg/ha. from 2002-03 to 2016-17. Among the pulses in Jalna district, Red gram productivity decreased from 556 kg/ha. in 2002-03 to 220 kg/ha. in 2016-17. The productivity of black gram decreased from 437 kg/ha. to 428 kg/ha during the year 2002-03 to 2016-17. In case of gram it is decreased from 644 kg/ha. in 2002-03 to 252 kg/ha. in 2016-17 and in case of green gram from 289 kg/ha. to 105 kg/ha during the year 2002-03to 2016-17.

Among the oilseeds, average productivity of oilseed has decreased from 443 kg/ha. to 368 kg/ha during the year 2002-03 to 2016-17. Among the Oilseed in Jalna district, Groundnut has decreased from 626 kg/ha. in 2002-03 to 3 kg/ha. in 2016-17. The productivity of Sunflower decreased from 770 kg/ha. in 2002-03 to 478 kg/ha. in 2016-17. Soybean it showed the productivity 1701 kg/ha. in 2002-03 and later on it declines to 912 kg/ha. in 2016-17. Also safflower showed the increased in productivity it was 480 kg/ha. in 2002-03 and it is increased to 526 kg/ha. in 2016-17.Among the cash crops, Sugarcane has shown increased productivity it was 63 kg/ha in 2002-03 and it is increased to 110 kg/ha in 2016-17 and cotton show the increased productivity it was 198 kg/ha. in 2002-03 and it was increased to 256 kg/ha. in 2016- 17.

Table 4.4 Changes in average productivity of major crops in Jalna district

(Productivity in "kg/ha")

Sr. No.	Crops	2002-2003	2016-2017	Percentage Change
1	Jowar	2126	2032	0.28
2	Maize	1493	2470	45.95
3	Bajra	1465	900	-38.56
4	Wheat	716	745	4.05
5	Other cereal	939	450	-52.07
6	Total cereal	1985	812	-59.09
7	Red gram	556	220	-6043
8	Green gram	289	105	-63.63
9	Black gram	437	428	-2.05
10	Gram	644	252	-60.86
11	Other pulses	239	215	-10.04
12	Total pulses	1182	450	-61.92
13	Groundnut	626	3	-99.5
14	Safflower	480	526	9.58
15	Sunflower	770	478	-37.92
16	Soybean	1701	912	-46.38
17	Total Oilseed	443	368	-16.93
18	Cotton	198	256	29.29
19	Sugarcane	63	110	74..60
20	Total food grain	820	450	-45.12

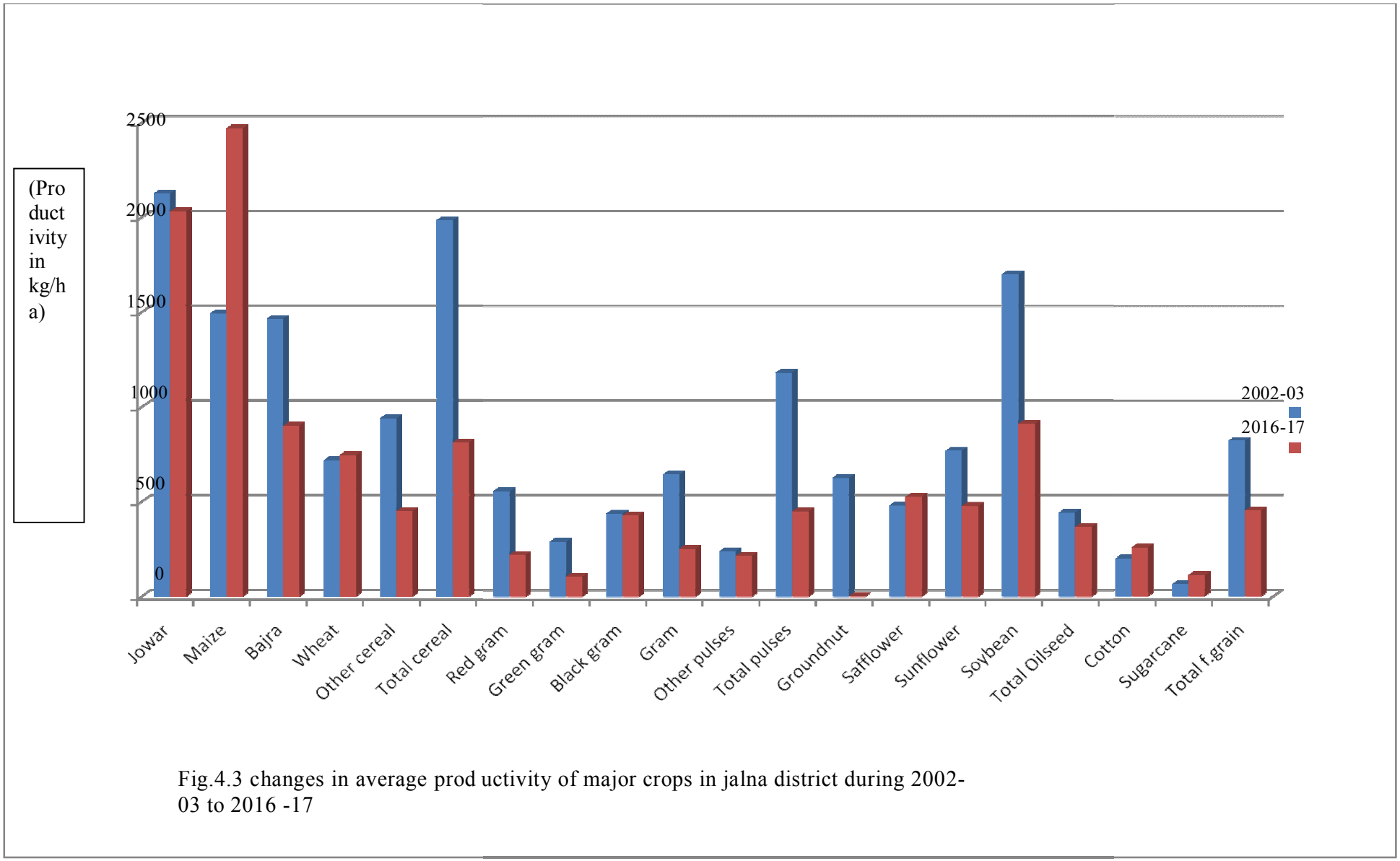

Fig.4.3 changes in average prod uctivity of major crops in jalna district during 2002-03 to 2016 -17

4.5 Area irrigated by different sources

Irrigation is the key factor in agricultural development. The use of modern inputs ultimately results in increase of productivity. The position of Jalna from the year 2002-03 to 2016-17 is given in table 4.5.

The area irrigated by surface irrigation was 4095 hundred hectares in 2002-03, which has decreased to 1113 hundred hectares -72.82 per cent in 2016-17. It is noted that lifts installed on the irrigation projects and rivers were the important sources of irrigation next to wells in the district. At the same time area under well irrigation has decreased from hundred hectares in 2002-03 to 42657 hundred hectares in 2016-17. It is apparent from the table that the net area irrigated was 5400 hundred hectares in 2002-03 which increased to 14800 hundred hectares in 2016-17. The proportion of net irrigated area to the net sown area has increased from 7.39 per cent in 2002-03 to 21.48 per cent in 2016-17. The gross area irrigated was 530 hundred hectares in 2002-03 which has decreased to 437 hundred hectares in 2016-17.The proportion of gross irrigated area to gross cropped area has decreased from 6.14 per cent in 2002-03 to 5.40 per cent in 2016-17.

Table 4.5 Trends in the area irrigated by various sources in Jalna district

(Area in "00" ha.)

Sr .No	Particulars	2002-2003	2016-2017	Percentage Change
1	Surface irrigation	4095	1113	-72.82
2	Well irrigation	48950	42657	-12.87
3	Net area irrigated	5400	14800	174.04
4	Percentage of net irrigated area to net sown area	7.39	21.48	190.66
5	Gross irrigated area	530	437	-17.59
6	Percentage of gross irrigated area to gross cropped area	6.14	5.40	-12.05

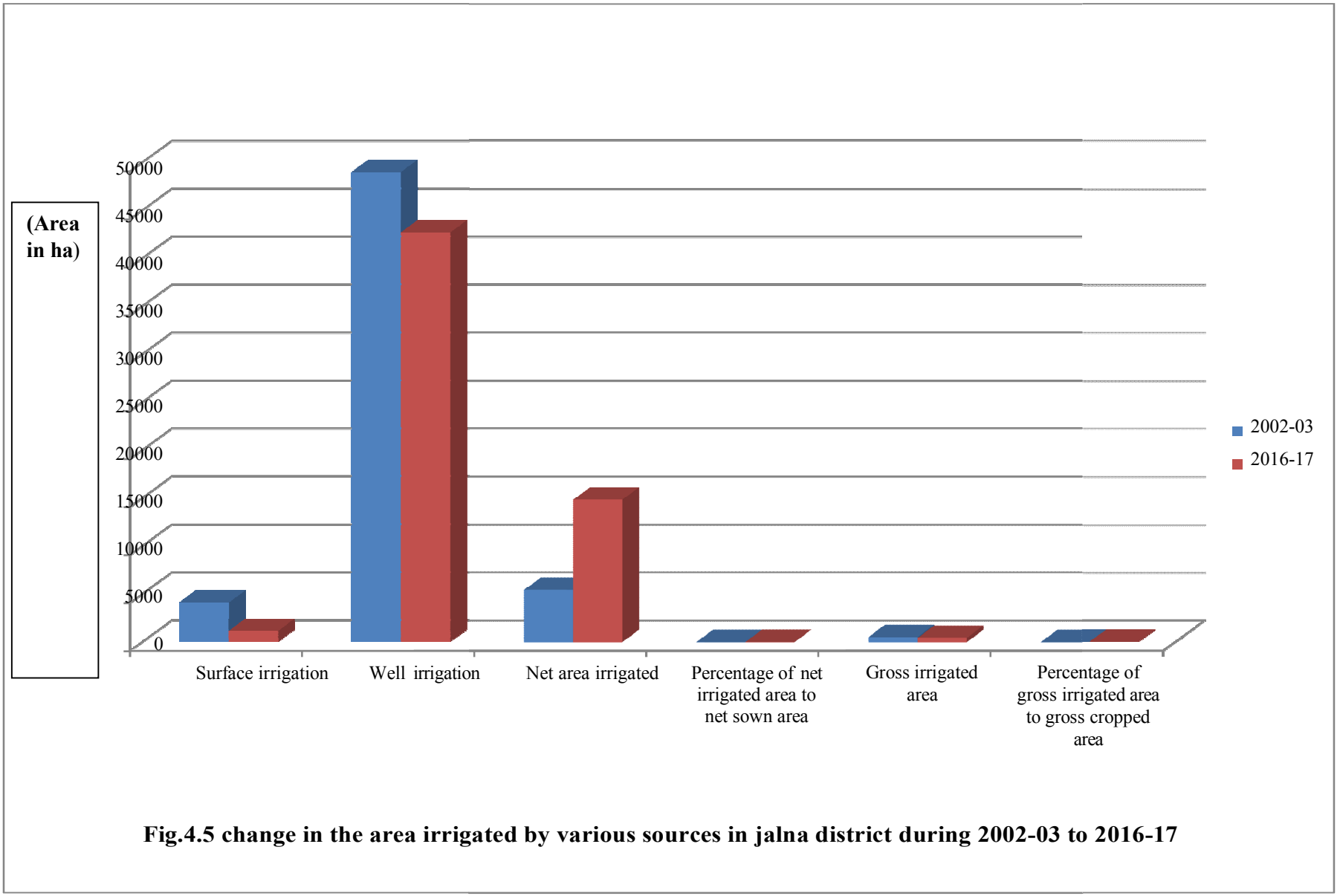

Fig.4.5 change in the area irrigated by various sources in jalna district during 2002-03 to 2016-17

4.6 Changes in consumption of NPK

The changes in consumption of N,P and K fertilizers in Jalna district is presented in the table 4.6. it can seen from the table that, the total consumption of fertilizers in Jalna district was 30138 MT in the year 2002-03, which has increased to 67695 MT in the year 2016-17. Per hectare N, P and K consumption showed an increasing trend during the entire period under study, especially in the last 15 years. It is noted that during the span of last 15 years, the consumption of N and P increased as compared to K. It was mainly due to the farmer's awareness towards use of chemical fertilizers for improving the productivity of crops and the government's incentives and subsidy to phosphate fertilizers. The change in consumption of total fertilizers (N, P and K), at given periods in jalna districts shown graphically in fig. 5.4.

Table 4.6 Changes in total consumption of fertilizers in Jalna district

[Fertilizer in "Qty"]

Sr.No	Particulars	2002-2003	2016-2017	Percentage Change
1	Nitrogen	30138 (59.45)	67695 (57.08)	124.61
2	Phosphorus	16922 (32.21)	39445 (32.26)	133.09
3	Potassium	11550 (22.67)	21548 (18.17)	86.56
4	Total	50948 (114.33)	118588 (107.51)	132.76

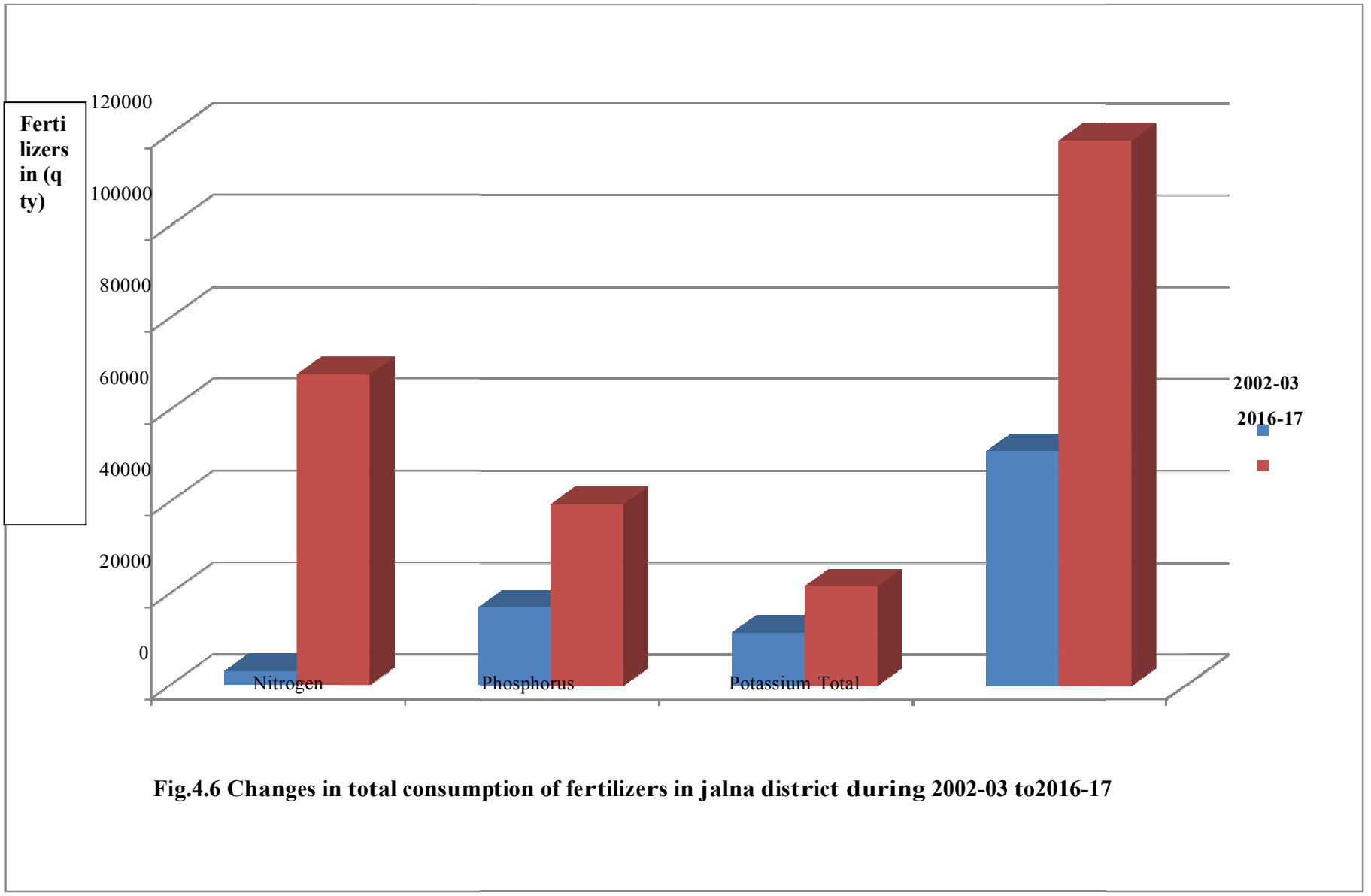

Fig.4.6 Changes in total consumption of fertilizers in jalna district during 2002-03 to2016-17

Development of selected parameters

Development in selected parameters was discussed below:

4.7 Trends in Land Utilization

Land forms the most important natural wealth, its proper utilization is a matter of almost concern to the people as its improper usage leads to wastage and progressive deterioration or reduction in productivity. To know the development of the district, mean, SD, CV, SE of land utilization are worked out for three periods i.e. 2002-03 to 2009-2010 (I), 2010-11 to 2016-17 (II) and 2002-03 to 2016-17 (III).

4.7.1 Area under forest

The area under forest was 4941.14 hectares in period I which increased to 7324.25 hectares in period II and in entire period III it was again decreased to 6212.13 hectares. Its variability was 97.66,38.72and 63.40 per cent period I,II and entire period respectively.

4.7.2 Area under barren and uncultivable land

Barren and uncultivable land use was increased from 14557.14 to 15650 hectares during the period I and period II. And in entire period III it is also decreased to 15140 thousand ha. Its variability was 2.85,1.02 and 4.20 per cent in period I, II and III respectively.

4.7.3 Land under non-agricultural use

The land under non-agricultural use showed increase, it was 71142.86.hectares in period I which decreased to 58525 hectares in period II and overall the period III it was again increased to 64413.33 hectares. Its variability was 0.13,23.33 and 18.08 per cent period I,II and overall period respectively.

4.7.4 Area under cultivable waste land

The area under cultivable waste land was 80985.71 hectare in period I which decreased to 49600 hectare in period II and again increased to 64246 hectare in period III. Its variability was 0.18,68.10 and 44.93per cent in period I,II and overall period, respectively.

4.7.5 Area under permanent pasture and other grazing land

In Jalna district average area under permanent pasture and other grazing land in the period I was 41414.29 hectare which was increased to 42575 hectare in the period II. The mean of overall period III was 42033.33hectare.its variability was 1.29,0.72 and 1.73 per cent in period I,II and overall period, respectively.

4.7.6 Area under current fallow

The current fallow land was 20057.14 hectare area in period I which increased to 56000 hectare in period II and again decreased to 39226.67 hectare in period III and its variability was 37.20,53.45 and 72.83 per cent in period I, II and III, respectively.

4.7.7 Area under other fallow

The average area under other fallow in period I was 18585.72 hectare. In period II it was 31337.50 hectare and in overall period III it was 25386.67 hectare and its variability was 1.43,33.49. and 39.092 per cent, respectively.

4.7.8 Area under Net sown area

The average area under net sown area in period I was 73088.57 hundred ha; which decreased to 70850 hundred ha; in period II and in overall period III it was 71894.66 hundred ha; and its variability was 0.79, 3.44 and 2.93 per cent in period I, II and III respectively.

4.7.9 Area sown more than once

The average area sown more than once in period I was 13035.71 hundred ha, it was decreased to 12077.50 hundred ha in period II and for overall period III it was 12524.67 thousand ha and variability was 3.33, 4.43 and 5.46 per cent respectively.

4.7.10 Area under gross cropped area

The gross cropped area was 66257.1 hectares which showed a significant increase to 68358.8 hectares in period I in period II and finally showed decline in period III to 66044.60 hectares Its variability was 0.04,9.34 and, 6.59 per cent in period I, II and III, respectively.

Table 4.7 Land utilization pattern of Jalna district (2002-03 to 2016-17) (Area ha)

Particular	Mean			SD			CV			SE		
	Period I	Period II	overall	Period I	Period II	overall	Period I	PeriodII	overall	Period I	Period II	Overall
1. Forest	4941.14	7324.25	6212.13	4825.67	2835.96	3939.3	97.66	38.72	63.40	1823.93	1002.66	1017.05
2. Barren and uncultivable land	14557.14	15650	15140	415.76	160.34	636.72	2.85	1.02	4.20	157.17	56.69	164.40
3. Land under non-agricultural use	71142.86	58525	64413.33	97.76	13658.97	11650.94	0.137	23.33	18.08	36.95	4829.17	3008.25
4. Cultivable waste land	80985.71	49600	64246.67	145.47	33781.82	28866.91	0.180	68.109	44.93	54.98	11943.68	7453.40
5. Permanent pastures and other grazing land	41414	42575	42033.33	536.73	310.25	728.70	1.29	0.72	1.73	202.86	109.69	188.15
6. Current fallow	20057.14	56000	39226.67	7461.20	29933.26	28572.05	37.20	53.45	72.83	2820.07	10583.07	7377.27
7. Other fallow	18585.72	31337.50	25386.67	267.25	10497.07	9924.05	1.43	33.49	39.09	101.01	3711.27	2562.38
8. Net sown area	73088.57	70850	71894.66	583.06	2437.16	2109.92	0.79	3.44	2.93	220.37	861.66	544.77
9. Area sown more than once	13035.71	12077.50	12524.67	434.65	535.10	684.10	3.33	4.43	5.46	164.28	189.18	176.81
10. Gross cropped area	66257.1	68358.8	66044.60	29.27	7755.3	6157.03	0.04	9.34	6.59	11.06	217.84	1122.38

4.8 Area under different crops

To know the development in area under different crops in Jalna for the study period (2002-03 to 2016-17) the Mean, S.D, C.V. and S.E. were worked out and presented in table 4.8.

4.8.1 Area under Jowar

The average area under Jowar during period I in the district was 1841 hundred ha. and it decreased to 1000 hundred ha. during period II and area under cultivation of rice during overall period III was 1392.4 hundred ha. The variability was 33.30, 56.95 and 49.55 per cent respectively during the period I, II and III.

4.8.2 Area under Maize

The district had an average area of 622 hundred ha. under Maize cultivation during the period I and it decreased to 666.51 hundred ha. in period II and the average area of cultivation during the period III was 642.8 hundred ha. There was variability of 6.03, 40.87 and 30.10 per cent during the period I, II and III respectively.

4.8.3 Area under Wheat

Wheat occupied an average area of 236.75 hundred ha. during the period I and it decreased to 175 hundred ha. during period II and area under cultivation during period III was 204.46 hundred ha. The variability was 24.26,70.91 and 49.49 per cent during the period I, II and III, respectively.

4.8.4 Area under Bajra

It was 666.42 hundred ha. under Bajra cultivation during the period I, but it decreased to 313.25 hundred ha. during period II and the area under bajra cultivation during overall period was 478.06 hundred ha. The variability was 27.80, 40.46and 49.50 per cent respectively in I, II and III period.

4.8.5 Area under Total cereals

Jalna is well known for its cereals production. Hence, there had been huge proportion of area under cultivation of cereals in total food grain cultivated area. The average area under total cereals cultivation during the period I was 2710 hundred ha. and due to constraints of irrigation and management the area had been reduced to 2159 hundred ha. during period II and the area under cultivation during overall period III was 2416.73 hundred ha. The variability was 31.02, 39.37 and 35.71 per cent during the period I, II and III respectively.

4.8.6 Area under Red gram

Average area under Red gram cultivation in the district during the period I, II and III was 488.71 thousand ha., 481 thousand ha and 484.06 thousand ha respectively. The respective variability figures were 15.19, 6.52 and 11.06 per cent

4.8.7 Area under Green gram

The district has contribution in cultivation of Green gram. The average area under Green gram cultivation during period I, II and III were 357, 316.75 and 335.86 thousand ha. respectively. The variability for respected period was 48.36, 46.00 and 46.02 per cent.

4.8.7 Area under Black gram

Average area under Black gram cultivation during the period I was 169 thundred ha. and for the period II was 144 hundred ha. The area under cultivation during the overall period III was 155.67 hundred ha. The variability was 25.88, 32.17 and 29.15 per cent for the period I, II and III respectively.

4.8.8 Area under Gram

Average area under Gram cultivation during the period it was 155.71 hundred ha. and for the period II it was 260.62 hundred ha. The area under cultivation during the overall period III was 211.66 thousand ha. The variability of 18.86, 17.82 and 30.60 per cent for the period I, II and III respectively.

4.8.9 Area under other pulses

The average area under total pulses cultivation during the period I was 73.14 thousand ha. and 7.00 thousand ha. during the period II. The period III had area of 37.86 thousand ha. under cultivation. The variability was 48.45, 113.51and 110.04 per cent for the period I, II and III respectively.

Area under Total Pulses

The average area under total pulses cultivation during the period I was 1772.14 thousand ha. and 1144.00 thousand ha. during the period II. The period III had area of 1437.13thousand ha. under cultivation. The variability was 49.55, 33.92 and 49.74 per cent for the period I, II and III respectively.

Area under Soybean

The average area under soybean cultivation in the district during the periods of I, II and III were 237.28, 749.25 and 510.33 thousand ha. The variability was 51.66, 37.78 and 66.85 per cent for period of I, II and III respectively.

Area under Safflower

The average area under Safflower cultivation during the period I was 140 thousand ha and 31.37 thousand ha during the period II. The period III had area of 82.06 thousand ha. under cultivation. The variability was 63.31, 151.52 and 106.53 per cent for the period I, II and III respectively.

Area under Sunflower

The average area under Sunflower had been decreased by 101.0 thousand ha. During the period I from16.37 thousand ha. during the period II. The area under cultivation during the overall period III was 55.86 thousand ha. The variability was 38.46,38.84 and 37.90 per cent for the respected period of I, II and III.

Area under Groundnut

The average area under Groundnut decreased by 17.00 thousand ha during the period I from 6.75 thousand ha. during the period II. The area under

cultivation during the overall period III was 11.53 thousand ha. The variability was 44.41, 52.97 and 66.50 per cent for the respected period of I, II and III.

Area under Total Oilseeds

The average area under total oilseeds had been increased as 605.00 thousand ha (period II) from 837.75 thousand ha (period I). The average area under overall period III was 729.13 thousand ha. The variability was 16.16, 28.70 and 29.87 percent for the period I, II and III respectively.

Area under Cotton

There had been continuous increase in cultivation of cotton in the district. The average area under cultivation for the period I was 2112.28 thousand ha. and for the period II was 2969.62 thousand ha. The overall period III was 2569.53 thousand ha. The variability was 25.92, 2.75 and 22.28 per cent for the period I, II and III respectively

Area under Sugarcane

There had been continuous cultivation of sugarcane in the district. The average area under cultivation for the period I was 145.00 thousand ha. and for the period II was 249.62 thousand ha. The overall period III was 200.80 thousand ha. The variability was 50.81, 74.80 and 75.00 per cent for the period I, II and III respectively.

Area under Total food grain

The total area under food grain had been decreased in the district. It was 3766 thousand ha. during the period I and it reduced to 3059.00 thousand ha. The area under cultivation during the overall period III was 3888.60 thousand ha. The variability was 40.85, 35.68 and 38.97 for the period I, II and III respectively.

Table 4.8 Area under different crops in Jalna(2002-03 to 2016-17)

(Area in 00 ha)

S. No	Particular	Mean			SD			CV			SE		
		I	II	III	I	II	III	I	II	III	I	II	III
1	Jowar	1841	1000	1392.4	633.36	560.07	719.29	33.301	56.95	49.55	211.70	204.79	174.38
2	Maize	622	666.517	642.8	40.37	269.674	193.49	6.03	40.87.	30.10	15.26	95.36	49.96
3	Wheat	236.75	175	204.46	58.15	.125.15	101.17	24.26	70.91	49.49	21.22	44.25.	26.12
4	Other ceraal	13	6.25	9.6	9.36	7.50	8.55	72.97	106.71	89.15	3.53	2.44	2.21
5	Bajra	666.42	313.25	478.06	185.31	126.75	236.67	27.80	40.46	49.50	70.04	44.81	61.10
6	Total cereal	2710	2159	2416.73	840.38	850.19	863.20	31.02	39.37	35.71	317..63	300.59	222.87
7	Gram	155.71	260.62	211.66	20.96	46.31	64.77	18.86	17.82	30.60	7.924	16.37	16.72
8	Red gram	488.71	481.0	484.06	74.27	74.27	.53.60	15.19	6.52	11.06	28.07	11.10	13.84
9	Green gram	357	316.75	335.86	172.99	145.73	154.57	48.36	46.00	46.02	65.38	51.52	39.91
10	Black gram	169.00	144.00	155.67	43.73	46.33	45.38	25.88	32.17	29.15	16.53	16.38	11.71
11	Other pulses	73.14	7.00	37.86	35.43	7.94	41.67	48.45	113.51	110.04	13.39	2.80	10.75
12	Total pulses	1772.14	1144.00	1437.13	878.13	388.06	714.83	49.55	33.92	49.741	331.90	137.20	184.57
13	Safflower	140.00	31.37	82.06	88.64	47.54	87.43	63.31	151.52	106.53	33.50	16.80	22.57
14	Sunflower	101.00	16.37	55.86	27.00	23.87	50.07	38.46	38.84	37.90	10.20	8.44.	12.92
15	Soybean	237.28	749.25	510.33	122.59	283.10	341.19	51.66	37.78	66.85	46.33	100.09	88.09
16	Groundnut	17.00	6.75	11.53	7.55	3.57	7.67	44.41	52.97	66.50	2.85	1.26	1.98
17	Total oilseed	605.00	837.75	729.13	97.81	240.45	217.84	16.16	28.70	29.87	36.96	85.01	56.24
18	Sugarcane	145.00	249.62	200.80	73.67	186.73	150.60	50.81	74.80	75.00	27.84	66.02	38.88
19	Cotton	2112.28	2969.62	2569.53	547.57	81.81	572.58	25.92	2.75	22.28	206.96	28.92	147.84
20	Total food grain	3766.42	3059.00	3888.60	1538.88	1091.09	1320.60	40.85	35.68	38.97	581.65	385.75	340.97

Production of different crops

The average mean, SD, CV and SE for the production of principal crops in the District were given in table 4.9

Production of Jowar

The production of Jowar for the period I was 1575.12 thousand tonnes and for the period II, it was 637.75 thousand tonnes. The production of Jowar for the overall period III was 1075.40 thousand tonnes. The variability was 18.44, 78.04 and 58.41 per cent for the period I, II and III respectively.

Production of Maize

The district produced 1406.28 thousand tonnes of maize during the period I and it decreased to 1235.62 thousand tonnes during the period II. The production of maize for the overall period III was 1315.26 thousand tonnes. The variability in production for the different periods I, II and III was 28.21, 49.48 and 38.93 per cent respectively.

Production of Bajra

It was 651.14 thousand tonnes of production during the period I, but it gained in production by 217.7 thousand tonnes during the period II. The production for the overall period III was 420.06 thousand tonnes. The variability was 32.60, 61.92 and 66.69 per cent for the period I, II and III respectively.

Production of Wheat

It was 371.42 thousand tonnes of production during the period I, but it decline in production by 196.62 thousand tonnes during the period II. The production for the overall period III was 278.2 thousand tonnes. The variability was 30.38.93.97 and 62.95 per cent for the period I, II and III respectively

Production of Total cereals

The production of total cereals was decreased as 3329.42 thousand tonnes during the period I whereas it was 2021.37 thousand tonnes during the period II. The production for the overall period III was 2631.8 thousand tonnes.

The variability was 26.80, 75.10 and 53.06 per cent for the period I, II and III respectively.

Production of Red gram

The production of Redgram for the study period I, II and III were 316.85 and 270.12,291.93 thousand tonnes. The variability of production was 36.43, 67.00 and 51.58 per cent for the period I, II and III respectively.

Production of Green gram

It was 192.28 thousand tonnes of production for the period I and 107.25 thousand tonnes of production for the period II. The production for the overall period III was 146.93 thousand tonnes. The variability was 51.04, 69.24 and 63.89 per cent for the period I, II and III respectively.

Production of Black gram

The production of Black gram remains change for the study peiod. It was 94.45 thousand tonnes of production during the period I and 49.00 thousand tonnes during the period II. The production for the overall period III was 70.02 thousand tonnes. There was 54.09, 50.10 and 63.22 per cent of variability in the production for the period I, II and III respectively.

Production of Gram

The production of Gram remains change for the study period. It was 106.00 thousand tonnes of production during the period I and 131.25 thousand tonnes during the period II. The production for the overall period III was 119.44 thousand tonnes. There was 28.61, 56.78 and 48.38 per cent of variability in the production for the period I, II and III respectively.

Production of Total pulses

The production of total pulses in the district for period I, II and III were 1080.00, 463.12 and 751 thousand tonnes. There was increase in production during the study period I, when compared to period II. The variability in production of total pulses was 51.62, 68.73 and 71.13 per cent for the respected period I, II and III respectively.

Production of Safflower

The safflower production for the study period I was 137.42 thousand tonnes and it decreased to 19.37 thousand tonnes during the period II. The production of Safflower for the overall study period III was 74.46 thousand tonnes. The variability in production for the period I, II and III was 30.29, 155.86 and 94.14 per cent respectively.

Production of Soybean

The soybean production for the study period I was 258.14 thousand tonnes and it increased to 685.00 thousand tonnes during the period II. The production of soybean for the overall study period III was 485.80 thousand tonnes. The variability in production for the period I, II and III was 52.07, 41.63 and 64.11 per cent respectively.

Production of Sunflower

The sunflower production for the study period I was 47.71 thousand tonnes and it decreased to 8.68 thousand tonnes during the period II. The production of sunflower for the overall period III was 26.89 thousand tonnes. The variability for the period I, II and III was 30.55, 159.94and 90.60 per cent respectively.

Production of Groundnut

There was decrease in production of Groundnut from 14.00thousand tonnes during the period I to 3.83 thousand tonnes during the period II. The production of total oilseeds for overall period III was 8.58 thousand tonnes. The variability in production was 55.63, 36.95and 80.07 per cent for the period I, II and III respectively

Production of Total Oilseeds

There was increase in production of total oilseeds from 480.71 thousand tonnes during the period I to 212.2 thousand tonnes during the period II. The production of total oilseeds for overall period III was 604.3 thousand tonnes. The variability in production was 33.43, 41.45and 43.47 percent for the period I, II and III respectively.

Production of Cotton

The production of cotton had been decreased by 3461.00 thousand tonnes during the period I from production of 3944.62 thousand tonnes during the period II. The production of cotton for the period III was 3718.93 thousand tonnes. And the variability in production for the period I, II and III was 53.44, 65.40 and 59.25 per cent respectively.

Production of Sugarcane

The production of Sugarcane had been decreased by 9202.14.thousand tonnes during the period I from production of 11646.00 thousand tonnes during the period II. The production of Sugarcane for the period III was 10505.05 thousand tonnes. And the variability in production for the period I, II and III was 67.56, 24.00 and 44.71 per cent respectively

Production of Total food grains

The production of total food grain in the district for the study period I was 4517.00 thousand tonnes and it was 2778.75 thousand tonnes for the period II and the total food grain production for the overall period III was 3589.93 thousand tonnes. The variability in production was 19.55, 61.50 and 44.92 per cent for the period I, II and III respectively.

Production of other cereals.

The production of other pulses in the district for the study period I was 4.85 thousand tonnes and it was 2.12 thousand tonnes for the period II and the other cereal production for the overall period III was 3.4 thousand tonnes. The variability in production was 85.24 ,81.26 and 96.78 per cent for the period I, II and III respectively.

Production of other pulses

The production of total other pulses in the district for the study period I was 16.57 thousand tonnes and it was 1.71 thousand tonnes for the period II and the total other pulses production for the overall period III was 8.64 thousand tonnes. The variability in production was 45.80, 107.73 and 106.79 per cent for the period I, II and III respectively.

Table 4.9 Production of different crops in Jalna (2002-03 to 2016-17)

(Production in "00" tonnes)

S.No	Particular	Mean			SD			CV			SE		
		I	II	III	I	II	III	I	II	III	I	II	III
1	Jowar	1575.12	637.85	1075.4	290.6	497.7	628.16	18.44	78.04	58.41	109.23	175.33	162.19
2	Maize	1406.28	1235.62	1315.26	396.75	611.02	512.03	28.21	49.48	38.93	149.95	216.18	132.20
3	Bajra	651.14	217	420.06	212.33	134.03	280.14	32.60	61.92	66.69	80.25	47.70	72.33
4	Wheat	371.42	196.62	278.200	112.84	184.	175.14	30.38	93.37	62.95	42.65	65.32	45.22
5	Other cereal	4.85	2.12	3.4	4.14	1.72	3.29	85.24	81.26	96.78	1.56	0.61	0.85
6	Total cereal	3329.42	2021.37	2631.8	892.36	1518..22	1396.44	26.80	75.10	53.06	337.03	536.77	360.56
7	Red gram	316.85	270.12	291.93	115.45	180.99	150.57	36.43	67.00	51.58	43.63	63.99	38.87
8	Green gram	192.28	107.25	146.93	98.15	74.26	93.88	51.04	69.24	63.89	37.09	26.25	24.24
9	Black gram	94.45	49.00	70.20	51.08	24.55	44.38	54.09	50.10	63.22	19.30	8.68	11.45
10	Gram	106.00	131.25	119.44	30.33	74.53	57.80	28.61	56.78	48.38	11.46	26.35	14.92
11	Total pulses	1080.00	463.12	751	557.56	318.34	534.21	51.62	68.73	71.13	210.73	122.55	137.93
12	Safflower	137.42	19.37	74.46	41.62	30.19	70.10	30.29	155.86	94.14	15.73	10.67	18.10
13	Sunflower	47.71	8.68	26.89	14.58	13.88	24.36	30.55	159.94	90.60	5.51	4.90	6.29
14	Soybean	258.14	685.0	485.80	134.42	285.21	311.46	52.07	41.63	64.11	50.80	100.83	80.41
15	Groundnut	14.0	3.83	8.58	7.78	1.41	7.38	55.63	36.95	80.07	2.94	0.50	1.90
16	Total Oilseed	480.71	212.2	604.3	160.72	295.38	262.72	33.43	41.45	43.47	60.74	104.43	67.83
17	Cotton	3461.00	3944.62	3718.93	1849.69	2579.84	2203.69	53.44	65.40	59.25	699.11	912.08	568.99
18	Sugarcane	9202.14	11646.0	10505.53	6216.92	2795.29	4697.21	67.56	24.00	44.71	2349.77	988.28	1212.82
19	Total food grain	4517.0	2778.75	3589.93	883.44	1709.11	1612.7	19.55	61.50	44.92	333.93	604.26	416.39
20	Other pulses	16.57	1.71	8.64	7.59	1.84	9.23	45.80	107.73	106.79	2.86	0.65	2.38

Productivity of different crops

To determine the improvement in productivity of different crops, Mean, S.D., C.V. and S.E. were worked out and presented in table 4.10.

Productivity of Jowar

The productivity of Jowar in district for the period I was 2023 kg/ha and it decreased was 1533.37 kg/ha for the period II. The productivity for the overall period III was 1761.86 kg/ha. The variability in productivity of Jowar was 16.26, 42.89 and 32.43 per cent for the period I, II and III respectively.

Productivity of Maize

The productivity of maize was 2241 kg/ha during the period I and it increased to 2464 kg/ha during the period II. The productivity for the overall period III was 2359.93 kg/ha. The variability in productivity was 23.42, 48.95 and 39.27 per cent for the respected period I, II and III.

Productivity of Bajra

The district had productivity of 957.71 kg/ha of wheat for the period I and it decreased to 763.50 kg/ha during the period II. The productivity of wheat for the overall period III was 854.13 kg/ha. The variability in productivity was 13.89,46.50. and 33.25 per cent for the period I, II and III respectively.

Productivity of Wheat

The district had productivity of 1557.71 kg/ha of wheat for the period I and it decreased to 1145.87 kg/ha during the period II. The productivity of wheat for the overall period III was 1338.06 kg/ha. The variability in productivity was 12.74, 44.18 and 32.60 per cent for the period I, II and III respective

Productivity of other cereals

The productivity of total cereals in the district for the period I was 629.14 kg/ha and it decreased to 396.50 kg/ha during the period II. The productivity for overall period III was 505.06 kg/ha. The variability in productivity was 123.47,65.09 and 109.59 per cent for the period I, II and III respectively.

Productivity of Total cereals

The productivity of total cereals in the district for the period I was 2040.14 kg/ha and it decreased to 1863.12 kg/ha during the period II. The productivity for overall period III was 1945.73 kg/ha. The variability in productivity was 43.79,68.29 and 55.35 per cent for the period I, II and III respectively.

Productivity of Red gram

The productivity of Red gram in the district during the period I was 647.14 kg/ha of and it decreased as 549 kg/ha during the period II. The overall period III productivity was 594.80 kg/ha. The variability was 30.08, 68.61 and 50.37 per cent for the respected period.

Productivity of Green gram

The productivity of Green gram in the district during the period I was 441.57 kg/ha of and it decreased as 316 kg/ha during the period II. The overall period III productivity was 374.60 kg/ha. The variability was 37.26, 77.77 and 57.26 per cent for the respected period.

Productivity of Black gram

The productivity of Black gram was 517.85 kg/ha during the period I and it decreased to 372.62 kg/ha during the period II. The productivity for the overall period III was 440.40 kg/ha. The variability in productivity was 45.37, 55.85 and 51.25 per cent for the respected period I, II and III.

Productivity of Gram

The productivity of Gram was 673.85 kg/ha during the period I and it decreased to 512.62 kg/ha during the period II. The productivity for the overall period III was 587.86 kg/ha. The variability in productivity was 18.67, 60.60 and 42.34 per cent for the respected period I, II and III.

Productivity of other Pulses

The district had productivity of 456.14 kg/ha of total pulses for the period I and it decreased to 276.62 kg/ha during the period II. The productivity of wheat for the overall period III was 360.40 kg/ha. The variability in

productivity was 40.28,37.49 and 46.79 per cent for the period I, II and III respectively.

Productivity of Total Pulses

The district had productivity of 1254.85 kg/ha of total pulses for the period I and it decreased to 844.25 kg/ha during the period II. The productivity of wheat for the overall period III was 1035.86 kg/ha. The variability in productivity was 12.92, 59.56 and 41.26 per cent for the period I, II and III respectively.

Productivity of Safflower

The district had productivity of 749.71 kg/ha of total pulses for the period I and it decreased to 318.50 kg/ha during the period II. The productivity of wheat for the overall period III was 519.73 kg/ha. The variability in productivity was 29.85, 97.19 and 66.36 per cent for the period I, II and III respectively.

Productivity of Sunflower

The productivity of sunflower in the district during the period I was 473.14 kg/ha of and it increased to 506.62 kg/ha during the period II. The overall period III Productivity was 491 kg/ha. The variability was 16.44, 43.47 and 33.56 per cent for the respective period.

Productivity of Soybean

The productivity of soybean was 1064 kg/ha during the period I and it decreased to 994.50 kg/ha during the period II. The productivity for the overall period III was 1026.93 kg/ha. The variability in productivity was 44.33, 55.36 and 48.51 per cent for the respective period I, II and III

Productivity of Groundnut

The productivity of Groundnut was 1429 kg/ha during the period I and it decreased to 1088.33 kg/ha during the period II. The productivity for the overall period III was 1247.33 kg/ha. The variability in productivity was 44.77, and 46.14,46.23 per cent for the respected period I, II and III.

Productivity of Total Oilseeds

The district had productivity of 778.42 kg/ha of total oilseed for the period I and it decreased to 904.87 kg/ha during the period II. The productivity of oilseed for the overall period III was 845.86 kg/ha. The variability in productivity was , 19.93 and 56.21,44.85 per cent for the period I, II and III respectively.

Productivity of Cotton

The productivity of cotton in the district for the period I was 266.28 kg/ha of and it decreased to 244.75 kg/ha of lint during the period II. The productivity for overall period III was 254.80 kg/ha. The variability in productivity was 34.32, 54.97 and 44.25 per cent for the period I, II and III respectively.

Productivity of Sugarcane

The productivity of sugarcane in the district for the period I was 70.42 kg/ha it increased to71.12 kg/ha during the period II. The productivity for overall period III was 70.80 kg/ha. The variability in productivity was 16.22, 29.49 and 23.47 percent for the period I, II and III respectively.

Productivity of Total food grains

The total food grain productivity of the district for the period I was 1548.85 kg/ha and it decreased to 803.75 kg/ha. The overall productivity of food grain in the district for the period III was 1151.46 kg/ha. The variability in productivity for the period I, II and III was 102.40, 52.68 and 99.62 per cent respective

Table 4.10 Productivity of different crops in Jalna (2002-03 to 2016-17)

(Kg/ha)

Sr. No.	Particular	Mean			SD			CV			SE		
		I	II	III	I	II	III	I	II	III	I	II	III
1	Jowar	2023.0	1533.37	1761.86	329.01	657.71	571.50	16.26	42.89	32.43	124.35	232.53	147.56
2	Maize	2241	2464	2359.93	525.02	1206.25	926.78	23.42	48.95	39.27	198.44	426.47	239.29
3	Bajra	957.71	763.50	854.13	133.03	355.08	284.05	13.89	46.50	33.25	50.28	125.54	73.34
4	Wheat	1557.71	1145.87	1338.06	198.58	506.29	436.23	12.74	44.18	32.60	75.05	179.00	112.63
5	Other cereal	629.14	396.50	505.06	776.85	258.09	553.51	123.47	65.09	109.59	293.62	91.25	142.91
6	Total cereal	2040.14	1863.12	1945.73	893.49	1272.45	1077.063	43.79	68.29	55.35	337.70	449.87	278.09
7	Red gram	647.14	549.00	594.80	194.71	376.70	299.61	30.08	68.61	50.37	73.59	133.18	77.36
8	Green gram	441.57	316	374.60	164.57	245.75	214.49	37.26	77.77	57.26	62.20	86.88	55.38
9	Black gram	517.85	372.62	440.40	234.95	208.13	225.70	45.37	55.85	51.25	88.80	73.58	58.27
10	Gram	673.85	512.62	587.86	125.82	310.66	248.94	18.67	60.60	42.34	47.55	109.83	64.27
11	Other pulses	456.14	276.62	360.40	183.77	103.72	168.66	40.28	37.49	46.79	69.46	36.67	43.54
12	Total pulses	1254.85	844.25	1035.86	162.22	502.87	427.41	12.92	59.56	41.26	61.31	177.79	110.35
13	Soybean	1064	994.50	1026.93	471.69	550.61	498.22	44.33	55.36	48.51	178.28	194.67	128.64
14	Sunflower	473.14	506.62	491.00	77.79	220.26	164.77	16.44	43.47	33.56	29.40	77.87	42.54
15	Safflower	749.71	318.50	519.73	223.83	309.56	344.92	29.85	97.19	66.36	84.60	109.44	89.05
16	Ground nut	1429	1088.37	1247.33	639.84	502.24	576.64	44.77	46.14	46.23	241.83	177.56	148.89
17	Total Oilseed	778.42	904.87	845.86	155.20	508.70	379.44	19.93	56.21	44.85	58.66	179.85	97.97
18	Cotton	266.28	244.75	254.80	90.89	134.54	112.76	34.13	54.97	44.25	34.35	47.56	29.11
19	Sugarcane	70.42	71.12	70.80	11.42	20.97	16.61	16.22	29.49	23.47	4.32	7.41	4.29
20	Total food grain	1548.85	803.75	1151.46	1586.12	423.46	1147.12	102.40	52.68	99.62	599.49	149.71	296.18

Fertilizer consumption

Fertilizer consumption in the district for the study period is given in the table 4.11 and the Mean, S.D., C.V. and S.E. were worked out.

Nitrogenous fertilizer consumption

In Jalna the average consumption of nitrogen fertilizer was 47195.15 thousand tonnes in period I and it increased to 61492 thousand tonnes during period II. The overall consumption during period III was 54820.1 thousand tonnes. The variability for the study period I, II and III was 27.53, 18.34 and 25.17 per cent respectively.

Phosphate fertilizer consumption

The average phosphate fertilizer consumption in the district during period I was 20689.29 thousand tonnes, it increased to 81588.25 thousand tonnes in period II and in period III it was 53168.74 thousand tonnes. The variability was 45.58, 155.42 and 179.09 per cent for the respected period.

Potassium fertilizer consumption

During the period I, in Jalna the potassium fertilizer consumption was 17177.29 thousand ha tonnes, which increased to 17278 thousand tonnes in period II and in period III it was 17231 thousand tonnes. The variability was 45.50,37.48 and 39.85 per cent respectively.

Total fertilizer consumption

During the period I, in Jalna the Total fertilizer consumption was 90552.43 thousand ha tonnes, which increased to 115220 thousand tonnes in period II and in period III it was 103708.50thousand tonnes. The variability was 35.88, 21.86 and 29.43 per cent respectively.

Table 4.11 Fertilizer consumption pattern in Jalna (2002-03 to 2016-17)

(In Million tonnes)

Sr. No	Particular	Mean			SD			CV			SE		
		I	II	III	I	II	III	I	II	III	I	II	III
1	Nitrogen	47195.15	61492	54820.14	12996.17	11278.85	13802.13	27.53	18.34	25.17	4912.09	3987.67	3563.69
2	Phosphorus	20689.29	81588.25	53168.74	9430.17	126811.17	95224.48	45.58	155.42	179.09	3564.27	44834.72	24586.85
3	Potassium	17177.29	17278.00	17231	7817.25	6475.84	6867.36	45.50	37.48	39.85	2954.64	2289.55	1773.14
4	Total fertilizers	90552.43	115220	103708.50	32497.26	25189.14	30530.50	35.88	21.86	29.43	12282.81	8905.70	7882.94

4.12 Area irrigated by different sources

The irrigation strategy of district for the study period is shown in table 4.12. It is observed from the table, mean area irrigated by surface irrigation in period I was5617.14 thousand ha., which decrease to 2886.75 thousand ha. in period II and in overall period it was 4160.93thousand ha. The variability was 16.74, 113.7 and 66.95 per cent respectively.

Mean area under well irrigation was in period I was 49547.15 thousand ha., which decrease to 46215.5 thousand ha. during period II and area occupied by well irrigation for the overall period was 47770.27 thousand ha. The variability was 1.12, 8.23. and 6.72 per cent respectively. The Mean of Net area irrigated was in period I was 56285.72thousand ha., which increase to 89075 thousand ha during period II and area occupied by well irrigation for the overall period was 73713.34 thousand ha. The variability was 3.19,50.23 and 48.67per cent respectively. Percentage of net area irrigated to net sown area was 7.70 per cent in I, which increase to 12.76 per cent in II and overall mean was 10.40 percent. The variability was 3.19, 52.76 and 52.27 per cent respectively. Percentage of gross irrigated area to gross cropped area in I was 6.39 per cent, in II it was 5.83 per cent and for overall period was 6.09 per cent. The variability was 2.57, 10.50 and 8.73 per cent respectively. The Mean of Gross irrigated area was in period I was 66300 thousand ha, which decrease to 64037.50 thousand ha during period II and area occupied by well irrigation for the overall period was 65093.34 thousand ha. The variability was , 0.030,3.04 and 2.52 per cent respectively.

Table 4.12 Area irrigated by different sources in Jalna (2002-03 to 2016-17)

(Area in ha)

Sr. No.	Particular	Mean			SD			CV			SE		
		I	II	III	I	II	III	I	II	III	I	II	III
1	Surface irrigation	5617.14	2886.75	4160.93	940.77	3284.34	2785.81	16.74	113.7	66.95	355.57	1161.19	719.29
2	Well irrigation	49547.15	46215.50	47770.27	558.55	3804.19	3213.98	1.12	8.23	6.72	211.11	1344.98	829.84
5	Net area irrigated	56285.72	89075	73713.34	1799.3	44750.21	35907.97	3.19	50.23	48.67	211.11	1344.96	829.84
6	Percentage of net area irrigated to net area sown	7.70	12.76	10.40	0.246	6.73	5.43	3.19	52.76	52.27	0.09	2.38	1.40
8	Gross irrigated area	66300	64037.50	65093.34	26.12	2556.34	2152.20	0.030	3.04	2.52	9.87	903.80	555.69
9	Percentage of gross irrigated area to gross cropped area	6.39	5.83	6.09	0.16	0.61	0.53	2.57	10.50	8.73	0.062	0.21	0.13

Table 4.13 Socio-economic indicators of agricultural development in Jalna (2002-03 to 2016-17)

S. No	Particular	Unit	2001	2011	Percentage Change
A	Human population				
1	Total population	lakh	16.12	19.58	21.46
2	Rural population	lakh	13.04	15.81	21.24
3	Urban population	lakh	3.08	3.77	22.40
4	Male population	lakh	8.26	10.15	22.88
5	Female population	lakh	7.86	9.43	19.97
6	Sex ratio	Sq/km	952	929	2.47
B	Education				
7	Total literacy	Per cent	64.52	73.61	14.08
8	Male literacy	Per cent	79.17	85.25	7.67
9	Female literacy	Per cent	49.25	61.28	24.42
10	Primary School	No.	1300	1663	27.92
11	Secondary institutes	No.	193	227	17.61
C	Cooperative and Finance				
12	Cooperative Society	No.	2193	2993	36.47
13	Primary agriculture co-operative society	No.	750	565	24.66
14	Dairy Co-operative society	No.	303	455	20.26
D	Health				
15	Hospitals	No.	15	12	20
16	PHC	No.	39	40	2.56
17	Clinic no.	No.	11	12	9.09
E	Transport and communication				
18	Rail routes (length)	km	88	88	00
19	Road length	km	42	52	23.80
20	Gram panchayat	No.	785	781	0.50
F	Agro industries				
21	Registered factories	No.	207	276	33.33
22	Registered running fact	No.	201	234	16.41
23	Co-operative sugar fac	No.	4	5	25
24	Ginning factories	No.	4	4	00
G	Electricity				
25	Village	No.	971	963	0.82
26	Cities	No.	4	4	00
27	electrifield villages	No.	975	967	0.82

Human population

Human population of Jalna district as per the 2011 census was 16.12 lakh which was increased upto 19.58 lakh in 2011. Over the period 21.46 per cent increase in population was noticed. Spectacular proportionate increase was observed in urban population i.e. 22.40 percent

Male: female ratio was decreased from 952 to 929 per thousand male. Percent of male: female ratio 2.47 period of 2001 to 2011censuse

Co-operative and finance

Co-operative sector covers various aspects of agricultural needs such as extension of agricultural credit and provision of agricultural input through co operative societies. In the year 2002 there were 2193 number of all type of co-operative societies which increase 2993 in number. The dairy co-operative societies which increase from 303 to 455 in number during the period of 2002-11 Percentage change was 20.26 percent.. The number of primary agriculture co-operative society were decreased 750 upto 565 in the year 2016-17

Agro-industries

In the year 2002 there were 207 registered factories in 2016-17 increased upto 276 numbers. Percentage increased in registered factories noticed was 33.33. In Jalna district co-operative sugar factories increased 4upto 5 in number. Ginning factories would generate considerable employment potential. The number of ginning factories same upto 4 in number.

Electricity

The numbers of electrified villages were decreased from 971 to 963 during the period 2002-03 to 2016-17. The per capita consumption of electricity is being considered as an important indicator of development of an area and the people

Education and health

It is also important indicator of development. The literacy of Jalna district increased from 64.52 per cent to 73.61 per cent during period 2001 to 2016-17. In case of primary education there was an addition of 1300 to1663 primary schools in 2002-03 over 2016-17. The number of secondary

education institutes increased from193 to 227 during period of 2002-03 to 2016-17. The number of hospitals decreased from 15 to 12 from the year 2002-03 to 2016

Transport and communication

Railway route and road plays an important means of quick transport and communication. The total railway route was 88 km. Total road length was increased from 4224 kg to 5242 km. The percentage change noticed in road length was 23.80 per cent.

4.14 Growth rate of land utilization pattern.

Over the I period and over the II period and overall period of selected parameters were worked out and presented in table 4.14. Forest was negatively significant at 5 percent for I period and at 5 per cent period II and 5 per cent significant overall period respectively. Barren and uncultivable land was significant at 5 per cent for I period and significant at 1 percent for II period and significant at 1 per cent for overall period respectively. Area under cultivable weste land was significant at 1per cent for period I and negatively significant at 1per cent for period II,and negatively significant at 1 per cent overall period respectively. Area under permanent pastures was significant at 1 per cent for I period and period II and overall period respectively. Land under misc trees, grooves not included in area sown was negative significant at 1 percent for I period and signifiacant at 1 per cent period II, overall period was significant at 5 per cent. Area under current fallow was significant at 1 per cent for I period and significant at 1 per cent period II and overall period. The other fallow was significant at 1 per cent for I period and significant at 1 per cent for period II and significant at 1 per cent overall period. The net sown area was significant at 5 per cent for I period, negatively significant at 1 per cent period II and overall period. Area sown more than once was negative significant at 5 per cent for I period and period II,and negatively significant at 1per cent for overall period . The gross cropped area was significant at 5 per cent for I period and negatively significant at 1 per cent for II period and overall period respectively.

Table 4.14 Growth rate of land utilization pattern in Jalna (2002-03 to 2016-17)

Sr. No.	Particulars	LGR			CGR		
		I	II	overall	I	II	Overall
1	Forest	-39.17*	13.19*	3.05*	-38.23**	24.13**	6.72*
2	Barren and uncultivable land	0.81*	0.36**	0.85**	0.79*	0.36**	0.86**
3	Land under non-agricultural use	-0.05**	-8.25**	-3.08**	-0.05*	-8.03**	-3.39**
4	Cultivable waste land	0.06**	-24.27**	-7.68**	0.06*	-24.94**	-11.13**
5	Permanent pastures	0.47**	0.25**	0.36**	0.50**	0.23**	0.44**
6	Land under misc trees, grooves not included in area sown	-4.74**	7.74**	1.66*	-4.55**	8.11**	1.50*
7	Current fallow	14.92**	19.04**	14.00**	15.93**	23.27**	15.06**
8	Other fallow	0.57**	12.25**	7.33**	0.57**	14.54**	6.97**
9	Net sown area	0.15*	-1.14**	-0.46**	0.15*	-1.14**	-0.47**
10	Area sown more than once	-0.94*	-0.12*	-0.88**	-0.97*	-0.09*	-0.87**
11	Gross cropped area	0.05*	-1.21**	-0.51**	0.05*	-1.20**	-0.52**

Note: **Significant at 1 per cent *Significant at 5 per cent

4.15. Growth rate of area under different crops

The trend in area of different crops were studied and depicted in table 4.15.The area under Jowar cultivation had been negative significant at 5 per cent for I period and negative significant at 1 per cent for II period and negatively significant at 5 percent overall period . Area under Maize had significant at 5 per cent in period I and negatively significant at 1 per cent period II and negatively significant at 5 per cent overall period. Bajra had negative significant at 1 per cent period I and overall period and negatively significant at 5per cent period II. The area under other cereal significant at 5 per cent for period I and negatively significant at 1 per cent period II and overall period. The area under total cereal significant at 5 per cent period I,II and negatively significant at 5 per cent for overall period. Area under Redgram had negatively significant at 5 per cent for period I,II and overall period. The area under Green gram had been negative significant at 5 per cent for period I,II and overall period. the area under Black gram had negatively significant at 5 per cent for I period significant at 5 per cent period II and negatively significant at 5 per cent overall period The area under Gram had significant at 5 per cent for period I and significant at 5 per cent period II and overall period. The Area under cultivation of other pulses was negatively significant at 1 per cent period I,and negatively significant at 5 per cent period II and negatively significant at 1per cent overall period . Area under cultivation of total pulses had negatively significant at 5 per cent for period I and significant at 5 per cent period II, and negatively significant at 1 per cent overall period. The area under Sunflower had been negative significant at 5 per cent for period I and negatively significant at1 per cent for period I and overall period. The area under soybean had been significant at 1 per cent for I,II, and overall Period.. The area under Safflower had negatively significant at 5 per cent for I Period, and negatively significant at 1per cent for period II and overall period. The area under groundnut had been negatively significant at 5 per cent for period I and significant at 5 per cent for period II and negatively significant at 1 per cent for overall period and Total oilseed had been significant at 5 per cent for I period

and significant at 1 per cent for period II and overall period. The area under total food grain had negatively significant at 5 per cent for I,II period and overall period. The area under sugarcane had significant at 5 per cent for I,II period,and significant at 5 per cent for overall period. The area under cotton significant at 1 per cent for I period and negatively significant at 5 per cent II period and significant at1per cent for overall period.

Table 4.15 Growth rate of area under different crops in Jalna (2002-03 to 2016-17)

Sr. No	Particular	LGR			CGR		
		I	II	overall	I	II	overall
1	Jowar	-11.17*	-0.81**	-7.60*	-9.49*	-2.19*	-9.11*
2	Maize	1.76*	-3.07*	0.27*	1.76*	-5.60*	-0.67*
3	Bajra	-11.25**	-0.15*	-8.95**	-12.50**	-1.68*	-8.94**
4	Wheat	-0.46*	-2.15*	-3.26*	-0.71*	-8.66*	-7.03*
5	Other cereal	17.30*	-5.21*	-4.83*	24.00*	11.16*	-15.83*
6	Total cereal	1.31*	0.59*	-2.05*	2.49*	-0.59*	-2.36*
7	Red gram	-2.41*	-1.40*	-0.61*	-2.97*	-1.35*	-0.57*
8	Green gram	-7.74*	4.42*	-1.41*	-3.59*	1.71*	-1.80*
9	Black gram	-4.56*	6.15*	-1.24*	-7.01*	5.71*	-1.51*
10	Gram	1.17*	5.52**	6.06**	1.20*	5.44**	6.18**
11	Other pulses	-17.13**	-17.68*	21.26**	23.84**	-3.07*	25.87**
12	Total Pulses	-13.98*	2.26*	-5.82**	-13.90*	1.11*	-5.52*
13	Sunflower	-4.38*	-49.80**	18.13**	-6.05*	-45.94**	32.41**
14	Soybean	23.13**	13.13**	14.00**	34.02**	14.99**	19.14**
15	Safflower	-14.89*	-52.32**	18.77**	-22.63*	-81.53**	54.02**
16	Groundnut	-4.41*	11.64*	-8.51**	-5.71*	9.66*	-8.59**
17	Total oilseed	4.72*	10.05**	5.31**	5.11*	10.39**	5.13**
18	Total foodgrain	-0.24*	-2.71*	-2.48*	-0.16*	-5.86*	-3.18*
19	Sugarcane	15.04*	19.29*	9.89**	17.42*	14.47*	9.32**
20	Cotton	11.89**	-0.004*	4.31**	12.90**	-0.008*	5.03**

Note: **Significant at 1 per cent *Significant at 5 per cent

Growth rate of production of different crops

Growth rate of production of different crops in Jalna has been depicted in table 4.16. Production of Jowar was negative significant at 5 per cent for I period and negative significant at 5 percent for II period and negative significant at per cent for overall period. Bajra was negative significant at 1 per cent for I,II and overall period. Production of Wheat was negative significant at 5 per cent for I period and negative significant at 1 per cent for II and overall period. Production of other cereal was significant at 5 per cent for I,II period and negative significant at 5 per cent overall period. Production of Total cereal was significant at 5 per cent for period I and negatively significant at 5 per cent for period II and negatively significant at 1 per cent for overall period. The production of Red gram was significant at 5 per cent for I period and negatively significant at 5 per cent for period II and overall period. green gram was negatively significant at 1 per cent for I period. and negatively significant at 5 per cent for period II and negatively significant at 1 per cent for overall period the production was Black gram is negatively significant at 5 per cent for I,II period and negatively significant at 1per cent for overall period. The production Gram was significant at 1 per cent for I period and overall period and negatively significant at 5 per cent for II period. Production of total pulses was significant at 5 per cent for I,II period and negatively significant at 1 per cent for overall period. The production of Safflower was negative significant at 5 per cent for I period and negative significant at 1 per cent for II,and overall period and the production of Sunflower was significant at 5 per cent for I period and negative significant at 1 per cent forII, III overall period. The production of Groundnut was negative significant at 5 per cent for I,II period and negative significant at 1 per cent for overall period and the production of soybean was significant at 5 per cent for period I,and negatively significant at 5 per cent for II period and significant at 1per cent for overall period.The production of groundnut was negatively significant at 5 per cent for period I,II and negatively significant at 1 per cent for overall period. The production of total food grain was significant at 5 per cent for I period and

negatively significant at 1 per cent for II period and significant at 1per cent for overall period. The production of Sugarcane was significant at 5 per cent for i and overall period and negatively significant at 5 per cent II period. The production of Cotton was significant at 1 per cent for I period and negatively significant at 5 percent for II period.and significant at 5 per cent for overall period.

Table 4.16 Growth rate of production of different crops in Jalna (2002-03 to 2016-17)

Sr. No	Particular	LGR			CGR		
		I	II	overall	I	II	overall
1	Jowar	2.28*	-22.94*	-10.42**	1.02*	0.79*	0.85**
2	Maize	1.75*	-10.68*	-2.61*	1.00*	0.87*	0.95*
3	Bajra	-11.78**	-20.20**	-13.71**	0.85*	0.80**	0.84**
4	Wheat	2.73*	-30.12**	-9.11**	1.03*	0.73*	0.85**
5	Other cereal	15.42*	3.92*	-5.46*	15.78*	16.34*	-12.31*
6	Total cereal	134.00*	-439.53*	183.33**	1.04*	0.79*	0.89**
7	Red gram	21.17*	-49.98*	-10.05*	1.06*	0.81*	0.94*
8	Green gram	-21.67**	-12.14*	-9.95**	0.73**	0.90*	0.89**
9	Black gram	-14.22*	-4.47*	-8.85**	-23.42*	-2.75*	-8.04*
10	Gram	2.89*	-12.49*	0.31*	3.41*	-11.36*	0.76**
11	Other pulses	-12.28*	-15.78*	-20.00**	-19.78*	-2.26*	24.33**
12	Total Pulses	-153.78*	-93.58*	-91.10**	0.84*	0.83*	0.87**
13	Sunflower	0.29*	-54.09**	-17.07**	0.44*	77.14**	50.66**
14	Soybean	0.69*	-0.02*	0.66**	22.00**	-0.33*	13.07**
15	Safflower	-2.33*	-52.65**	-18.34**	-2.96*	79.54**	55.57**
16	Groundnut	-6.12*	-4.74*	-13.16**	-8.88*	-3.97*	12.89**
17	Total oilseed	7.39*	-3.65*	3.77*	8.14*	-3.93*	3.97*
18	Total foodgrain	2.15*	-17.27*	-6.57**	1.57*	-21.09*	-10.94*
19	Sugarcane	17.51*	-4.93*	3.04*	18.08*	-4.26*	5.34*
20	Cotton	19.95**	-18.34*	0.23*	23.77**	19.48**	-0.75*

Note: **Significant at 1 per cent *Significant at 5 per cent

Growth rate of productivity of different crops

Trend in productivity of different crops has been depicted in table 4.17. Productivity of Jowar negative significant at 5 per cent for period I, II and overall period III. The productivity of Maize was negative significant at 5 per cent for period I, II and significant at 5 per cent for overall period.The productivity of bajra was negative significant at 5 per cent for period I,II and overall period.productivity of wheat significant at 5 per cent for period I and negatively significant at 5 per cent for period II and overall period. The Productivity of Total cereal negatively significant at 5 per cent for period I,II and overall period. Productivity of Red gram was significant at 1per cent for I period.and negatively significant at 5 per cent for period II and overall period. The Productivity of green gram was negatively significant at 5 per cent for period I,II and negatively significant at 1per cent for overall period. Black gram was negatively significant at 5 per cent for period I,II and overall period.The Productivity of Total pulses was negative significant at 5 per cent for I period and negatively significant at 1 per cent for period II and overall period. The Productivity of sunflower was significant at 5 per cent for I period and overall period and period II are negatively significant at 5 per cent. The Productivity of soybean was negatively significant at 5per cent for period I,II and overall period. The Productivity of safflower was significant at 5 per cent for period I and negatively significant at 1 per cent for period II and overall period. The Productivity of total foodgrain was negative significant at 5 per cent for I period and negatively significant at 1 per cent for period II and overall period.The Productivity of Total oilseed was significant at 5 per cent for period I and negatively significant at 5 per cent for period II and overall period. Productivity of Sugarcane was significant at 5 per cent for period I,II and overall period. The Productivity of cotton was significant at 1 per cent for I period and negatively significant at 5 per cent for period II and overall period.

Table 4.17 Growth rate of productivity different crops in jalna (2002-03 to 2016-17)

Sr. No	Particular	LGR			CGR		
		I	II	overall	I	II	overall
1	Jowar	-1.83*	-8.14*	-4.05*	-2.01*	-10.91*	-5.62*
2	Maize	-0.29*	-1.23*	0.72*	-1.12*	-3.80*	-0.87*
3	Bajra	-2.11*	-10.66*	-3.94**	-2.63*	-12.67*	-5.57**
4	Wheat	3.70*	-12.95**	-4.31**	3.72*	-11.23*	-5.26**
5	Other cereal	-3.57*	8.82*	-4.01*	-6.98*	31.08*	-14.85*
6	Total cereal	-29.07*	-15.64*	-12.02*	-18.52*	16.81*	-9.60*
7	Red gram	8.70*	-18.18*	-3.22*	9.37*	19.12**	5.60*
8	Green gram	-12.70*	-17.57*	-7.07**	16.72*	19.43*	9.93**
9	Black gram	-14.47*	-6.85*	-5.87*	17.44*	7.56*	6.48*
10	Gram	2.05*	-17.08*	-4.74*	2.27*	16.22*	6.66**
11	Other pulses	-3.18*	-3.29*	-5.76**	3.69*	3.58*	5.28*
12	Total Pulses	-0.44*	-20.34**	-6.50**	0.64*	17.91**	8.17**
13	Sunflower	5.63*	-4.81*	0.47*	5.97*	12.73*	2.65*
14	Soybean	-6.82*	-15.46*	-3.63*	4.47*	17.00**	4.00*
15	Safflower	5.81*	-33.84**	-10.56**	6.69*	85.35*	53.93**
16	Groundnut	-14.12*	-13.77**	-6.15**	25.14*	13.00*	6.34*
17	Total oilseed	3.08*	-13.94*	-0.45*	2.87*	16.32**	2.24*
18	Total foodgrain	-29.07*	-15.64**	-12.02**	-18.52*	16.81**	-9.60**
19	Sugarcane	3.55*	0.11*	0.46*	4.08*	-0.94*	0.13*
20	Cotton	9.21*	-11.28*	-1.50*	9.28*	12.40*	3.10*

Note: **Significant at 1 per cent *Significant at 5 per cent

Growth rate of area irrigated by different sources.

Growth rate of area irrigated by different sources in (2002-03 to 2016-17) has been cited in table 4.18. Surface irrigation was significant at 1per cent for I period and negatively significant at 1 per cent for II period and overall period. The well irrigation was significant at 1 per cent for I period and negative significant at 1per cent for II and overall period. Net area irrigated was significant at 5 per cent for I, II and overall period. Percentage of net area irrigated to net area sown was significant at 1 per cent for I, II and overall period. Gross area irrigated was significant at 1 per cent for I and negatively significant at 1percent for II and overall period. Percentage of gross irrigated area to gross cropped area was significant at 1 percent for I, and negatively significant at 1 per cent or period II and overall period.

Growth rate of fertilizer consumption.

Trend in fertilizer consumption had been depicted in table 4.19 Nitrogen was significant at 1 per cent for period I and overall period and negatively significant at 5 per cent for period II. Phosphorus was significant at 5 per cent for I period and significant at 1 per cent for II period and significant at 5 per cent for overall period. The potassium was significant at 1per cent for period I and negatively significant at 5 per cent for period II and significant at 5 per cent for overall period.

Table 4.18. Growth rate of area irrigated by different sources in Jalna (2002-03 to 2016-17)

Sir .No	Particular	LGR			CGR		
		I	II	overall	I	II	overall
1	Surface irrigation	7.17**	-35.11**	-9.24**	7.71**	-24.83**	-13.58**
2	Well irrigation	0.45**	-2.93**	-1.07**	0.45**	-2.89**	-1.11**
3	Net area irrigated	1.39**	19.09**	8.01**	1.41**	23.07**	6.82**
4	Percentage of NAI to NAS	1.39**	19.93**	8.64**	1.41**	24.49**	7.35**
5	Gross irrigated area	1.13**	-4.82**	-1.73**	1.14**	-4.62**	-1.81**
6	Percentage of GIA to GCA	1.13**	-3.69**	-1.33**	1.14**	-3.53**	-1.37**

Note: **Significant at 1 per cent*Significant at 5 per cent

Table 4.19. Growth rate of fertilizer consumption (2002-03 to 2016-17)

Sr. No	Particular	LGR			CGR		
		I	II	overall	I	II	overall
1	Nitrogen	12.01**	-0.31*	3.58**	13.71**	0.18*	4.23**
2	Phosphorous	0.85*	24.22*	17.06*	-6.86*	11.81*	11.26**
3	Potassium	18.11**	-2.41*	1.50*	17.83**	-0.79*	1.79*

Note: **Significant at 1 per cent*Significant at 5 per cent

Summaryand Conclusions

CHAPTER – V

SUMMARY AND CONCLUSION

The main purpose of this chapter is to summarise the research work carried out on this topic and to draw useful conclusion on the basis of analysis of data.

Agriculture sector contributes 17-18 percent in national income in India and it sustains 60 percent of population for their lively hood. The share of agriculture sector in national economy is decreasing but not the population dependent on it. Agriculture development plays an important role in the growth of other sectors of economy. Agriculture development means process through which shift takes place from stage of traditional agriculture to stage of modernized agriculture. It includes higher level of foodgrains, fruits, and vegetables and other farm products, high income and better standard of living.

Maharashtra plays a major role in economic development of India. In India 9.29 per cent of the total population which occupied by Maharashtra is currently 11.24 corer people with the literacy rate 82.9 per cent. The geographical area of Maharashtra is 307713 Sq. km. approximately 140-145 lack ha of land is cultivated in the Kharif season and 60-65 lack ha in rabbi season. The production of food grain in 2016-2017 expected to register decrease of 23 per cent with the production of 118.09 lack metric tonnes. Hence it was felt necessary to study "Agriculture development of Jalna district" with following objectives.

1. To study changes in land utilization pattern
2. To examine the cropping pattern
3. To estimate growth rates of area, production and productivity of major crops grown
4. To study the agriculture development with respect to different socio-economic indicators over a period of time

Jalna District will be purposively selected for present study because Jalna district has made progress in Agricultural development due to increase of

irrigation facilities trough major irrigation dam via. Jaykwadi dam, Ghanewadi dam, It comprises 8 talukas having 22.40 per cent of total population live in urban areas. It devotes 48% of its land for cultivation occupying 33.15% Cereals and 14.85% Pulses.

Land under forest during 2002-03 was 15.23 percent and in 2016-17 decreased to 14.91 per cent and percentage change during 2016-17 over 2002-03 was -9.90 Under net sown area 80.09 per cent area in 2002-03 while it was 80.16 per cent in 2016-17. It shows that there was increase in area by7.90 per cent. Area sown more than once in 2002-03 was 19.90 per cent and it was 19.83 per cent in 2016-17 and percentage change was -8.33 per cent. The total gross cropped area in 2002-03 was 85.76 per cent while in 2016-17 it was 78.91 per cent in 2016-17 and percentage change was -7.99 per cent.

In Jalna area under food grains in 2002-03 was 23.01 per cent while in 2016-17 it was 62.62 per cent and the percentage change was 22 per cent of which the percentage change of cereals and pulses were 128 and -2.47 per cent, respectively. Area under maize and cotton were changed by -46.71 per cent and 63 per cent, respectively.

The production of soybean, Total oilseed increased significantly. There had been great decline in production of all major crops due to reduction in area under cultivation. However there was huge increase in production of soybean. However, declining in production was observed for total foodgrain and total cereal in studied period.

Irrigation is the key factor in agricultural development. The factor use of modern inputs ultimately results in increase of productivity. The major source of irrigation has been surface irrigation of 40950 thousand ha in 2002-03 and it decreased by -72.82 per cent in 2016-17. At the same time area under well irrigation has been decreased by -12.87 percentage change from the year 2002-03 to 2016-17. Percentage change of net area irrigated to net sown area was 190.66 per cent in 2016-17 and percentage change of gross irrigated area to gross sown area was -12.05 per cent.

The consumption of fertilizer in study period was 59.45 kg/ha. in 2002-03 to 57.08 kg/ha. in 2016-17. The NPK ratio has changed i.e. 124.61 to 133.09 to 86.56 during the period 2002-03 to 2016-17, respectively. The livestock is an integral part of agricultural production system in Jalna. Livestock statistics in Jalna covers the census of 2007 and 2017, it was noticed that livestock population of cattle, buffalo, sheep, goat and total poultry there was reduction. As per livestock census 2007, the total livestock in the district was about 934749 and it was 1668237 during 2012.

The area under forest in Jalna was 4941.1 ha., which remain change to 7324.25 ha. in the II period and overall in period it was again 6212.13 ha. The area under barren and uncultivable land in Jalna in the period I was 14557.14 ha. which increase to 15650 ha. at the period II and in overall period was also with 15140 thousand ha.

Land under non-agricultural use during the period I was 71142.86 ha. and it had decreased in period II up to 58525 ha. and in overall period it was 64413.33 ha. The average area under net sown area in period I was 73088.57 ha., which decreased to70850 ha. in period II and in overall period it was 71894.66 ha. The average area under area sown more than once in period I was 13035.71 ha., it was decreased to 12077.50 ha in period II and for overall period it was 12524.67 ha. The average area under gross cropped area in period I was 66257.1 ha. which increased to 68358.5 ha. and overall in period III it was 66044.60 ha.

Jalna is well known for its cereals production. Hence there had been huge proportion of area given to cultivation of cereals in total foodgrains cultivation. The average area under total cereals cultivation during the period I was 2710 thousand ha and the area had been decreased to 2159 thousand ha. during period II and the area under cultivation during overall period was 2416.73 thousand ha. The average area under total pulses cultivation during the period I was 1772.14 thousand ha. and 1144.00 thousand ha during the period II. The overall period had area of 1437.13 thousand ha. under cultivation. The average area under total oilseeds had been increased as 605 thousand ha period

I from 837.75 thousand ha period II. The average area under overall period was thousand ha. The total area under foodgrains had been decreased in the district. It was 3766.42 thousand ha. during the period I and it decreased to 3059 thousand ha. The area under cultivation during the overall period was 3888.60 thousand ha.

The production of total cereals was increased as 3329.42 thousand tonnes during the period I whereas it was 2021.37 thousand tonnes during the period II. The production for the overall period was 2631.8 thousand tonnes. The production of total pulses in the district for the period I, II and overall 1080,463.12 and 751 thousand tonnes. There was decrease in production of total oilseeds from 480.71 thousand tonnes during the period I to 212.2 thousand tonnes during the period II. The production of total oilseeds for overall period was 604.3 thousand tonnes.

The production of cotton had been increased by 3461 thousand tonnes during the period I to 3944.62 thousand tonnes during the period II. The production of cotton for the overall period was 3718.93 thousand tonnes. The production of total food grain in the district for the study period I was 4517. thousand tonnes and it was 2778.75 thousand tonnes for the period II and the total food grain production for the overall period was 3589.93thousand tonnes.

The productivity of total cereals in the district for the period I was 2040.14 kg/ha. and it increased to 1863.12 kg/ha during the period II. The productivity for overall period was 1945.73kg/ha. The district had productivity of 1254.85 kg/ha. of total pulses for the period I and it decreased to 844.25 kg/ha. during the period II. The productivity of total pulses for the overall period was 1035.86 kg/ha. The productivity of total oilseeds was 778.42 kg/ha. for the period I and it increased to 904.87 kg/ha. during the period II. The productivity of total oilseed for the overall period was 845.86 kg/ha. The productivity of cotton in the district for the period I was 266.28 kg/ha. of and it decreased to 244.75 kg/ha of lint during the period II. The productivity for overall period was 254.80 kg/ha. The total food grain productivity of the district for the period I was 1548.85 kg/ha and it increased to 803.75 kg/ha. The

overall productivity of foodgrains in the district for the overall period was 1151.46 kg/ha.

In Jalna the average consumption of nitrogen fertilizer was 47195.15 thousand tonnes in period I and it increased to 61492 thousand tonnes during period II. The overall consumption of nitrogen fertilizer during overall period was 54820.14 thousand tonnes. The average phosphatic fertilizer consumption in the district during period I was 20689.29 thousand tonnes, it decreased to 81588.25 thousand tonnes in period II and in overall period it was 53168.74 thousand tonnes. During the period I, in Jalna the potash fertilizer consumption was 17177.29 thousand tonnes, which decreased to 17278.00 thousand tonnes in period II and in overall period it was 17231 thousand tonnes.

Mean area irrigated by surface irrigation in period I was 5617.14 thousand ha, which was decreased to 2886.75 thousand ha., in period II and in overall period it was 4160.93 thousand ha. Area under well irrigation in period I was 49547.15 thousand ha., which decrease to 46215.50 thousand ha during period II and area occupied by well irrigation for the overall period was 47770.27 thousand ha. Percentage of net area irrigated to net sown area was per cent in I period, which decrease to 12.76 per cent in II period and overall mean was 10.40 per cent. Percentage of gross irrigated area to gross cropped area in period I was 6.39 per cent, in period II it was 5.83 per cent and overall period was 6.09 per cent.

As per the 2001 census human population of Jalna was 16.12 lakh which increased to 19.58 lakh in 2011 census which was increased by 21.46 per cent as computed to 2001. Rural population of the district in 2001 census was 13.01 lakh and it increased to 15.81 lakh in 2011 census, urban population was 3.08 lakh and increased to 3.77 lakh. Male population was 8.26 lakh in 2001 census, which increased to 10.12 lakh in 2011 census; Female population was 7.86 lakh and increased to 9.43 lakh in 2011 census. Total literacy in the district on 2001 census was 64.52 per cent and it had been increased to 73.61 per cent in 2011 census. Total number of primary school on 2001 was 1300 and it increased to

1663 in number during 2011 census. The percentage change was 27.92 per cent.

Area under forest was non significant for overall period. Cultivable waste land was significant at 1 per cent for period I respectively. The Gross cropped area was significant at 5 per cent for period I.

Area under jowar, wheat, groundnut, total foodgrain and sugarcane was non-significant for overall period. The area under soybean, cotton was significant at 1per cent for overall period. Area under total foodgrain was negative significant at 5 per cent for period I. The Production of Bajra, safflower and grounnut was non-significant for overall period. Production of red gram,maize, jowar, total pulses and cotton was significant at 1 per cent for period I. The Productivity of Bajra, greengram, soybean, blackgram,Sunflower, and total pulses was non-significant for overall period. The productivity of cotton was significant at 1 per cent for period I. The productivity of red gram was significant at 1 per cent for period I.

The phosphorous fertilizer was significant at 1 per cent for period I and significant at 5 per cent for overall period.

CONCLUSION

1) Cereals occupy a major role in agriculture of Jalna district, it occupies -- 7.99 per cent of Gross cropped area in the district. Maize, jowar and gram occupies -46.17, and -47,117 per cent change of gross cropped area of the district.

3) Tubewell irrigation was major source of irrigation in Jalna.

4) Fertilizer consumption of phosphorous in the district remains significant for overall period

5) Socio-economic indicators exhibited an immense decrease in urban as well rural population, increase in literacy, total road length, cooperatives, hospitals over the period of time. But the railway route was stagnant with 88 kms.

6) More than area and production, productivity has played an very crucial role in the agricultural development of the district which lead to the increase in kg/ ha by the adoption of various farming techniques.

7) Cotton cultivation also had an increament due to the farmer's interest to increase their income.

8) Despite its declining importance in the overall economy, however, agriculture remains a major source of employment and earnings for the rural poor.

9) There is significant growth potential for the livestock and poultry sectors arising from growing consumer demand.

10) Traditional sources of agricultural growth face major constraints including growing water scarcity, increasing land degradation and declining farm sizes, and rising costs of agricultural labor.

Policy Implementation

1) Area under waste land should be brought under horticultural cultivation to promote development as there is more scope for processing in this state which can support through various policies to the district as well.

2) Production and productivity play key role in sustainable development of the district and more attention is needed to increase the irrigation potential to keep pace with the increase in area under cultivation.

3) Even though reduction in area under cultivation, there has been constant increase in productivity.

Thesis Abstract

ABSTRACT

Name of the Student	:	Mr.KHARAT ARJUN ANANDRAO
Registration No.	:	2017A/59ML
Degree	:	M.Sc.(Agri.)
Year of admission	:	2016-2017
Major advisor		Dr. K.V.DESHMUKH Associate Dean and Principal, College of Agriculture, Ambajogai
Discipline	:	Agricultural Economics
Major Field	:	Agricultural Economics
a) Minor Field	:	Extension Education, Computer Application
b) Supporting field	:	Statistics
Title ofthe thesis	:	Economic Appraisal of Agricultural Development in Jalna district of Maharashtra

4) The development of agriculture is a process through which the shift takes place from the stage of traditional agriculture to the stage of modernized agriculture resulting in increased productivity and production per unit of resource due to use of modern technology. In India 9.29 per cent of the total population which occupied by Maharashtra is currently 11.24 crore people with the literacy rate 82.9 per cent. The geographical area of Maharashtra is 307713 km^2, approximately 140-145 lack ha of land is cultivated in the Kharif season and 60-65 lack ha in rabi season. Jalna district is having good Industrial background, specially famous for the Seed and Steel industries. The industrial development at Jalna is widely based on Engineering, Plastic and Agriculture. Pulses mills, oil mills, refineries, steel re-rolling,

plastic, tiles & cement pipe, fertilizers, insecticides, pesticides and the co-operative sugar factories are also playing important part in the industrial development of Jalna.

5) Land under forest during 2002-03 was 15.23 percent and in 2016-17 decreased to 14.91 per cent and percentage change during 2016-17 over 2002-03 was -9.90 Under net sown area 80.09 per cent area in 2002-03 while it was 80.16 per cent in 2016-17. It shows that there was increase in area by7.90 per cent. Area sown more than once in 2002-03 was 19.90 per cent and it was 19.83 per cent in 2016-17 and percentage change was -8.33 per cent. In Jalna The consumption of fertilizer in study period was 59.45 kg/ha. in 2002-03 to 57.08 kg/ha. in 2016-17. The NPK ratio has changed i.e. 124.61 to 133.09 to 86.56 during the period 2002-03 to 2016-17, respectively. Jalna area under food grains in 2002-03 was 23.01 per cent while in 2016-17 it was 62.62 per cent and the percentage change was 22 per cent of which the percentage change of cereals and pulses were 128 and -2.47 per cent, respectively. Area under maize and cotton were changed by -46.71 per cent and 63 per cent, respectively. Change in cropping pattern in 2016-17 over 2002-03 was more in soybean and cotton i.e. -75 per cent and 63 per cent.
6) The production of total cereals was increased as 3329.42 thousand tonnes during the period I whereas it was 2021.37 thousand tonnes during the period II. The production for the overall period was 2631.8 thousand tonnes. The production of total pulses in the district for the period I, II and overall 1080,463.12 and 751 thousand tonnes. There was decrease in production of total oilseeds from 480.71 thousand tonnes during the period I to 212.2 thousand tonnes during the period II
7) Area under jowar, wheat, groundnut, total foodgrain and sugarcane was non-significant for overall period. The area under soybean, cotton was significant at 1per cent for overall period. Area under total foodgrain was negative significant at 5 per cent for period I only

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Appendix

APPENDIX - I

Land utilization pattern of Jalna district (2002-03 to 2016-17) (Area in "00"ha)

Year	Geographical area	Forest	Barren and uncultivable land	Land under non-agricultural	Cultivable waste	Pastures	Current fallow	Other fallow	Net sown area	Area sown more than Once	Gross cropped area
2002-03	910	650	144	712	809	411	840	485	5310	1320	6630
2003-04	910	650	144	712	809	411	840	485	5310	1320	6630
2004-05	910	650	144	712	809	411	840	485	5310	1320	6630
2005-06	910	650	144	712	809	411	840	485	5110	1320	6630
2006-07	910	650	155	712	812	422	760	485	5110	1320	6630
2007-08	910	650	155	710	812	422	760	485	5110	1320	6630
2008-09	910	650	155	710	812	422	760	453	5010	1205	6630
2009-10	910	650	155	710	812	422	760	453	5010	1205	6630
2010-11	910	650	155	714	812	428	760	453	5010	1205	6630
2011-12	910	650	155	714	810	428	450	453	4938	1205	6630
2012-13	910	650	155	714	810	428	450	420	4938	1210	6520
2013-14	910	710	158	455	180	428	450	420	4938	1207	6477
2014-15	910	710	158	455	180	326	450	400	4890	1210	6100
2015-16	910	790	158	460	180	326	450	400	4890	1210	6100
2016-17	910	710	158	460	180	326	450	400	4890	1210	6100

APPENDIX - II

Area under different crops in jalna district (2002-03 to 2016-17) (Area in "00" ha)

Year	Jowar	Maize	Bajra	Wheat	Total Cereal	Red gram	Green gram	Black gram	Gram	Total Pulses	Groundnut	Sunflower	Soybean	Total oilseed	Total food grain	sugarcane	cotton	safflower
2002-03	3189	578	864	276	1551	480	542	190	157	1456	13	115	62	491	1526	162	1449	223
2003-04	1714	612	745	184	3272	497	504	169	131	3018	12	83	117	494	4662	73	1569	200
2004-05	1709	609	733	195	3556	474	50	165	140	3013	27	104	159	564	4625	46	1740	244
2005-06	1720	593	762	239	3325	577	353	175	181	1354	27	118	302	697	4683	104	2161	181
2006-07	1790	677	726	341	1528	554	414	189	187	1447	19	135	306	746	5007	175	2333	211
2007-08	1139	682	517	241	3004	494	429	217	145	1319	13	100	347	649	4323	251	2675	129
2008-09	1626	611	318	179	2739	345	212	78	149	798	8	52	374	594	3539	204	2859	13
2009-10	1498	614	391	215	2738	477	344	130	224	1200	7	64	393	615	3399	182	2907	118
2010-11	1346	638	413	309	2708	531	385	148	261	1329	6	42	493	662	4040	193	3033	95
2011-12	836	604	264	207	1913	527	253	104	228	1113	4	16	603	656	3026	187	3069	25
2012-13	951	652	261	65	1023	464	222	104	193	984	4	3	624	650	2914	128	2890	11
2013-14	1130	1269	167	98	2210	442	22	955	269	270	2	2	746	777	3267	135	2986	1
2014-15	242	576	233	19	1081	472	450	218	271	1422	8	1	1093	1103	522	211	2942	0
2015-16	1104	619	227	116	2066	465	443	205	298	1414	13	1	1202	1227	3440	261	2861	0
2016-17	1690	308	550	383	3537	470	415	148	341	1420	10	2	840	1012	3820	700	3069	1

APPENDIX - III

Production of different crops in Jalna district (2002-03 to 2016-17) (Production'00 tonnes)

Year	Jowar	Maize	Wheat	Bajra	Total Cereal	Red gram	Green gram	Black gram	Gram	Total Pulses	Groundnut	Sunflower	Soybean	Total oilseed	Total food grain	sugarcane	cotton	safflower
2002-03	1667	1233	440	839	2262	303	318	167	119	922	11	51	102	329	4896	11200	2000	143
2003-04	1017	1619	240	750	3639	191	303	107	68	1729	09	28	148	312	4330	3397	1637	107
2004-05	1809	1097	274	651	3334	213	183	58	75	1941	22	52	150	412	3876	3560	2065	124
2005-06	1435	1287	342	773	3843	338	168	88	121	738	27	51	357	666	4578	7238	2704	211
2006-07	1903	1469	548	766	2353	486	201	95	156	962	14	67	368	639	5655	4482	5147	173
2007-08	1643	2162	458	554	4828	450	199	136	111	907	10	57	452	642	5735	19014	6491	108
2008-09	1555	977	298	219	3047	237	29	10	92	361	05	28	230	365	3412	15524	4183	96
2009-10	1540	1291	401	364	3599	406	94	39	204	718	06	38	456	576	4348	16937	5031	70
2010-11	1041	1838	516	443	3839	540	263	97	199	1100	05	21	800	900	4939	11927	7766	65
2011-12	623	1579	210	272	2765	277	125	53	138	594	03	08	900	930	3559	13064	5271	16
2012-13	7167	1146	29	142	215	108	24	15	31	179	03	01	436	443	1662	8026	1902	02
2013-14	907	2128	137	201	3376	475	137	58	236	236	1.7	1.4	1236	1269	4294	9723	6814	01
2014-15	68	322	15	77	487	119	72	40	68	312	03	0	403	400	148	10075	1591	00
2015-16	336	569	83	58	1045	101	38	30	84	254	05	0.003	574	582	1300	13341	1491	00
2016-17	420	1012	102	186	345	135	105	65	90	312	04	0.01	675	600	2185	10075	1691	1

APPENDIX - IV

Productivity of different crops in Jalna district (2002-03 to 2016-17 (Productivity in "kg/ha")

Year	Jowar	Maize	Bajra	Wheat	Total Cereal	Red gram	Green gram	Black gram	Gram	Total Pulses	Groundnut	Sunflower	Soybean	Total oilseed	Total food grain	sugarcane	cotton	safflower
2002-03	2126	2133	971	1593	1431	631	587	877	759	1369	1858	443	1640	670	5103	69	235	643
2003-04	2319	2645	1015	1303	2305	400	601	632	516	1123	2061	337	1261	632	929	47	177	534
2004-05	1829	1801	888	1405	2693	450	365	353	536	1204	1457	500	244	731	838	77	202	507
2005-06	1736	2170	1014	1430	2376	587	475	503	671	1176	1990	428	1182	956	978	70	213	163
2006-07	2035	2169	1056	1607	1540	577	484	502	854	1455	1506	496	1203	857	1929	83	375	820
2007-08	2369	3170	1071	1899	3359	912	464	627	764	1425	1796	570	1303	489	1327	76	413	839
2008-09	2252	1599	689	1667	2282	673	115	131	617	1032	135	538	615	614	964	71	249	742
2009-10	1552	2103	932	1863	2725	851	273	297	912	1469	1763	570	1161	936	1105	93	294	590
2010-11	2040	2882	1072	1671	3080	1017	684	657	761	1605	1728	509	1622	1360	1223	62	435	685
2011-12	1995	2614	1031	1401	2997	526	495	508	606	1121	858	511	1493	1417	1110	70	292	627
2012-13	1861	1758	542	449	211	232	110	148	159	345	1425	467	699	682	570	63	112	141
2013-14	1245	4857	1201	1400	3294	1075	615	613	876	574	865	852	1657	1633	1314	72	388	502
2014-15	1984	558	331	769	719	253	159	185	252	455	320	570	368	368	284	48	92	0
2015-16	526	2470	254	714	1057	218	87	195	283	435	836	48	475	475	374	51	59	0
2016-17	2032	2470	745	900	812	220	105	428	252	450	912	526	478	368	450	110	256	3

APPENDIX – V

Area irrigated by different sources in Jalna district (2002-03 to 2016-17)

Year	Surface irrigation	Well irrigation	NIA	% of NIA to NSA	GIA	% of GIA To GCA	NSA	GCA
2002-03	4095	48950	54000	7.39	53045	6.15	731000	66300
2003-04	5200	48950	54000	7.39	54150	6.27	731000	66300
2004-05	5220	48950	56000	7.66	54165	6.28	731000	66300
2005-06	6530	48995	56000	7.66	55215	6.40	731000	66300
2006-07	6530	48995	58000	7.93	56525	6.55	731000	66300
2007-08	6530	48995	58000	7.93	56525	6.55	731000	66300
2008-09	6530	48995	58000	7.93	56525	6.55	731000	66300
2009-10	8208	49774	44200	6.05	57982	6.72	731000	66300
2010-11	8208	49774	44200	6.05	57982	6.72	731000	66300
2011-12	1113	49774	44200	8.21	50887	6.14	731000	66300
2012-13	1113	49774	60000	18.32	50887	6.97	731000	65200
2013-14	1113	42657	124000	18.00	43770	5.14	677000	65200
2014-15	1113	42657	124000	18.00	43770	5.40	689000	61000
2015-16	1113	42657	124000	18.00	43770	5.40	689000	61000
2016-17	1113	42657	148000	21.48	43770	5.40	689000	61000

APPENDIX-VI

Changes in total consumption of fertilizers in Jalna district (Fertilizer in "MT")

Year	Nitrogen	Phosphorus	Potassium	Total
2004-05	30138	17665	7212	52201
2005-06	31138	20741	11436	379894
2006-07	44366	23897	12618	73957
2007-08	47760	24300	15666	81161
2008-09	55565	20504	111833	176065
2009-10	63979	29620	13232	88789
2010-11	57420	40248	26118	127636
2011-12	75696	38988	12522	114966
2012-13	67772	25882	13168	84355
2013-14	38326	31768	14982	105007
2014-15	63749	26746	13524	93846
2015-16	54884	28500	11388	82437
2016-17	58368	34132	17419	98472
2017-18	65446	37739	18469	114583