

**ECONOMIC APPRAISAL OF AGRICULTURAL DEVELOPMENT  
IN NANDED DISTRICT OF MAHARASHTRA**

**by**

**Miss. Bhadre Tejaswini Vilas**

**(Reg. No. 019/202)**

**DEPARTMENT OF AGRICULTURAL ECONOMICS**

**POST GRADUATE INSTITUTE  
MAHATMA PHULE KRISHI VIDYAPEETH  
RAHURI-413722, DIST-AHMEDNAGAR  
MAHARASHTRA STATE, INDIA**

**2022**

**ECONOMIC APPRAISAL OF AGRICULTURAL DEVELOPMENT  
IN NANDED DISTRICT OF MAHARASHTRA**

by

**Miss. Bhadre Tejaswini Vilas**

**(Reg. No. 019/202)**

A Thesis submitted to the  
**MAHATMA PHULE KRISHI VIDYAPEETH,  
RAHURI- 413 722, DIST- AHMEDNAGAR,  
MAHARASHTRA, INDIA.**

In partial fulfilment of the requirements for the degree

of

**MASTER OF SCIENCE (AGRICULTURE)**

in

**AGRICULTURAL ECONOMICS**

APPROVED BY

**Dr.R.B.Hile**

(Chairman and Research Guide)

**Dr. D. B. Yadav**

(Committee Member)

**Dr.G.G. Joshi**

(Committee Member)

**Dr. V. S. Wani**

(Committee Member)

**DEPARTMENT OF AGRICULTURAL ECONOMICS**

**POST GRADUATE INSTITUTE  
MAHATMA PHULE KRISHI VIDYAPEETH  
RAHURI-413722, DIST-AHMEDNAGAR  
MAHARASHTRA STATE, INDIA**

**2022**

## **CANDIDATE'S DECLARATION**

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

Place :MPKV, Rahuri.

Date :

(Tejaswini V.Bhadre)

**Dr.R.B.Hile**

Associate Professor,  
Department of Agricultural Economics,  
Mahatma Phule Krishi Vidyapeeth,  
Rahuri-413722, Dist. Ahmednagar,  
Maharashtra State (India)

## **CERTIFICATE**

This is to certify that the thesis entitled “**ECONOMIC APPRAISAL OF AGRICULTURAL DEVELOPMENT IN NANDED DISTRICT OF MAHARASHTRA**” submitted to the Faculty of Agriculture, Mahatma Phule Krishi Vidyapeeth, Rahuri, Dist. Ahmednagar (Maharashtra) in partial fulfilment of the requirement for the award of the degree of **MASTER OF SCIENCE (AGRICULTURE)** in **AGRICULTURAL ECONOMICS**, embodies the result of a piece of bonafide research work carried out by **MISS. BHADRE TEJASWINI VILAS** under my guidance and supervision and that no part of the thesis has been submitted for any other degree or diploma.

The assistance and help received during the course of this investigation have been duly acknowledged.

Place : MPKV,Rahuri.

Date :

(Dr.R.B.Hile)  
Research Guide

**Dr.D.B.Yadav**

Head,

Department of Agricultural Economics,

Mahatma Phule Krishi Vidyapeeth,

Rahuri-413722, Dist. Ahmednagar,

Maharashtra State (India)

## **CERTIFICATE**

This is to certify that the thesis entitled “**ECONOMIC APPRAISAL OF AGRICULTURAL DEVELOPMENT IN NANDED DISTRICT OF MAHARASHTRA**” submitted to the Faculty of Agriculture, Mahatma Phule Krishi Vidyapeeth, Rahuri, Dist. Ahmednagar (Maharashtra) in partial fulfilment of the requirement for the award of the degree of **MASTER OF SCIENCE (AGRICULTURE)** in **AGRICULTURAL ECONOMICS**, embodies the result of a piece of bonafide research work carried out by **MISS. BHADRE TEJASWINI VILAS** under the guidance and supervision of **Dr.R.B.Hile**, Associate Professor, Department of Agricultural Economics, MPKV, Rahuri, Maharashtra State (India) and that no part of the thesis has been submitted for any other degree or diploma.

Place : MPKV,Rahuri.

(Dr.D.B.Yadav)

Date :

**Dr. P. N. Rasal**

Associate Dean,

Post Graduate Institute,

Mahatma Phule Krishi Vidyapeeth,

Rahuri-413722, Dist. Ahmednagar,

Maharashtra State (India)

## **CERTIFICATE**

This is to certify that the thesis entitled “**ECONOMIC APPRAISAL OF AGRICULTURAL DEVELOPMENT IN NANDED DISTRICT OF MAHARASHTRA**” submitted to the Faculty of Agriculture, Mahatma Phule Krishi Vidyapeeth, Rahuri, Dist. Ahmednagar (Maharashtra) in partial fulfilment of the requirement for the award of the degree of **MASTER OF SCIENCE (AGRICULTURE)** in **AGRICULTURAL ECONOMICS**, embodies the result of a piece of bonafide research work carried out by **MISS. BHADRE TEJASWINI VILAS** under the guidance and supervision of **Dr.R.B.Hile**, Associate Professor, Department of Agricultural Economics, MPKV, Rahuri, Maharashtra State (India) and that no part of the thesis has been submitted for any other degree or diploma.

Place : MPKV,Rahuri.

(Dr.P.N.Rasal)

Date :

## ACKNOWLEDGEMENT

*I am really happy; finally, that time has come to say thanks to everyone who helped me. I am really fortunate for getting an opportunity to work under the dynamic and able guidance from **Dr.R.B.Hile**, Associate Professor, Department of Agricultural Economics, MPKV, Rahuri, he has provided constant encouragement, constructive criticism and sympathetic attitude throughout the course of investigation and preparation of this manuscript.*

*I extend my sincere and deepest thanks to **Dr. P. G. Patil**, Honorable Vice Chancellor, MPKV Rahuri, **Dr. P. N. Rasal**, Dean, Faculty of Agriculture, MPKV, Rahuri and Associate Dean, Post Graduate Institute, MPKV, Rahuri, for his directives and valuable guidance during the experimentation of research work.*

*It is great privilege for me to express my profound sense of gratitude to **Dr. D. B. Yadav**, Head, Department of Agricultural Economics, MPKV, Rahuri, for his valuable suggestions, technical guidance, thought provoking ideas and support during the tenure of my research and studies.*

*I avail this opportunity to express my sincere thanks to my committee members, **Dr. V. S. Wani**, Professor, Department of Statistics, MPKV, Rahuri and **Dr. G. G. Joshi**, Assistant Professor Department of Economics, MPKV, Rahuri, for their valuable guidance, kind co-operation, inspiration and support for the successful conduct of my studies.*

*I have great pleasure in acknowledging my gratitude to my colleagues Ashwini, Rizwana, Swati, Ankita, Poonam, Dhiraj, Rahul, Pradeep, Pradnyashil, Swapnil, Shatanand, Sagar, Prashant, Dnyaneshwar who directly or indirectly gave me the confidence.*

*Unforgettably I would like to mention my friend Sachin along with my elder sister Varsha di who directly or indirectly gave me the inspiration and moral support. Their support, encouragement and credible ideas have been great contributions in the completion of the thesis. I'm most thankful to my senior friends Amruta di and Pooja di and other associates for their kindly help during course of this investigation.*

*My acknowledgement would be incomplete without thinking the biggest source of my strength, my family. The blessings of my parents **Dr. Vilas Amrutrao Bhadre** and **Dr. Vandana Vilas Bhadre** the love and the care of my younger brother **Pritam** who were the source of constant inspiration and moral support in stepping up my academic career without which it was difficult for me to achieve my goal.*

*I would be failing my duties if I do not remember our farmers, soldiers and scientists who have devoted their life for country.*

*Finally, I would respectfully mention the symbol of knowledge and my idol Dr. B.R.Ambedkar who always inspire me to follow the path of success by educating and enlightening.*

Place : MPKV, Rahuri

Date :

(Tejaswini V. Bhadre)

## CONTENTS

Chapter No.	Title	Page No.
	CANDIDATES DECLARATION	III
	CERTIFICATE OF RESEARCH GUIDE	IV
	CERTIFICATE OF HEAD OF DEPARTMENT	V
	CERTIFICATE OF ASSOCIATE DEAN	VI
	ACKNOWLEDGEMENT	VII
	CONTENTS	VIII
	LIST OF TABLES	XI
	LIST OF FIGURES	XIII
	LIST OF PLATES	XIII
	LIST OF ABBREVIATIONS	XIV
	ABSTRACT	XV
<b>1</b>	<b>INTRODUCTION</b>	1
	1.1 General	1
	1.2 Agricultural Development	1
	1.3 Agricultural Development in India	2
	1.4 Agricultural Development in Maharashtra	3
	1.5 Problem	4
	1.6 Objectives	5
	1.7 Hypotheses of Study	5
	1.8 Scope and Utility of the Study	5
	1.9 Limitations of the Study	6
<b>2</b>	<b>REVIEW OF LITERATURE</b>	7
	2.1 General	7
	2.2 Studies on the Changes in Land Use and Cropping Pattern	7
	2.3 Studies on the Growth Rates of Area, Production and Productivity of Major Crops	10
	2.4 Studies on the Changes in Infrastructural development in Agriculture	12
	2.5 Studies on the Factors Responsible for Agricultural Development	14
	2.6 Studies on problems of development in	15

		Agriculture	
<b>3</b>	<b>METHODOLOGY AND SALIENT FEATURES OF STUDY AREA</b>		<b>19</b>
	3.	Methodology	19
	3.1	Basic approach of the study	19
	3.2	Location of the study	20
	3.3	Sources of data	20
	3.4	Method of analysis	20
	3.4.1	Structural changes in land use, cropping pattern and input use	20
	3.4.2	The growth rates of area, production and productivity of major crops	21
	3.4.3	Factors influencing agricultural production in Nanded	21
	3.2	Salient features of Nanded	23
	3.2.1	General	23
	3.2.1.1	Location	24
	3.2.2	Topography	24
	3.2.2.1	Soil	24
	3.2.2.2	Rivers	24
	3.2.3	Climate and rainfall	24
	3.2.4	Area and demography	25
	3.2.5	Agriculture	26
	3.2.6	Development of Infrastructural Facilities in Nanded	32
<b>4</b>	<b>RESULTS AND DISCUSSION</b>		<b>35</b>
	4.1	Changes in Land Use Pattern of Nanded	35
	4.2	Changes in Expansion of Irrigated Area in Nanded	37
	4.3	Changes in Cropping Pattern of Nanded	38
	4.4	Changes in Crop Production in Nanded	40
	4.5	Changes in Productivity of Major Crops in Nanded	41
	4.6	Annual Compound Growth Rates of Area, Production and Productivity of Major crops in Nanded	43
	4.7	Changes in Consumption of Fertilizers (NPK) in Nanded	47

	4.8	Changes in Area under High Yielding Varieties in Nanded	47
	4.9	Changes in Agriculture workforce of Nanded district	48
	4.10	Changes in the Use of Implements and Machinery in Nanded	48
	4.11	Changes in Annual Rainfall in Nanded	49
	4.12	Changes in Livestock population in Nanded	50
	4.13	Development of Infrastructural Facilities Nanded	51
	4.13.1	Changes in agro- based industries in Nanded	51
	4.13.2	Change in number of warehouses and their capacity in Nanded	51
	4.13.3	Fair price shops and Agricultural Produce Market Committees in Nanded	52
	4.13.4	Changes in credit disbursement through PACCS in Nanded	52
	4.13.5	Changes in media and communication devices in Nanded	53
	4.13.6	Changes in roads and railway length in Nanded	53
	4.13.7	Changes in educational and health facilities in Nanded	54
	4.13.8	Changes in consumption of electricity in Nanded	55
	4.14	Factors Influencing Agricultural Production in Nanded	56
	4.15	Problems in Development of Agriculture in Nanded	58
	4.16	Suggestions to overcome the Problems	58
<b>5</b>	<b>SUMMARY AND CONCLUSIONS</b>		<b>59</b>
<b>6</b>	<b>LITERATURE CITED</b>		<b>64</b>
<b>7</b>	<b>VITAE</b>		<b>68</b>

## LIST OF TABLES

<b>Table No</b>	<b>Title</b>	<b>Page No</b>
3.1	Tehsil wise rainfall of Nanded (2018-19)	25
3.2	Administrative set up of Nanded (2018-19)	26
3.3	Population of Nanded (2018-19)	26
3.4	Land use pattern of Nanded (2018-19)	28
3.5	Area irrigated by various sources in Nanded (2018-19)	29
3.6	Irrigation projects in Nanded (2018-19)	29
3.7	Cropping pattern of Nanded (2018-19)	30
3.8	Livestock population in Nanded (2012 census)	31
3.9	Use of implements and machineries in Nanded	32
3.10	Agro based industries in Nanded (2018-19)	32
3.11	Financial institutes in Nanded (2018-19)	33
3.12	Road and railway length in Nanded (2018-19)	33
3.13	Health facilities in Nanded (2018-19)	34
3.14	Electricity use in Nanded (2018-19)	34
4.1	Changes in land use pattern of Nanded	36
4.2	Changes in area irrigated by various sources in Nanded	37
4.3	Changes in irrigated area in Nanded	38
4.4	Changes in cropping Pattern of Nanded	39-40
4.5	Changes in crop Production in Nanded	41
4.6	Changes in average productivity of major crops in Nanded	42
4.7	Annual Compound Growth Rates of Area, Production and Productivity of Major crops in Nanded	45
4.8	Changes in consumption of fertilizers (NPK) in Nanded	47

4.9	Changes in area under high yielding varieties in Nanded	47
4.10	Changes in agriculture workforce of Nanded district	48
4.11	Changes in the use of implements and machinery in Nanded	48
4.12	Changes in annual rainfall of Nanded	49
4.13	Changes in livestock population in Nanded	50
4.14	Changes in agro based industries in Nanded	51
4.15	Changes in warehouse number and capacity in Nanded	51
4.16	Changes in fair price shops and APMC's in Nanded	52
4.17	Changes in credit disbursed through PACS in Nanded	52
4.18	Changes in media and communication in Nanded	53
4.19	Changes in road and railway length in Nanded	53
4.20	Changes in educational facilities in Nanded	54
4.21	Changes in health facilities in Nanded	55
4.22	Changes in consumption of electricity in Nanded	55
4.23	Results of multiple regression analysis for agricultural development in Nanded	57

## LIST OF FIGURES

<b>Figures No</b>	<b>Title</b>	<b>Between pages</b>
1	Tehsil map of Nanded district	
2	Political map of Nanded district	
3	Land use pattern of Nanded district	
4	Changes in land use pattern of Nanded district	
5	Changes in cropping pattern of Nanded district	
6	Changes in production of major crops in Nanded district	
7	Changes in productivity of major crops of Nanded district	
8	Changes in average rainfall of Nanded district	

## LIST OF PLATES

<b>Plate No</b>	<b>Title</b>	<b>Between pages</b>
1	Features of Nanded district	

## LIST OF ABBREVIATIONS

%	:	Per cent
/	:	Per
@	:	At the rate
0C	:	Degree celcius
AES	:	Agro ecological situations
APMC	:	Agricultural produce market committee
et al.	:	And others (co- workers)
etc	:	And so on and other people things
Fig	:	Figure
g	:	Grams
GCA	:	Gross cropped area
GI	:	Geographical index
ha	:	Hectare
HYV	:	High yielding varieties
ie	:	That is
K Wh	:	Kilo Watt hour
Kg/ha	:	Kilograms per hectare
Km	:	Kilometers
Ltd	:	Limited
M.Sc	:	Master of Science
Mg	:	Miligram
Million ha	:	Million hectare
Mm	:	Mili meter
MT	:	Metric Tonnes
NH	:	National highway
No	:	Number
NPK	:	Nitrogen, phosphorus and potassium
PACS	:	Primary agricultural credit societies
PCO	:	Public call office
Reg. No	:	Regestration number
Rs	:	Rupees
SC	:	Scheduled caste
Sq. km	:	Square kilometer
ST	:	Scheduled tribe
STD	:	Subscriber trunk dialing
viz.,	:	Namely (Vide licet)

## ABSTRACT

---

### **ECONOMIC APPRAISAL OF AGRICULTURAL DEVELOPMENT IN NANDED DISTRICT OF MAHARASHTRA**

By

**Miss. Bhadre Tejaswini Vilas**

A candidate for the degree

**MASTER OF SCIENCE (AGRICULTURE)**

In

**AGRICULTURAL ECONOMICS**

Post graduate Institute

**MAHATMA PHULE KRISHI VIDYAPEETH**

**RAHURI – 413 722**

**2022**

---

**Research Guide : Dr. R.B. Hile**

**Department : Agricultural Economics**

---

The present investigation was undertaken to evaluate the process of agricultural development by way of studying the changes in land use pattern and cropping pattern, growth rates of area, production and productivity of major crops, development of infrastructure and to identify factors influencing agricultural production during the period from 1990-91 to 2018-19 in Nanded district. The time series data covering the above period relating to the aspect of the study were collected from the published literature as well as from relevant sources. The data were analysed by adopting suitable analytical tools to arrive at the following results.

The study revealed that, the irrigated area increased by 22.38 per cent. The net sown area showed increasing trend by 8.35 per cent and gross cropped area also increased by 4.39 per cent over the base period. The land under cultivable waste decreased by 41.16 per cent. Current fallows showed increasing trend by 54.76 per cent. The land under non-agricultural use decreased 29.35 per cent. The cropping pattern showed the predominance of oilseed crops in the district. Cotton and soyabean are the main crops in the district. The commercial crop sugarcane showed slight increase. Area under food grains decreased by 10.34 per cent over the base period while area under fruits and vegetables slightly increased.

The period wise annual compound growth rates in area, production and productivity of minor crops decreased significantly. The annual compound growth rates for

productivity of total food grains were highly significant but the growth rate for area was negative. The annual compound growth rates for area, production and productivity of total oilseeds were highly significant. The infrastructural facilities such as use of implements and machineries, electricity consumption, transport and communication facilities, financial institutions, education and health facilities etc. has impact on agricultural development.

The study brought an important fact that, the new technology available during post green revolution period help to improve productivity of crops *viz.*, Kharif jowar, black gram, total food grains. It concludes from the study that factors such as average annual rainfall in the Nanded in mm ( $X_7$ ), area under fruits and vegetables in '00' ha ( $X_8$ ), number of milch animals in lakh ( $X_9$ ) and area under commercial crops ('00' ha) ( $X_5$ ) had shown positive significant association with agricultural production.

Although agricultural development was satisfactory in the district but, there are some lacunas which were, increase in land under non-agriculture use, lack of assured irrigation facilities, inadequate availability of quality seeds and fertilizers. The important policy implications made on the basis of the present investigation are maintaining forest area, expansion of irrigated facilities, supply of fertilizers and proper supervision on the use of credit. The area expansion of HYV's may be properly supervised for its best utilization in addition to this the use of agronomical and mechanical measures for harvesting, rain water, quality inputs for development of agriculture are essential.

As such, there is need to give emphasis on proper policy support for decreasing land under non- agricultural use, policy for increasing productivities of crops, priority to irrigation schemes, providing quality inputs, policy for rapid development of transportation etc., need to be emphasized.

## 7. VITAE

MISS. TEJASWINI VILAS BHADRE

MASTER OF SCIENCE (AGRICULTURE)

IN

AGRICULTURAL ECONOMICS

2022

<b>Title of thesis</b>	:	Economic appraisal of agricultural development in Nanded district of Maharashtra
<b>Major field</b>	:	Agricultural Economics
<b>Biographical information</b>		
<b>Personal</b>	<b>Date of Birth</b>	: 23 December 1997
	<b>Place of Birth</b>	: Nanded
	<b>Father's Name</b>	: Dr. Vilas Amrutrao Bhadre
	<b>Mother's Name</b>	: Dr. Vandana Vilas Bhadre
<b>Educational</b>	<b>Bachelor Degree</b>	: Collage of Agriculture, VNMKV, Parbhani.
	<b>Class</b>	: First class
	<b>Name of University</b>	: Mahatma Phule Krishi Vidyapeeth, Rahuri.
<b>Extra-curricular activities</b>		Working as student's council chairman under 'Young Inspirators Network'(YIN) Contributed as Master volunteer during pandemic under 'Surakshit Hum Surakshit Tum Abhiyan' State level first prize in Agriculture Poster Presentation' Working with NGO 'Samajbandh'
<b>Address</b>	:	Shravasti nagar, nasratpur road, Nanded-431602.
	<b>e-mail id</b>	: tejaswnibhadre9890@gmail.com
	<b>Contact number</b>	: 9359460712

# 1. INTRODUCTION

## 1.1 General

Agriculture is the primary occupation and economic backbone of developing countries like India. The agriculture industry generates 17.32 per cent of national income and employs 60-70 per cent of the population. The agricultural sector's part of the economy is shrinking, but not the number of people who rely on it. The land is a fixed and constrained production factor. As a result, it is vital to increase output by implementing new, more advanced technology. Since the start of the Five-Year Plans in 1950-51, planners have prioritised agriculture and devoted special attention to agricultural growth in each plan.

## 1.2 Agricultural Development

Agricultural development refers to the transition from traditional agriculture to modernised agriculture, which results in greater production and productivity per unit of resource due to the application of modern technology. The original equilibrium position changes during the transformation process, and the production function rises to a higher level, occupying a new equilibrium position where profits are at their highest. The use of high yielding cultivars, as well as an improved package of activities such as fertiliser use, plant protection measures, irrigation and the use of mows, are all part of the agricultural development process. The method tries to maximise the use of available resources, such as land, labour and capital. Finally, it displays the significant changes in resource consumption and allocation, as well as crop productivity, over time on the farm.

Agriculture development is significant from the standpoint of expanding agricultural productivity in both the state and the country. Agriculture production is India's single most important economic activity. Agriculture is not only a profession, but also a way of life that has influenced the thoughts and perspectives of millions of people for millennia. Agriculture's share of GDP is declining, but the number of people who rely on it is not. If we completely exploit our natural and human resources, we can solve the problem of hunger and development. Geographically, India has the world's second-largest fertile land area and 127 agroclimatic zones, providing it global leadership in a variety of crops. India produces the most milk in the world and is second in rice, wheat, fish, fruits, and vegetables. Over the last decade, the horticulture industry has grown at a rate of 5.5 percent each year. Because agriculture is such an important part of our economy, the government has started new measures to boost agricultural production and double farmers' income by improving their socioeconomic position.

### 1.3 Agricultural Development in India

Agriculture has been the major source of livelihood in India since primordial age. Recognizing the important role of agriculture, the five-year plan assigned high priority to agricultural development, the scenario of Indian Agriculture has been changed after mid -sixties as a result of green revolution introduced by Dr. M. S. Swaminathan in India. He generated climate of confidence in agricultural capabilities and the country became self-sufficient. Since 1966-67, with the beginning of agricultural development involving technical change and introduction of high yielding varieties, chemical fertilizer, irrigation facilities, Indian agriculture no longer remain traditional one. Increased agricultural production made India self- sufficient in food grains (Source: <https://en.m.wikipedia.org>).

According to third advance projections, food grain output will reach a new high of 284.83 million tonnes in 2017-18, while horticulture production will reach 306.82 million tonnes. India is the world's second-largest fish producer, employing over 15 million people and supporting their livelihoods. As a result, total fish production in the country increased to 111.41 million ton in 2018-19, up from 0.75 million ton in 1950-51. Apart from that, India generated more than 5.78 billion US dollars (37871 crores) from fish and fish products exports in 2017-18.

PM Narendra Modi's Cabinet Committee on Economic Affairs (CCEA) authorised an increase in MSP for kharif crops in 2018-19. It fulfils the promise of the present principle of fixing MSPs at 150 per cent of cost of production, as stated in the union budget for 2018-19. India is the world's second-largest producer of fruits and vegetables, after China. Horticultural crops have produced more than food grains, despite poor climatic conditions, thanks to horticulture crop research and development efforts. Several coordination activities have been implemented to ensure the country's food and nutritional security-

- 1.NFSM (National Food Security Mission)
- 2.NHM (National Horticulture Mission)
- 3.NMOOP (National Mission on Oilseeds and Oil palm)

The Soil Health Card System was created to tell farmers about the health of their farm's soil, the types of crops that should be cultivated, and the types and quantities of nutrients that should be employed. In addition, over 100 irrigation projects are being built under the PMKSY moto of "Har Khet ko Paani" (Pradhan Mantri Krishi SinchanYojna). e-NAM was established to provide farmers with improved price discovery. With the country's growing population. it is a barrier to inclusive growth. According to Agricultural Statistics at a Glance,2018 despite efforts to improve India's agricultural status, the development in agricultural input remained uneven over three years and across different states and areas of the country.

Farmers' income is expected to double by 2020, according to the Ministry of Agriculture and Farmers' Welfare. As farm mechanisation is a key component of this project, the government is subsidising equipment purchases through SMAM (Sub-Mission of Agricultural Mechanization). SMAM will also support custom recruiting models. India has emerged as a prominent exporter of agricultural machinery in recent years, with a CAGR of 6.2 per cent (Source: Agricultural statistics at a Glance,2019).

#### **1.4 Agricultural Development in Maharashtra**

Maharashtra is a forerunner in several modern agricultural development projects. In terms of various agro-climatic conditions, Maharashtra might be regarded one of India's most diversified state. The state is divided into four regions: Konkan, Western Maharashtra, Marathwada and Vidarbha. Each region has its own set of natural, physical, social, and economic characteristics. Variation in terrain, soil, and climatic conditions have a substantial impact on crop and land use patterns, production input consumption and technology adoption, as well as crop production innovations among different locations. The inter-regional comparison of agricultural performance reveals that, due to major imbalances and differences in farm family income levels in the region, advanced technologies have been unable to make considerable progress in increasing production and productivities of various crops.

Maharashtra is located in the country's western and central regions. It has a 720-kilometer coastline on the Arabian Sea. Maharashtra is known for its magnificent Sahyadri and Satpura mountains. Maharashtra has a population of 11.24 crore people and a geographical area of 3.08 lakh square kilometres, according to the 2011 Population Census. It came in second in terms of population and third in terms of area. Nearly 45.2 percent of the state's population lives in metropolitan areas.

Despite the fact that the state has become more industrialised in many aspects, agriculture remains the primary source of income in many areas. Maharashtra leads the nation in coal-based thermal electricity generation and nuclear electricity generation, with a market share of 13 percent and 17 percent, respectively. Maharashtra is India's most industrialised state, accounting for 13 per cents of the country's total industrial production. It is also introducing Jatropha cultivation and has launched an initiative to identify potential Jatropha cultivation sites. Maharashtra is one of India's most heterogeneous states when it comes to agroclimatic conditions. For simplicity, the state is divided into four regions: Konkan, western Maharashtra, Marathwada, and Vidarbha. In terms of natural, physical, social, and economic situations, each one is unique. Variability in terrain, soil, and climatic conditions have a big impact on crop and land use patterns, production inputs, and new technology adoption in the region.

Agriculture and related activities employ 64.14 percent of Maharashtra's population. Because the majority of the state's cultivable land is rainfed, the south west monsoon, which occurs between June and September, is critical for the state's sustenance and quality of life. Any changes in the timing, distribution, or quality of the monsoon rains can result in floods or droughts, putting the agriculture industry at risk. Satara, Sangli, Solapur, and Ahmednagar in Maharashtra's Deccan plateau and Marathwada region are particularly vulnerable to drought. Farmers' suicides have increased in recent years in the state as a result of debts brought on by monsoon failure and climate change. Occasionally, the cost of production exceeds the market price for a variety of reasons. The state of Maharashtra has the most dams in India. Despite this, the net irrigated area is just 33500 square kilometres, accounting for barely 16 percent of cultivable land. Millets such as bajra, jowar, and finger millet are important monsoon crops. Wheat, legumes, vegetables, and onion are among the other crops. As a result of the little rainfall in the Konkan and Eastern foothills of the Sahyadri mountains, they plant a variety of rice cultivars. Cotton, sugarcane, turmeric, and oilseeds including groundnut, sunflower, and soyabean are the main cash crops here. Mangoes, bananas, grapes, pomegranates, and oranges are the principal horticulture crops. The state's total food grain output climbed to 172.29 lakh tones in 2018-19, up from 121.81 lakh tones in 1990-91, and the gross irrigated area increased to 39.47 lakh hectares in 2018-19, up from 33.19 lakh hectares in 1990-91. When it comes to milk production, it was 104.02 lakh MT in 2018-19, compared to 101.52 lakh MT in 2018-19(Source: Economic survey of Maharashtra,2018-19).

After independence, Maharashtra was a forerunner in Agricultural Cooperative Societies. In the dairy, cotton, and fertiliser industries, these cooperatives play a major role. Cooperatives play an important role in the marketing of fruits and vegetables in Maharashtra, as they do in dairy and sugar. When the agricultural sector develops, it has an impact on other sectors of the economy as well as the region's general economic development.

## **1.5 The Problem**

Farmers in India have been able to break free from their traditional agriculture thanks to the emergence of the green revolution in the mid-sixties. They now understand the need of utilising critical inputs like as irrigation, credit, fertilisers, high yielding varieties, seeds, plant protection measures, and so on in order to increase agricultural productivity. It appears that the aforementioned inputs, in combination with new agricultural technology, have a significant impact on agricultural productivity and output. Since the mid-sixties, Maharashtra's agriculture has seen a number of changes as a result of the national drive for agricultural development.

A study of this nature might go into great detail in evaluating the trend of changes in land use and cropping patterns, as well as the growth rates of essential crops and the identification of major factors influencing agricultural productivity. Examining changes in acreage, productivity, and yield of important crops following the introduction of the green revolution may also be beneficial. There are few studies on the aforementioned aspects of evaluating the agricultural growth of a study region, like a district. Changes in land use, cropping pattern, area, production, productivity of crops grown in the district, and other infrastructural improvements such as storage, irrigation, livestock, and so on have been noticed in the Nanded district over time. As a result, it was planned to conduct research titled "Economic Appraisal of Agricultural Development in Nanded District of Maharashtra" that would span the years 1990-91 to 2018-19.

### **1.6 Objectives of the study**

1. To study the changes in land use and cropping pattern.
2. To estimate the growth rates of area, production and productivity of major crops.
3. To study the changes in infrastructural development in agriculture.
4. To assess the factors responsible for agricultural development.
5. To identify the problems in agricultural development and suggest suitable measures.

### **1.7 Hypotheses**

1) Null ( $H_0$ ): Cultivated and irrigated area remain stagnant for last several years in Nanded district.

Alternative ( $H_1$ ): Cultivated and irrigated area varying for last several years in Nanded district.

2) Null ( $H_0$ ): The growth rates in area, production and productivity of major crops remain stagnant during last several years.

Alternative ( $H_1$ ): The growth rates in area, production and productivity of major crops are varying.

### **1.8 Scope and utility of the study**

The study's scope is limited to the Nanded district of Marathwada region of Maharashtra with a focus on the above-mentioned objectives. However, the study's findings can be extrapolated to larger areas with similar agro-climatic circumstances. The study will shed light on crucial agricultural development characteristics in a district, which can then be investigated further in different conditions throughout the state to determine their significance. Important results drawn in the research region are expected to be valuable in the formulation and

implementation of agricultural development programmes in the district. Weaknesses in resource allocation can be identified using changes in the district's crop pattern over time, as well as growth rates in significant crops, and then addressed by proposing appropriate strategies for balanced agricultural growth in the district.

### **1.9 Limitations of the study**

The current research was based on secondary data gathered from published sources and development agencies in the Nanded area. The analysis was limited to the data that is currently available on the study's elements. The degree of reliability of secondary data determines the validity of the study's findings. The information was gathered from the Department of Agriculture, Government of India, the District Collectorate Office, the District Statistical Abstracts, and Epitomes released by the Maharashtra Department of Agriculture. Because the data was secondary, it has its own set of constraints when it comes to additional analysis and display. However, in order to meet the objectives and draw relevant conclusions, an in-depth examination of the data is attempted.

## **2. REVIEW OF LITERATURE**

### **2.1 General**

This chapter has been devoted to present reviews of previous studies which are identical to present one. The basic purpose of this chapter is to understand the methodology adopted and the trends of conclusion derived in the earlier related studies so that a suitable methodological frame. The literature closely related to the present study is briefly presented under four major headings are as below. The basic objective of the present study was to examine the process of agriculture development in terms of changes in several parameters of agricultural growth and development in Nanded district. The reviews so far drawn have been categorized into five groups based upon the aspects of the present study.

- a. Studies on the changes in land use and cropping pattern.
- b. Studies on the growth rates of area, production and productivity of major crops.
- c. Studies on the changes in infrastructural development in agriculture.
- d. Studies on the factors responsible for agricultural development.
- e. Studies on problems of development in agriculture

### **2.2 Studies on changes in land use and cropping pattern**

While studying the agricultural development in particular region, shifting pattern in case of land use and crops is always given much more importance.

Bhatt (2012) studied on economic development of agriculture development in Himachal Pradesh. He concluded that the land utilization pattern over years showed that most of the geographical area of the state was under forest and pastures. The area under forests increased from about 21.71 per cent in 1975-76 to 24.67 per cent during 2007-08. The area under pastures declined marginally from 40.62 to 32.67 per cent during the period of 32 years.

Shaikh (2013) studied on economic appraisal of agricultural development in Andhra Pradesh. He observed that area of Andhra Pradesh. The area under forest was decreased from 22.64 per cent in the year 1980-81 to 22.58 per cent in the year 2009-10. The total area sown increased from 122.82 lakh hectares to 125.61 lakh hectares during the year 2009-10. Area under cereals at state level was decreased from 55.03 per cent in 1980-81 to 37.49 per cent in 2009-10. The area of pulses, vegetables, flowers, and fruits increased.

Kalaskar (2015) analysed the economic appraisal of agricultural development in Yavatmal district. He revealed that area not available for cultivation category has increased by 20.43 per cent during the span of last thirty years. The fallow land decreased from 78.45 thousand hectares in the year 1980-81 to 65 thousand hectares in the year 2011-12. The area under forest was slightly decreased from 16.93 per cent in the year 1980-81 to 16.42 in the year

2011-12. The net sown area of Yavatmal district had decreased by 1.25 per cent over the base year.

Rejula and Singh (2015) explored changes in land use and cultivation patterns in Kerala as a consequence of elevated food insecurity. The current research examines changes in land use patterns. It also looks at how cropping patterns have changed in Kerala (2001 to 2012). Current fallow, other fallow, and cultivable waste land all confident growth. Rubber (1.07 %) and banana (1.53 %) had the most positive increase in terms of area, whereas paddy (4.01 %), tapioca (3.83 %), and plantain (1.01 %) had the most negative growth in the targeted area.

Nayak (2016) studied agricultural diversification, shifting cropping patterns, and productivity of crops in Odisha. He performed a district-by-district examination and reported that Odisha is a monocrop state. Rice is mostly grown in that region since rice output is increasing as a result of improved irrigation facilities and the state government's offer of MSP (Minimum Support Price). Nearly 30 crops cover 96-98 percent of the total cultivated area in the region. Rice production climbed to 55.6 percent in 2000-2005, up from 48.1 percent in 1980-85, whereas cash crops, cereals, condiments, and spice crop production declined by various degrees.

Raypure (2016) analysed agricultural growth, land use patterns, and cropping patterns in Maharashtra's Gadchiroli district. She described the pattern of growth in the years 2013-14. The district's geographical area is 1491600 hectares. Net sown area, forest area, and gross cropped area account for approximately 12.18 percent, 74.10 percent, and 107.48 percent of the total geographical area, respectively.

Sreedhar *et al.* (2016) studied an appraisal of land use and| land cover change scenario of Tummalapalle region of Andhra Pradesh. The land use analysis was carried out using IRS P6 LISS-III multiterm portal data pertaining to the years 2006 to2016. The area under built up and agricultural classes are found increased from 0.84 percent to 2.44 per cent and 54.84 per cent to 56.82 per cent, respectively during 2006-2016. Area under forest, wasteland and water bodies are found decreased considerably from2.75 per cent to 0.76 per cent, 38.56 per cent to 37.88 per cent and 2.71 per cent to 2.09per cent respectively.

Doke (2017) studied that the land is used for different activities, such as agriculture, forests, mining, transport, settlement, entertaining and manufacturing. The unused lands are unproductive waste i.e., barren and fallow (temporary and permanent) land. Green canopy plays an important role in maintaining surface temperature and humidity. The final classification map provided the land use and land cover information. Three specific bands were used with reasonable success to correlate soil, wetness and vegetation. In the present study the crop-land covers the highest area 10814 sq.km i.e., 35.17 per cent.

Krishnan (2017) studied micro analysis on changes in land use and cropping pattern in Tamil Nadu. In which, he concluded that the net area sown declined from 55.78 to 48.19 lakh hectares. The gross cropped area decreased from five per cent to 11 the total geographical area of Tamandu. The land put to non-agriculture use increased around 3 per cent to the geographical area. The area under pulses reached 883 lakh hectares which represent 68 per cent increase comparing the base year 2005-06.

Malik (2017) studied that land is a source of all basic human needs (e.g., Agriculture, forest, water supply etc.), which is being continuously depleted by various agents. Urban growth and urbanization are considered as one of the major factors responsible for change in land cover dynamics and depletion of land resources. An attempt therefore, has been made to acquire reliable and timely spatio-temporal information of Hisar Tehsil of Haryana state to study and predict land cover dynamics. Decadal changes in the land use pattern of the study area were monitored since 1990. Many models to forecast the spatial and temporal changes in the land-use have been developed. Therefore, it was thought worthwhile to use such models for Indian conditions.

Mangalagowri and Nagaraj (2017) studied the land use pattern at any given time is determined by several factors including size of human and livestock population, the demand pattern, the technology in use, the cultural traditions, the location and capability of land, institutional factors like ownership pattern and rights and state regulation. Non-agriculture land has increase from 8.9 per cent to 11 per cent and current fallow land increase from 3.2 per cent to 6 per cent of total area and also cultivable waste land decrease from 4 per cent to 3 per cent.

Johanson (2018) examined changes in the cropping pattern of Kerala over the last 61 years. Specifically, it puts together a district-level database on agriculture in Kerala from 1956–57, when the State was formed, to 2016–17, the most recent year for which data are available. The available data were apportioned to nine composite districts according to the district boundaries of 1957–58 in order to construct a new dataset. The special features of this note are the construction of continuous databases on land-use pattern and area and production statistics for Kerala for a 61 year period at the district level.

Pandey and Ranganathan (2018) examined dynamics of land-use pattern in India with a focus on fallow lands. They find significant changes in the land-use pattern, and a continuous expansion of fallow lands in spite of increasing demand for land for agricultural and non-agricultural purposes. The fallow lands are distributed across the country but have a greater concentration in the states of Bihar, Andhra Pradesh, Rajasthan, and Karnataka. These changes in the temporal and spatial distribution of fallow lands are due to increasing variability in the precipitation and irrigation water, and low level of mechanization. If these lands can be brought

under cultivation would enhance agricultural production and food security of the poor and marginal farmers.

Parmar (2019) studied the economic appraisal of Raigad district. The study revealed that, the net irrigated area increased by 26.13 per cent during the entire period under study. The net sown area showed decreasing trend by 14.39 per cent and gross cropped area also decreased by 9.19 per cent over the base year. The land under cultivable waste tends to be decreased by 41.82 per cent and area under current fallow land showed increasing trend by 155.22 per cent during entire period under study. The cropping pattern showed the predominance of food grain crops in district.

Sharma and Burark (2021) studied the land use pattern in Rajasthan and revealed that the area under forest land, non-agricultural use and net area sown to total reporting area has increased during the past years and while area under barren and uncultivable land and fallow lands declined. Out of net cropped area of 195.49 lakh hectares, 75 per cent hectares is rainfed and 25 per cent is irrigated. However, this 25 per cent irrigated area contributes more than 50 per cent of agricultural output.

From above references, it was concluded that area under forest showed decreasing trend over the period. There were unfavourable increasing trends in the area of non-agricultural uses, barren and uncultivable area. There was a decrease in area under cereals. The area under forest showed a decreasing tendency over time, based on the above references. In the field of non-agricultural uses, barren and uncultivable land, there were unfavourable increasing tendencies. The amount of space under the cereals has shrunk.

### **2.3 Studies on growth rates in area, production and productivity of major crops**

The increased growth rates in area, production and productivity of the major crops have significant impact on agricultural development in any region.

Basnet (2006) looked at Nepal's agricultural development in general and the livestock sector in particular. He discovered that the population of milking cows and buffaloes, pigs, lay hens, and fowls grew at a positive rate over the research period, whereas the population of sheep grew at a negative rate. The growth rate of cow milk, eggs, and fish production proved satisfactory.

Dhakre and Sharma (2010) studied the growth analysis of area, production and productivity of maize in Nagaland. The study revealed that maximum decrease in area under maize crop was 16.02 per cent found in the year 1999-2000 and maximum increase in area under maize crop was 30.23 per cent in the year 2000-01, whereas maximum increase in production and productivity of maize crop in Nagaland was 103.05 per cent in the year 1988-89 and 101.26 per cent in the 1988-89, respectively. Among area, production and productivity of maize the

instability was the highest for the production. Growth rates of area, production and productivity were significant at 1 per cent level of significance.

Ghosh (2010) studied the growth and variability in the production of crops in West Bengal (India). He analysed that, operation Barga and the production of high yielding varieties during the eighties have turned West Bengal into a progressive state. The study reveals that, the agricultural growth of major crops declined significantly since the mid-nineties. Also, with the help of non- parametric test, the study makes it clear that the crop production variability varies significantly across the state and higher growth path is associated with the higher degree of variability.

Jaypatre *et. al.* (2010) examined the trends in area, production and productivity of mango crop in South Gujarat region in the present study. The district wise time series data on area, production and productivity of mango crop were collected from General Statistical Information of Agricultural Development published by Government of Gujarat. The study period was splitted into two sub periods. The results revealed that linear growth rates (LGR) for mango was non-significant in both the periods. For Valsad district, the production and productivity of mango was highly significant in period II as compared to period I. The instability index for area, production and productivity were found higher in period II as compared to period I.

Srivastava *et al.* (2010) studied the pulses performance of India. He compared pulses performance to cereals like wheat and paddy, the growth rate of area and production of pulses negligible and there exists wide variability in their yield in different states of country.

Acharya *et al.* (2012) assessed growth rates in the acreage, production, and productivity of various crops in Karnataka. From 1982-83 through 2007, the relevant secondary data were collected during a 26-year period. -08. Area under pulses, vegetables and spices, fruits and nuts exhibited large positive development, whilst grains showed significant negative growth. Annually, the area under jowar, bajra ragi, and other millets drops significantly. The area under rice has increased somewhat each year. Area under oilseeds and commercial crops grew at a negative and non-significant rate.

Dinesha and Sriramappa (2015) investigated the growth rates in area, output, and productivity of vegetables and fruits in India, with a focus on Karnataka. The essential data was gathered over a 22-year period, from 1990-91 to 2012-13. It was split into two parts: 1991-92 to 2000-01, and 2001-02 to 2012-13. For the first time, the area and production of fruits grew at a positive rate of 4.3 percent. Fruit crop productivity increased slightly but not significantly. Similarly, in Karnataka, the area and output of fruits showed positive rates of 1.80 and 0.90 percent, respectively. During the study period 1990-91 to 2012-13, however, production fell by 0.90 percent.

Korem *et al.* (2018) analysed the growth rates in area, production and productivity of rice crop in Telangana state. They concluded from study that, growth rates in area, production and productivity showed significantly at 5 per cent level of significance. These growth rates clearly indicate the performance of the variable under consideration and hence it can be very well used for making policy decisions.

Parmar (2019) estimated the growth rates in area, production and productivity of different crops in Raigad district. The period wise annual compound growth rates in area, production and productivity of major crops in Raigad district indicated that, the area of major crops decreased significantly. The annual compound growth rates for productivity of total food grains were highly significant. The annual compound growth rates for area of total food grains and total oilseeds were negatively significant, but for productivity were highly significant during the entire period under study.

Based on the aforementioned references, it can be concluded that growth rates of area and pulse production vary across the country. Crop production varies substantially across the United States. Fruit and vegetable output, area, and productivity all grew at a positive rate.

#### **2.4 Studies on the changes in infrastructural development in agriculture**

Ghosh and Kumar (2010) assessed irrigation and agriculture sector performance in Orrisa. He also looked into their impact on the state's economic development. Though irrigation potential has increased throughout time, food grain output in that region has grown at a slower pace. Assurance of irrigation, on the other hand, increased paddy area by per cent during the dry season.

Kumar and Palanisami (2010) studied on impact of drip irrigation on farming system in Southern India: Evidence from Southern India. They observed in terms of cropping pattern, resource use and yield. The drip method of irrigation has been found to have a significant impact on resources saving, cost of cultivation, yield of crops and farm profitability. Drip irrigation saves the 70-75 per cent of irrigated water. It shows significant response towards the agricultural development.

Bissa and Vyas (2014) studied the infrastructural status in agricultural marketing. They concluded that, India has undergone a rapid change in last two decades. Investment in agricultural sector, both in public and private sector has increased. In recent years, regarding the efficiency of marketing of agriculture produces in India. It is believed that poor linkages in marketing channels and poor marketing infrastructure are leading to high and fluctuating consumer prices. The efforts are already underway to evolve location of specific technologies, transfer them to farmers fields and assure inputs supply to farmers in right time, place and over time.

Chandrachud and Gajalakshmi (2015) studied the impact of infrastructure development on Indian agricultural growth (prospects and perspectives). The study reveals that, agriculture is the prime source of livelihood for more than 55 per cent of population, it's share to the National Gross Domestic Product has declined to 14.2 percent. This is mainly due to rapid growth of industrial and service sectors. But, with the sustainable provision for the infrastructural facility, we can achieve the new peaks of agricultural production, in turn higher contribution to GDP.

Ahmed *et al.* (2016) analysed the rural infrastructural development and its role in poverty reduction: Evidence from Pakistan. The study not only find out status of rural infrastructural development in Pakistan, but also to investigate the role of infrastructure in rural development. Finally, with the help of Pakistan 2008 MOUZA Statistics a compressive and composite index of principal infrastructural variables accessible to rural communities has been constructed.

Lokesha and Mahesha (2016) evaluated road infrastructure and concluded that road transport is critical for agricultural growth because it is the primary mode of transportation for agricultural produce from farms to markets and to various urban neighbourhoods. As a result, road infrastructure development is critical for agricultural, economic growth, and improved quality of life.

Prajapati (2017) researched the availability of rural infrastructure and its impact on well-being for Uttar Pradesh. His research papers demonstrated the link between rural infrastructure development and rural people's standard of living. Given the state's large population and rising unemployment, the researcher examined the relationship between infrastructure, poverty, and population well-being in Uttar Pradesh.

Gaikwad (2018) studied the major aspects of growth like compound growth rates of crops and major inputs, crop diversification, sources of output growth as also region-wise agricultural and socio-economic development of Maharashtra. Economic analysis among four regions of state (Konkan, Western Maharashtra, Marathwada and Vidarbha) was done in respect of compound growth rates of principle crops in cereals, pulses, oilseeds and commercial crops as also N:P:K fertilizer input use over 50 years. Compound growth rate analysis has shown that in Maharashtra area under *kharif* sorghum crop significantly decreased during over all period by 1.84 per cent per annum, while significant increase seen in yield by 1.99 per cent per annum. In all the regions area under sorghum crop declined significantly and productivity increased.

Singla (2018) studied the technology push and demand-pull practices for achieving sustainable development in manufacturing industries. He evaluated the significance of various technology push (TP) and demand pull (DP) practices substantial or achieving sustainable

development in Indian manufacturing industries. The research crucially examines the effectiveness of TP-DP practices in manufacturing companies.

The above references proved that infrastructural amenities such as roads, fertilisers, HYVs, and drip irrigation projects had a beneficial and significant effect on the corresponding target. Weak links in marketing channels and poor marketing infrastructure have resulted in high and unpredictable consumer costs in recent years in India when it comes to the effectiveness of agriculture output marketing.

## **2.5 Studies on factors responsible for agricultural development**

Kumar *et al.* (2003) evaluated the regional variations in consumption patterns in South Asia. Agricultural diversity, he said, is an important part of agricultural development. In both domestic and global markets, high-value food goods such as milk, meat, fruits, vegetables, and fish are in great demand.

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

Reij and Smalling (2008) studied on successes in agriculture and land management in sub- Sahara, Africa over for 4 decades. Cases can be grouped into those based on agricultural commodities and those based on areas and people. Success can be proven by indicators. Complicating factors are that a) an intervention geared at success may lead to multiple costs and benefits instead of the single one envisaged and b) Success cannot always be attributed to a single intervention. At the same time, the aggregate picture for the region contributes to be gloomy.

Ghosh and Kumar (2010) they reported on performance of irrigation and agricultural sector performance in Orrisa and their influence on economic development of the state was studied. They concluded that, in spite of increase in irrigation potential over the years, food grain production in Orrisa has showed slower growth, however, assured irrigation supply has increased rice area during dry season by 60 per cent.

Borthakur and Singh (2012) studied the agricultural research in India: An exploratory study. In which he concluded that, agricultural research system in India includes some 27,500 scientists and more than 100000 the supporting staff actively engaged in it, which makes it probably the largest research system in the world. The research and education responsible at the state level rest with the state country. In addition to these main streams of research, some general agricultural and other agencies like scientific organizations related to

agriculture, Government schemes related to agriculture are also important for farmer's development.

Bairwa *et al.* (2013) looked at population, production, and trade with a focus on the livestock industry. According to the survey, marginal agricultural households owned 50 per cent of India's livestock, and this sector was predominantly controlled by women. The livestock industry has added 25 per cent to the value of agriculture and related activities due to a massive growth in production of various products. Although total livestock exports have increased over the last two decades, they are still limited to a few nations with higher levels of volatility. Poultry goods are among the several animal items exported. Buffalo meat and dairy products are at the top of the list.

Shaikh (2013) investigated agricultural development in Andhra Pradesh and found that the use of machinery increased in the state during the study period. Tractor usage increased by 185.71 percent over the previous year. During the study period of 1980-81 to 2009-10, the total number of pump sets and sugarcane crushers also increased.

Saleena (2017) compared our country's agriculture to that of the rest of the world in terms of area, production and productivity. He looked at trends in Indian agricultural development with a focus on Kerala, where he identified agricultural worker participation as well as cropping intensity. In the end, it was determined that a paradigm change is required to transform the agricultural sector from traditional to modern. It can be accomplished by improving the quality and quantity of agricultural products and services, as well as social development and the use of new technologies.

Parmar (2019) analysed factors responsible for agricultural development in Raigad district. The study brought an important fact that, the new technology available during post green revolution period help to improve the productivity of crops *viz*; rice, green gram, black gram, total food grains. It concludes from the study that in overall period (1990-91 to 2016-17), average annual rainfall in mm ( $X_1$ ), amount of loan disbursed through PACCS per year in lakh rupees ( $X_4$ ) and percentage of gross irrigated area to gross cropped area ( $X_5$ ) shown the positive association with agricultural production in Raigad district.

From the preceding references, it was established that characteristics like net sown area, area under high yielding varieties, and average annual rainfall had a substantial positive relationship with raising the value of aggregate crop output. Farmers' development was aided by the rise of the livestock sector.

## **2.6 Studies on problems of development in agriculture**

Yadav (1990) analysed mountain agriculture and found that increasing land use and population increase are putting pressure on the mountain region's vast range of micro-environments and farming. This genetic variety in crop resources has the potential to boost

production and promote sustainable agriculture in mountainous areas. Using resource centered technology, the dual goals of improving production and conserving resources can be met.

Denholm *et al.* (1992) investigated agroforestry and proposed that it could be a viable choice for agricultural development in mountain areas, as agroforestry is a strategy that can contribute to the long-term sustainability of mountain agriculture.

Chaudhary (1994) examined the agricultural transformation in South Asia. He emphasised that the Green Revolution was a major contributor to the fastest growth in agricultural production, particularly in cereals. Government policy worked as a positive incentive to encourage the adoption of new technology during the Green Revolution in that situation. As a result of the surplus, countries like India and Pakistan saw rapid growth in cereal production. Sri Lanka, Bangladesh, and Nepal, on the other hand, had less surplus and hence became more reliant on imports.

Gaddi and Kunnal (1996) explored the sources of output growth in new milk production technology. He concluded that the pure breed effect contributed 25-47 percent, while improved management practises and inputs were the reason for increased milk production in other parts of the country. He also suggested that crossbreeds' poor contribution to increased milk production was greater than the increased input use.

Goswami (1996) evaluated the indigenous farming method in Meghalaya. He recommended that the government develop policies and provide incentives to encourage the growth of HYV paddy in valley and terrace land. If farmers are given seedlings and other inputs, they will be motivated to plant rubber in jhum land, which will act as a long-term jhum management measure.

Jodha (1996) in his study on sustainable mountain agriculture in Himalayas pointed out that the traditional technologies were sensitive to resource conservation needs but had low productivity potential. On the other side, newer technologies were sensitive and might boost output, but they were not shown to be sensitive to conservation demands. He emphasised the importance of combining ancient wisdom and customs with modern scientific understanding and updating them.

Gill (2002) looked into the effect of institutional reforms in agricultural growth in India. He observed that positive institutional arrangements would encourage economic progress, whilst unfavourable institutional arrangements could stifle economic growth. He also mentioned the importance of striking a balance between efficient, optimal, and equitable water use, as well as water conservation, in order to ensure irrigation's long-term viability. He also stated that the

government should provide more assistance in the formation of regulated marketplaces to protect the farming community.

Saika (2006) looked at the potentials, current state, agricultural development issues, and solutions for overcoming them in our country's north eastern region. He highlighted that the central concerns in agricultural development include shifting cultivation technique, low farm power, inputs, loans, and marketing, dominance of traditional agricultural technology, rainfed conditions, and flood damage. High yielding varieties, double/multiple cropping, short duration paddy types (for flood-affected areas), conventional horticulture crop techniques, watershed management, irrigation infrastructure, enhanced shifting cultivation models, and so on should all be included.

Parmar (2019) reported the problems in agricultural development in Raigad district. The results revealed that, there are some problems in development of agriculture in Raigad district which are, increases in land under non-agriculture use, lack of assured irrigation facilities, inadequate availability of quality seeds and fertilizers. The important policy implications made on the basis of the present investigation are decreasing area under non-agricultural use and bringing other fallow land by intensifying afforestation, use of high yielding varieties and adoption of modern cultivation practices.

All the above researchers studied and examined the basic problems in agricultural development. They concluded that irrigation facilities, modern technologies, use of high yielding varieties, modern cropping technologies etc. are some of the techniques which can be used to tackle the problems in agricultural development.



### 3. METHEDODOLOGY AND SALIENT FEATURES

#### 3. Methodology

In order to achieve objectives of any research work, it is always necessary to conduct the study on specific lines and adopt appropriate methodology. The efforts taken in that direction will be useful for arriving at meaningful conclusions. The present investigation gives an overall outlook regarding selection of area, sampling, collection of data and analytical procedure adopted etc. This methodological aspect will help us to fulfil the requirement of objectives. So, this chapter clarifies the methodology adopted in the present research work.

#### 3.1 Basic approach of the study

Evaluation of agricultural development in Nanded district for last twenty-nine years is the core objective of the present investigation. For conducting the study in that direction, some crucial aspects in agricultural development are taken into consideration. When we talk about agricultural development, there needs to be some significant changes in land use pattern, cropping pattern etc. in a particular region. This is due to the investment in structural and agricultural investment and also due to allocation of resources to the higher extent by farmers. The new production technologies which were adopted in agriculture resulted in increased production and productivity of crops which finally increased the total agricultural production. Therefore, an attempt was made here to evaluate agricultural development by examining land use and cropping pattern, production and productivity of major crops, infrastructural development and factors impacting agricultural development.

Particularly, the present study analyses significant changes in last twenty-nine years from 1990-91 to 2018-19 in terms of land use pattern and cropping pattern in the district. This will be helpful in getting a trend of resource allocation as a result of agricultural development in Nanded district.

The attempt to identify factors responsible for development is also done by using multiple regression analysis. This is carried out by taking total agricultural production (in monetary terms) of Nanded district as a dependent variable and factors *viz.*, percentage of gross irrigated area to gross sown area ('00') ( $X_1$ ), consumption of total fertilizer (NPK) per hectare of gross sown area in ( $X_2$ ), percentage of net sown area to gross sown area ( $X_3$ ), area under HYV seeds ('00' ha) ( $X_4$ ), area under commercial crops ('00' ha) ( $X_5$ ), amount of loan disbursed through PACCS per year (In lakhs) ( $X_6$ ), average annual rainfall in Nanded district (mm) ( $X_7$ ), area under fruits crops in ('00' ha) ( $X_8$ ) and Number of milch animals( $X_9$ ) are considered as independent variables.

Adoption of research procedure for the above aspects under study is discussed below

### **3.2 Location of the study**

The Nanded district has been purposively selected for present study. The Nanded is situated in south-east edge of Maharashtra. The farmers in the district agriculturally conscious and have made sincere efforts for agricultural development since the inception of green revolution in the country. The district is bounded by Yavatmal district to north, eastern side lies Adilabad, Nirmal, Nizamabad and Kamareddy districts of Telangana state, on south lies Bidar of Karnataka state. Nanded also shares boundaries with Latur on south west and with Parbhani and Hingoli districts on west.

### **3.3 Sources of data**

The study is primarily based on the timely data obtained from different sources *viz.* Published statistical literature by Zilla Parishad, Co-operative and District Statistical Office, Economic Survey reports, Census Reports, Post Graduate Institute, M.P.K.V., Rahuri library, Epitomes, Publication of Department of Agriculture, Maharashtra state etc. Specially, the data regarding area, production and productivity of major crops in the district for twenty-nine years is collected from Socio-Economic Review and District Statistical Abstracts of Nanded district published by Directorate of Economics and Statistics, Planning Department Government of Maharashtra and India. The website of Department of Agriculture, Government of Maharashtra was also utilized for the data collection.

The above information was very useful for estimation of growth rates in area, production and productivity of selected crops in Nanded district. The information regarding disbursement of credit through co-operatives, average annual rainfall, improved seeds and distribution of fertilizers in Nanded district from the year 1990-91 to 2018-19 was collected from Zilla Parishad, district co-operative sales, District Statistical Office, Nanded and majorly from cooperative banks. The efforts taken for the collection of data as explained above became an important source to meet objectives of the study and also useful in identification of different variables affecting agricultural development in Nanded district.

### **3.4 Method of analysis**

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

#### **3.4.1 Structural changes in the land use and cropping pattern**

The data collected on the land use pattern and cropping pattern of Nanded district for the twenty-nine years were classified into triennium averages as i.e., period I (1990-91 to 1992-93), period II (2003-04 to 2005-06) and period III (2016-17 to 2018-19) were analysed by simple tabular method. The proportions were estimated for each of the above year to know the changes in the land use, cropping pattern and average of three years is calculated. The changes in the land use and cropping pattern were also graphically depicted.

### 3.4.2 The growth rates of area, production and productivity of major crops

The data obtained on area, production and productivity of major crops *viz.*, paddy, *kharif* and *rabi* jowar, maize, gram, red gram, green gram, black gram, groundnut, soyabean, sunflower, cotton, sugarcane etc.in Nanded district were utilized for estimating compound growth rates. The data was analysed to obtain compound growth rates of area, production and productivity of the above crops for two different periods *viz.*, Period I 1990-91 to 2004-05, Period II 2005-06 to 2018-19 and for overall period 1990-91 to 2018-19.

#### Compound Growth Rate

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

$$Y = ab^t$$

Where,

Y = Area in hectares, production in tones and productivity in kg per hectare

a = Intercept

b = Regression coefficient

t = Time period in year

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

$$\text{CAGR} = (\text{Antilog } b - 1) \times 100$$

The significance of the estimated compound growth rates was tested with the help of student's 't' test.

### 3.4.3 Factors influencing agricultural production in Nanded

The information regarding total agricultural production, percentage of gross irrigated area to gross sown area, consumption of total fertilizer per hectare of gross sown area, percentage of net sown area to gross sown area, area under high yielding variety seeds, area under commercial crops, loan disbursed through PACCS per year in lakhs of rupees and average annual rainfall in the district during overall period were used for fitting a multiple linear regression equation. This was done for identifying the important variables and their role in influencing agricultural production in the district. They were assessed by fitting multiple linear regression equation.

$$Y = a + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + b_5X_5 + b_6X_6 + b_7X_7 + b_8X_8 + b_9X_9 + \mu t$$

Where,

Y = Total agricultural production of food grains and non-food grains (in lakh ₹)

a = Intercept

bi's = Regression coefficient

X<sub>1</sub> = Percentage of gross irrigated area to gross sown area

$X_2$  = Consumption of total fertilizer (NPK) per hectare of gross sown area (in kg)

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

$X_4$  = Area under HYV seeds ('00' ha)

$X_5$  = Area under commercial crops ('00' ha).

$X_6$  = Amount of loan disbursed through PACCS per year (in lakh ₹)

$X_7$  = Average annual rainfall in the Nanded (mm)

$X_8$  = Area under fruits crops ('00' ha)

$X_9$  = Number of milch animals (in lakhs)

$\mu$  = error term.

### **Dependent Variables**

Total agricultural production obtained from food grains and non-food grains in Nanded district during the period 1990-91 to 2018-19 has been obtained. The collected data is then multiplied by the physical output of each crop with their farm harvest prices for a specific year for converting it into monetary form. The aggregate value of total agricultural production for a specific year was then calculated by adding the values of physical output of various crops.

### **Independent Variables**

1. Percentage of gross irrigated area to gross sown area ( $X_1$ ). The percentage of gross irrigated area to gross sown area was worked out for each of the year under study and thus, the variable was constructed. It was expected that the increase in this percentage of gross irrigated area to gross sown area would boost the agricultural output of the district. Therefore, this variable was considered.
2. Consumption of total fertilizers (NPK) per hectare of gross sown area in kilograms ( $X_2$ ). This variable was constructed in order to know the effects of fertilizer use on aggregate crop output.
3. Percentage of net sown area to gross sown area ( $X_3$ ). It was expected that the increase in percentage of net sown area to gross sown area would have a positive effect on farm output of the district and therefore this variable was considered.
4. Area under HYV seeds ('00' ha) ( $X_4$ ) This variable was developed in order to assess the effects of HYV seeds on the aggregate farm output of the district.
5. Area under commercial crops ('00' ha) ( $X_5$ ). The area under commercial crops like sugarcane, cotton was taken into consideration in assessment of total agricultural production.
6. Amount of loan disbursed through PACCS in Nanded district in lakh rupees ( $X_6$ ). Credit was most important factor in agricultural development. So, it is necessary to assess the relationship of credit, particularly the short term and medium term disbursed through PACS in Nanded district with the aggregate crop output in the Nanded district.

7. Average annual rainfall(mm) in Nanded district( $X_7$ ). The data available on annual average rainfall in the district were used to develop this variable. The purpose was to examine the effect of average annual rainfall on aggregate farm output in the district. From the usual statistical procedure was adopted for testing the significance of the estimates of parameters.

8. Area under fruits ('00' ha) ( $X_8$ ) This variable was taken to examine that whether increased in area of fruit crops would have positive effect on aggregate farm value in the district.

9. Number of milch animals (in lakh) ( $X_9$ ). The data available on total number of milch animals were used to examine livestock and dairy development in district.

### **3.2 Salient features of Nanded district**

#### **3.2.1 General**

The science and skill of raising plants and cattle is known as agriculture. Agriculture was an important milestone in the rise of sedentary human civilization, as it permitted people to live in cities by creating food surpluses from domesticated species cultivation. Foods, fibres, fuels, and raw materials are all examples of key agricultural goods. Cereals, pulses, vegetables, fruits, oilseeds, meat, milk, and eggs are examples of food classes. The most important aims for Indian agriculture are proper planning of area-specific cropping patterns, proper crop management techniques, solid marketing facilities, good export technology, and its awareness.

Nanded district is located in Marathwada region of Maharashtra state covering area of 10440 sq.km which is about 3.41 per cent of total area of the state. Land holding fragmentation resulted in average land holding of 2 hectares. Normally, all the cultivated area is under rainfed condition. Though irrigated area is seen in some regions, there is a need to develop irrigation facilities in the district in order to achieve agricultural development. In some areas, water harvesting can be done by construction of dams and it can be utilized for crop irrigation. Till the date, there are 4 major, 11 minor and some other irrigation projects in the district (Source: Nanded district statistics at a glance,2018-19)

The district is characterized by presence of black cotton soil. So, area under cotton is increasing day by day. Other important crops in the district are soyabean and gram. Jowar is taken in both the seasons i.e., *kharif* and *rabi*. Cereals such as wheat, bajra, maize and pulses such as red gram, green gram, black gram are also cultivated on small or large scale. Groundnut, sunflower, safflower and sesamum are some oilseeds which also occupy gross cropped area. Production and productivity of major crops is increasing in recent years due to modern agriculture technology and use of high yielding varieties.

Nanded is rapidly becoming an important industrialising centre. As a result, more people are migrating to the industrial sector, resulting in a severe scarcity of farm labour. As a result, suitable measures for agricultural mechanisation are adopted through submission. Value

addition of agricultural produce is an important aspect in increasing farmers' income, so post-harvest management and efficient and effective market linkages are prioritised.

A holistic approach is required for agriculture sector development. Infrastructure gaps, technology and extension, interconnectedness of diverse sectors, investment, and other issues are common in agriculture.

### **3.2.1.1 Location**

Nanded is one of the eighth districts in Marathwada division of state Maharashtra. It is located in south-east part of Maharashtra at 18°15"-19°55" north and 77°7"-78°15" east. Nanded is surrounded by districts Hingoli and Yavatmal from north, Parbhani from north west, Latur from south west. Adilabad and Nizamabad districts of Telangana state forms south east boundary of Nanded district while Bidar district of Karnataka state forms southern boundary. Total area of the district is 10440sq.km which is 3.41 per cent of Maharashtra. Of the total area, 241.31sq.km (2.29%) is under urban area and 10290 km sq. (97.71%) is under rural area.

### **3.2.2 Topography**

#### **3.2.2.1 Soil**

The soils of the districts are light, medium and heavy black cotton soils with hilly area in the northern part of the district. Some areas in Kinwat tehsil shows low quality reservoir of limestone which is mixed with sand. Special quality of soil required for construction work is available in Nanded.

#### **3.2.2.2 Rivers**

The main rivers flowing in Nanded districts are Godavari, Manjara, Manyad, Saraswati, Painganga, Asna, Sita and Lendi. Godaveri is an important river in Nanded district which flows from east and enter in Nizamabad district of Andhra Pradesh. Manjra is the tributary of Godaveri which flows from south to north and crosses the border of AP. River Manyad flows from Kandhar tehsil to the east while Saraswati from wakhed mountain ranges in south to north direction and merges with Godavari at Malkautha. Aasna flows in east and merges with Godavari at 1km away from Nanded. Lendi river flows in Degloor tehsil from west to east and merges with vardha river in Yavatmal district. Minor river Sita flows from north and merges with Godavari.

### **3.2.3 Climate and Rainfall**

The climate of Nanded district is warm and cool. As the rest of India Nanded district has three distinct seasons; Summer, Monsoon and the Winter season. Summer is from March-May while temperature increases from mid-November. Summers are hot and dry. The temperature can be 25-40<sup>0</sup>C during the peak of summer. The Monsoon sets in during June-September. During this season the weather is usually humid and hot. October days are hottest. Winter is from the month of November to February. Winters are cold and dry. Information regarding tehsil wise rainfall of Nanded district during year 2018-19 is given in the Table 3.1.

The actual rainfall in the district during 2018-19 was 1013.00 mm. Mudkhed taluka experienced more rainfall of 1279.70 mm while Hadgaon experienced low rainfall of 770.50 mm.

**Table 3.1 Tehsil-wise rainfall in Nanded (2018-19)**

Sr. No.	Tehsil	Rainy days	Actual rainfall (mm)
1	Mahur	60	1013.60
2	Kinwat	65	980.00
3	Himayatnagar	53	933.40
4	Hadgaon	55	770.50
5	Ardhapur	58	814.30
6	Nanded	27	1102.60
7	Mudkhed	63	1279.70
8	Bhokar	52	1013.80
9	Umri	61	994.10
10	Dharmabad	58	1071.40
11	Biloli	60	1042.80
12	Naigaon	53	1051.40
13	Loha	62	1063.70
14	Kandhar	48	1051.40
15	Mukhed	63	1055.90
16	Degloor	54	896.00
	<b>TOTAL RAINFALL</b>	<b>56</b>	<b>1013.00</b>

Source: Rainfall recording and Analysis, Department of Agriculture Maharashtra State, 2019

### 3.2.4 Area and Demography

Nanded district comes under Marathwada division of Maharashtra and divided into 8 subdivisions for ease of governance viz., Nanded, Bhokar, Biloli, Degloor, Dharmabad, Hadgaon, Kandhar and Kinwat. There are total 16 tehsils in the district and divided as following in Table 3.2.

Total area of the district is 10440 km sq. which is 3.41% of Maharashtra. The population given in table is based on the 2011 census. It is seen from Table 3.3, the district had population of 33,61,000 persons out of which rural population was 24,47,000 and urban population was 9,14,000. Out of total population, 17,30,000 were males and 16,31,000 were females. In the year 2018-19, the district recorded 6,40,000 SC population and 2,81,000 ST population. The district had sex ratio of 943(females per 1000 males). The density of population

in the year was 320 persons per sq.km. Out of the total literacy percentage, 84.27 per cent males were literate and 66.14 per cent females were literate.

**Table 3.2 Administrative setup of Nanded district during 2018-19**

Sr. No	Name of Sub-division	Name of Tehsil
1	Nanded	Nanded, Ardhapur
2	Bhokar	Bhokar, Mudkhed
3	Biloli	Biloli, Naigaon
4	Degloor	Degloor, Mudkhed
5	Dharmabad	Dharmabad, Umri
6	Hadgaon	Hadgaon, Himayatnagar
7	Kandhar	Kandhar, Loha
8	Kinwat	Kinwat, Mahur

Source: Socio-Economic Review and District Statistical Abstract of Nanded, 2019

**Table 3.3 Population of Nanded district** (in 000 numbers)

Sr. No	Population	Year
		2011
A.	Total population	3361
1.	Rural population	2447
2.	Urban population	914
3.	Male	1730
4.	Female	1631
5.	SC Population	640
6.	ST population	281
B.	Sex ratio (Per 1000 Males)	943
C.	Density (per sq.km.)	320
D.	Literacy rate (%)	
	Male literacy	84.27
	Female literacy	66.14

Source: Socio-Economic Review and District Statistical Abstract of Nanded, 2019

### 3.2.5 Agriculture

#### 3.2.5.1 Land use pattern of Nanded District

It is revealed from Table 3.4 that total geographical area of Nanded district was 1044000ha and area under forest was 12.64 per cent of total geographical area. It was 20.36 per cent less than needed area (33%) under forest.

Land under non- agriculture was 67,113ha and barren land was 48,700ha which was 6.42 and 4.68 per cent of total geographical area, respectively. Cultivable waste land was 26,518ha, permanent pastures and grazing land was 57,100ha and area under orchard was 10969ha. Current fallow and other land was 6,500ha and 6,800ha which was 6.22 per cent and 6.59 per cent of total geographical area.

Net sown area in the Nanded district was 5,67,800ha which was 54.38 per cent of total geographical area. Area sown more than once was 94,666ha which was 9.06 per cent of total geographical area. Gross cropped area was found 6,62,466ha which was 63.45 per cent. As gross cropped area was more than net sown area, cropping intensity was found 116.67 per cent in year 2018-19.

Hence, it was observed that Nanded district have less area under forest than the needed for maintaining environmental balance. More than 50 per cent area of the district was under cultivation. Gross cropped area was more than net sown which increased the cropping intensity.

**Table 3.4 Land use pattern of Nanded district (2018-19)**

(Area in '00' ha)

Sr. No	Particulars	Area	Percentage to total geographical area (%)
1	Geographical area	10440.00	100.00
2	Area under forest	1320.00	12.64
3	Land put to nonagricultural use	671.13	6.42
4	Barren and Uncultivated land	487.40	4.68
5	Cultivable waste	265.18	2.54
6	Permanent pastures and grazing land	571.60	5.48
7	Area under orchard and miscellaneous use	109.69	1.05
8	Current fallow land	650.00	6.22
9	Other fallow land	687.00	6.59
10	Net sown area	5678.00	54.38
11	Area sown more than once	946.66	9.06
12	Gross cropped area	6624.66	63.45
13	Cropping intensity (%)	116.67	

**Source: Socio-Economic Review and District Statistical Abstract of Nanded district, 2019**

### 3.2.5.2 Irrigation sources

Irrigation is the most essential input in agriculture. With the use of suitable irrigation facilities, a major modification in cropping pattern might be achieved.

Table 3.5 revealed that in surface irrigation was the primary source of irrigation. Net irrigated area by various sources during the year 2018-19 was 68100ha. Out of net irrigated area, 31000ha area was under surface irrigation, 24700ha area was under well irrigation and only 12400ha was under canal irrigation.

Information regarding major and medium irrigation projects in Nanded district is given in Table 4.6. There were 4 major irrigation projects in Nanded. Manar project covers 23,310ha and Godavari (vishnupuri) project 33725ha area is under irrigation. Adding to it, 11 medium projects are working to fill the need of irrigation. The district also completed 900 little works in this regard.

**Table 3.5 Irrigation sources and area irrigated in Nanded district (2018-19)**

Sr. No.	Irrigation sources	Area (in '00' ha)
1	Surface irrigation other than wells	310.00 (45.52)
2	Well irrigation	247.00 (36.27)
3	Canal irrigation	124.00 (18.21)
	<b>Net area irrigated</b>	681 (100)

(Figures in Parentheses indicates percentage to the net irrigated area)

Source: Socio-Economic Review and District Statistical Abstract of Nanded,2019

**Table 3.6 Irrigation projects in Nanded (2018-19)**

Sr. No.	Name of project	Location	Completed in year	Capacity (10 lakh cubic meter)	Area (Ha)
<b>Major</b>					
1.	Manar Project Varvant	Kandhar	1968	146.92	23310
2.	Lendi Project Goregaon	Mukhed	In progress	145.20	32410
3.	Shakarrao Chavan Vishnupuri Prkalp	Nanded	In progress	83.550	33725
4.	Aamdura Bandhara	Mudkhed	2015	23.71	1116
<b>Medium</b>					
1.	Kurandala Project	Mukhed	1971	10.41	1012
2.	Karakhed	Degloor	1976	11.01	1781
3.	Kudala	Bhokar	1974	4.87	405
4.	Pethvadaj	Kandhar	1978	9.04	1470
5.	Mahalingi	Kandhar	1977	4.78	820
6.	Loni	Kinwat	1983	9.21	2417
7.	Nagzari	Kinwat	1982	7.19	1291
8.	Dongargaon	Linwat	1983	9.60	1475
9.	Urdhwamanarlimboti	Loha	2017	107.19	6000
10.	Babhalibandhara	Dharmabad	2013	55.49	1995
11.	Balegaonbandhara	Umri	2015	40.78	1600

Source: Socio-Economic Review and District Statistical Abstract of Nanded,2019

### 3.2.5.3 Cropping Pattern of Nanded District

**Table 3.7 Cropping pattern of Nanded district (2018-19)**

(Area in '00' ha)

Sr. No.	Crop	Area	Percentage to the total gross cropped area (%)
1	Paddy	9.21	0.13
2	Wheat	211.00	3.18
3	<i>Kharif</i> Jowar	100.45	1.51
4	<i>Rabi</i> Jowar	215.00	3.24
5	Maize	84.00	1.26
6	Other Cereals	30.00	0.45
7	<b>Total Cereals</b>	<b>649.66</b>	9.80
8	Gram	780.00	11.77
9	Red Gram	170.00	2.56
10	Green Gram	168.00	2.53
11	Black Gram	156.00	<b>2.35</b>
12	Other Pulses	18.00	0.27
13	<b>Total Pulses</b>	<b>1292.00</b>	<b>19.48</b>
14	<b>Total Food grains</b>	<b>1941.66</b>	29.28
15	Groundnut	192.00	2.89
16	Soyabean	1600.00	<b>24.15</b>
17	Sesamum	26.00	0.39
18	Other oilseeds	11.00	0.16
19	<b>Total oilseeds</b>	<b>1829.00</b>	<b>27.60</b>
20	Sugarcane	120.00	<b>1.81</b>
21	Cotton	2666.00	<b>40.28</b>
22	Fruits and vegetables	37.00	<b>0.56</b>
23	Fodder crops	31.00	<b>0.47</b>
24	<b>Gross cropped area</b>	<b>6624.66</b> <b>(100)</b>	<b>100</b>

**Source: Socio-Economic Review and District Statistical Abstract of Nanded, 2019**

The cropping pattern of Nanded district for the year 2018-19 is presented in Table 3.8.

It can be seen from the table that the gross cropped area in the district was 662466ha. Among the grains, the *rabi* jowar occupied major area (3.24%) followed by wheat (3.18%) and pulses occupied area of 19.48 per cent. The oilseeds are key crops accounting for 27.60 percent

of total cropped land. Soyabean and cotton are the main crops in district covering area of 160000ha and 266600ha respectively. Fruits and vegetables accounted for only 0.55 per cent of total cultivated land. The other important crops in the district are *kharif* jowar, gram, groundnut and sugarcane.

#### 3.2.5.4 Animal Husbandry

Table 3.8 shows the livestock population in Nanded district based on results of 19<sup>th</sup> Livestock Census 2012.

From the table it can be concluded that, out of the total livestock population of 856990 in the district Indigenous cattle numbered 69732, Exotic/Hybrid cattle 13313 and buffaloes 123728. The overall population of poultry, sheep and goats were 1033419, 2156 and 91341 respectively.

**Table 3.8 Livestock population in Nanded (Census 2012)**

Sr. No.	Particulars	Number
1	Indigenous Cattle	697231
	Bullocks	213034
	Cows	274321
	Calf	209876
2	Exotic Cattle	13313
	Bullocks	1647
	Cows	6543
	Calf	5123
3	Buffaloes	123728
	He buffaloes	49223
	She Buffaloes	45600
	Calf	28905
4	<b>Total Sheep</b>	2156
5	<b>Total Goats</b>	91341
6	<b>Other livestock</b>	1835
7	<b>Total Livestock</b>	929604
8	<b>Total Poultry</b>	<b>1033419</b>

Source: Report on 19<sup>th</sup> Livestock Census-2012, Maharashtra State.

#### 3.2.5.5 Agricultural Machineries and Implements

The farmer's production efficiency is influenced by the type of agricultural implements and technology they utilize. The data in Table 3.9 shows the state of tools and machineries in the district for the year 2018-19. It is seen that there were 74568 wooden ploughs

and 10089 iron ploughs. Bullock carts and tractors in the field were 73248 and 2465 in number respectively. In addition, there were 550 oil pumps and 9453 electric pumps for irrigation.

**Table 3.9 Use of implements and machineries in Nanded district (2018-19)**

Sr. No.	Items	Number
1	Wooden plough	74568
2	Iron plough	10089
3	Bullock carts	72348
4	Tractors	2465
5	Oil pumps for irrigation	550
6	Electric pumps for irrigation	9453
7	Sugarcane crushers	745

**Source: Socio-Economic Review and District Statistical Abstract of Nanded,2019**

### **3.2.6 Development of Infrastructural facilities in Nanded**

#### **3.2.6.1 Agro- based industries**

**Table 3.10 Agro-based industries in Nanded district (2018-19)**

Sr. No.	Particulars	Number of units
1	Sugar factories	58
2	Cotton mills	120
3	Other industries	96
4	Handicraft industries	320

**Source: Socio-Economic Review and District Statistical Abstract of Nanded,2019**

Information related to agro based industries in Nanded district for the year 2018-19 is presented in Table 3.10.

After examining the table, it was determined that there were few agro based industries in Nanded district. There were 58 sugar factories, 120 cotton mills and 320 handicraft industries functioning in the district. Other industries like milk processing, dal mills, etc. were found to be 96 in number.

#### **3.2.6.2 Markets**

There are total 19 APMC's (Agricultural Produce Marketing Committee) in Nanded. Biloli and Naigaon each had 2 APMC's and remaining tehsils each had 1 APMC except Ardhapur. These APMC'S were located in Nanded, Mudkhed, Hadgaon, Himayatnager, kinwat , Mahur, Bhokar ,Umri , Dharmabad , Biloli ,kundalwadi, Naigaon, kuntus , Degloors, Mukhed, loha and Islapur.

### 3.2.6.3 Banking

The data related to banking sector for the year 2018-19 is depicted in table 3.11. It can be observed that there was total 943 Primary Agricultural Cooperative Credit Societies (PACS) to provide short term and medium-term loans to farmers while they can get long term loans from District Central Cooperative Bank. There were also 419 Commercial banks and 490 Non-agricultural Banks functioning in banking sector of the Nanded district.

**Table 3.11 Financial institutes in Nanded district (2018-19)**

Sr. No	Name of financial institutes	Number
1	District Central Cooperative Bank	1
2	Primary Agricultural cooperative credit societies	943
3	Commercial banks	419
4	Non-agriculture banks	490
5	LAMPS (Adivasi Cooperative societies)	-

Source: Socio-Economic Review and District Statistical Abstract of Nanded,2019

### 3.2.6.4 Transport and Communication Facilities

**Table 3.12 Road and railway length in Nanded (2018-19)**

Sr. No.	Particulars	Length in 'km'
1.	National Highways	848
2.	Main and other state highways	953
3.	Major district roads	2645
4.	Village roads	5065
5.	Other roads	1813
	<b>Total road length</b>	<b>11324</b>
<b>6.</b>	<b>Total railway length</b>	<b>208</b>

Source: Socio-Economic Review and District Statistical Abstract of Nanded,2019

Transportation and communication facilities are important in any region's prosperity. These facilities aid in development of agriculture by allowing surplus agricultural items to be easily moved from one place to another. It is seen from the table 3.12 that the district is crossed by national highway of length 848km. The total road length was 11324km in year 2018-19. The whole length of railway route was roughly 208 km.

### 3.2.6.5 Education and health facilities

SRTMU (Swami Ramanand Tirth Marathwada University) was started functioning in Nanded from 1994. Colleges in the districts of Nanded, Hingoli, Parbhani and Latur comes

under SRTMU. Nanded had science, commerce, medical, ayurvedic and engineering colleges. All tehsils in the district had colleges.

The district registered government institutes and local institutes for providing medical and health facilities. Nanded have Shri Gurugovindsinghji govt hospital and also a hospital under Ayurvedic college. The district had total of 273 doctors and 483 nurses. The hospitals have 1282 number of patients beds which were provided facilities to 21.63 lakh patients and given treatment to 30.051 lakh outsiders. Under Krushi kalyan kendrea(KKK), there were 85 management centres established till 2019. This provided operation facilities to 383457 patients. Out of which 18329 were males and remaining were females.

**Table 3.13 Health facilities in Nanded district (2018-19)**

Sr. No	Particulars	Numbers
1.	Civil hospital	1
2.	Rural hospitals	160
3.	Private Hospitals	110
4.	Primary health centers	95
5.	Sub PHC	450
6.	Public health centers	16

**Source: Socio-Economic Review and District Statistical Abstract of Nanded,2019**

From table 3.13, it can be seen that during year 2018-19, there were 160 rural hospitals, 110 private hospitals, 95 primary health centres and 450 sub PHC's in Nanded district for providing health facilities to peoples.

### 3.2.6.6 Electricity

The information related to electricity use in Nanded district is given in table 3.14. There was no any electricity project established till 2018-19. But Maharashtra State Electricity Board companies supplies electricity to the Nanded district. Year 2019 records 100 per cent electricity supply to all cities and villages in the district. In the year 2018-19 80,87,850kWh electricity was used in year 2018-19. Out of which 28,66,160 kWh for household purpose,55,23,860 kWh for agriculture, 532410 kWh for industries, 102313kWh for commercial and 33,76,300kWh for miscellaneous.

**Table 3.14 Electricity use in Nanded district (2018-19)**

Sr. No	Particulars	Electricity use (10 lakh kw.hr)
1.	Household purpose	74.73
2.	Industrial use	286
3.	Agriculture use	552
4.	Commercial use	102
5.	Other	33
	<b>Total</b>	<b>1026</b>

**Source: Socio-Economic Review and District Statistical Abstract of Nanded,2019**

## 4. RESULTS AND DISCUSSION

Agricultural development is a never-ending process. It was increased after the government adopted a new agricultural growth plan, the green revolution, in 1966, which must have resulted in certain structural changes in farm land use and cropping patterns. The green revolution's first major direct result was a significant increase in food grain production. The use of new modern technologies resulted in a movement from traditional agriculture to modern agriculture, from subsistence to commercial farming, from extensive to intensive farming, and from low-income to high-income enterprises. Area expansion led to the increase in output of some crops, but improvement in yield levels was the main element leading to the increase in production of others. The key sources of output gain for several crops were both area expansion and yield enhancement. Given the mixed type of crop performance throughout time, researchers must delve deeper into the pattern of area allocations, as well as the production and productivity disparities of diverse crops over time.

The present chapter of research study tries to analyse changes in land use pattern, cropping pattern and also production, productivity of major crops during various time periods in Nanded district as a whole. The data is collected for 29 years in order to depict the clear picture of different aspects and to obtain the results.

### 4.1 Changes in Land Use Pattern

The information regarding changes in land use pattern is given in Table 4.1. Data presented in table revealed the comparison between three periods. The triennium averages Period I (1990-91 to 1992-93), Period II (2003-04 to 2005-06) and period III (2016-17 to 2018-19) are depicted in the table. It can be seen from the table, that though total geographical area remains constant during the study period, the area under forest, land put to non-agricultural use, barren and uncultivated land, cultivable waste, permanent pastures and grazing land, area under orchard and miscellaneous use, current fallow were undergone significant changes.

Firstly, looking towards area under forest, it was 1,98,000ha in period I and declined to 1,32,000ha in period III. It was decreased in period II and period III by 17.08 and 33.33 per cent change over base year, respectively. Land under non-agricultural use was also decreased by 29.35 per cent over base year i.e., In period I, it was 9.09 per cent of total geographical area which was reduced to 6.42 per cent in period III.

Barren and uncultivated land showed some fluctuations as it was tremendously increased in period I by 57.24 per cent change over base year and then it was decreased in period II i.e., by 29.90 per cent change over base year. The cultivable waste land totally decreased during the study periods i.e., In period I, it was 4.33 per cent of total geographical area which was seen to be 2.54 per cent in period III. In terms of per cent change over base year, it was declined by 15.48 and 41.16 in period II and period III, respectively.

**Table 4.1 Changes in Land use pattern of Nanded district****(Area in '00'ha)**

Sr. No.	Particulars	Triennium average			Percent change over base year	
		Period I (1990 to 93) Base year	Period II (2003 to 06)	Period III (2016 to 19)	Period II	Period III
1	Geographical area	10440.00 (100)	10440.00 (100)	10440.00 (100)	-	-
2	Area under forest	1980.00 (18.96)	1641.73 (15.72)	1320.00 (12.64)	-17.08	-33.33
3	Land put to nonagricultural use	950.00 (9.09)	764.91 (7.32)	671.13 (6.42)	-19.48	-29.35
4	Barren and Uncultivated land	375.20 (3.59)	590.00 (5.65)	487.40 (4.68)	57.24	29.90
5	Cultivable waste	450.69 (4.33)	380.90 (3.65)	265.18 (2.54)	-15.48	-41.16
6	Permanent pastures and grazing land	465.00 (4.45)	661.81 (6.33)	571.60 (5.48)	42.32	22.92
7	Area under orchard and miscellaneous use	48.88 (0.46)	78.85 (0.76)	109.69 (1.05)	61.31	124.40
8	Current fallow	420.00 (4.05)	554.00 (5.32)	650.00 (6.22)	31.90	54.76
9	Other fallow	510.23 (4.88)	623.80 (5.97)	687.00 (6.59)	22.25	34.63
10	Net sown area	5240 (50.19)	5144.00 (49.28)	5678.00 (54.38)	-1.83	8.35
11	Area sown more than once	1105.58	1024.34	946.66	-7.34	-14.37
12	Gross cropped area	6345.58	6137.40	6624.66	-3.28	4.39
13	Cropping intensity (%)	121.00	119.30	116.67	-1.40	-3.57

**(Figures in parentheses indicate percentage to total geographical area)****Source: Socio- economic Review and Statistical abstract of Nanded district (1990-91 to 2018-19)**

The permanent pastures and grazing land were increased in period II by 42.32 per cent and then declined in period III i.e., by 22.92 per cent change over the base year. The area under orchard and miscellaneous found to be increased during the study period. It was 0.46 per cent of total geographical area in period I and seen to be 1.05 per cent in period III. Current fallow and other fallow land also increased from period I to period III. Net sown area was 524000 ha in period I i.e., 50.19 per cent to total geographical area was increased to 567800 ha in period III

which was 54.38 per cent. In period II it was declined by 1.83 per cent change over base year and in period III also it was increased by 8.35 per cent change over base year.

It can be concluded from above table that the area under forest, land put to non-agricultural use and cultivable waste were decreased while permanent pastures and grazing land, net sown area, area under orchard and miscellaneous use, current and other fallow were increased during study period and barren land showed slight fluctuation.

#### 4.2 Changes in Expansion of Irrigated Area in Nanded

The information about changes in area irrigated by various sources in Nanded district is given in Table 4.2. It is observed from the table, that mostly the sources of irrigation in the district were wells, canals, surface irrigation etc. The area irrigated by wells was slightly decreased by 23.11 per cent in the year 2005-06 and then it was increased by 30.39 per cent change over base year 2018-19. Canal irrigation also showed declining trend as its area was decreased by 39.27 per cent and 2.36 per cent in year 2005-06 and 2018-19, respectively. The area under surface irrigation other than wells was decreased in year 2005-06 i.e., 28.23 per cent change over base year and then it was increased by 29.16 per cent change over base year in 2018-19. In case of net irrigated area, it was increased to 68100ha in 2018-19 from 55643ha in 1990-91 i.e., by 22.38 per cent over base year. It must be noted that, net irrigated area was declined during the year 2005-06.

**Table 4.2 Changes in area irrigated by various sources in Nanded district**

(Area in '00'ha)

Sr. No.	Particulars	Year			Percent change over base year	
		1990-91 (Base year)	2005-06	2018-19	2005-06	2018-19
1	Surface irrigation other than wells	240.00 (43.13)	172.23 (43.60)	310.00 (45.52)	-28.23	29.16
2	Well irrigation	189.43 (34.04)	145.65 (36.87)	247.00 (36.27)	-23.11	30.39
3	Canal irrigation	127.00 (22.83)	77.12 (19.53)	124.00 (18.21)	-39.27	-2.36
4	Net area irrigated	556.43 (100.00)	395.00 (100.00)	681.00 (100.00)	-29.01	22.38

(Figures in Parentheses indicates percentage to the net irrigated area)

Source: Socio economic Review and District Statistical abstract of Nanded (1990-91 to 2018-19)

The information regarding change in irrigated area in Nanded district is given in Table 4.3. The percentage of net irrigated area to net sown area was increased by 13 per cent over base year. Net irrigated area was 55600ha in base year and increased to 68100ha in 2019.

Percentage of gross irrigated area to gross cropped area was decreased in 2005-06 and then increased in 2018-19 i.e., 18.61 per cent over base year. It can be concluded from the table that net sown area, net irrigated area, gross sown area and gross cropped area were showed fluctuations over the base year.

Thus, the hypotheses state that the cultivated and irrigated area varying for last several years in Nanded district has been proved. The similar results were confirmed by Ghosh and Kumar (2010) and Krishnan (2017).

**Table 4.3 Changes in irrigated area in Nanded district**

(Area in '00'ha)

Sr. No	Particulars	Year			Percent change over base year	
		1990-91 (Base year)	2005-06	2018-19	2005-06	2018-19
1	Net Sown area	5240.00	5144.00	5678.00	-1.83	8.35
2	Net irrigated area	556.43	395.00	681.00	-29.01	22.38
3	Percentage of net irrigated area to net sown area	10.61	7.67	11.99	-27.70	13.00
4	Area sown more than once	1105.58	1024.34	946.66	-7.34	-14.37
5	Gross irrigated area	767.40	563.21	950.61	-26.60	23.87
6	Gross cropped area	6345.58	6137.40	6624.66	-3.28	4.39
7	Percentage of gross irrigated area to gross cropped area.	12.09	9.17	14.34	-24.15	18.61

Source: Socio economic Review and District Statistical abstract of Nanded (1990-91 to 2018-19)

### 4.3 Changes in the cropping pattern

The data related to changes in cropping pattern of Nanded district is presented in the given Table 4.4. The presented data revealed in table revealed the triennium averages compared between three periods of the study i.e., Period I (1990-91 to 1992-93) Period II (2003-04 to 2005-06) and period III (2016-17 to 2018-19).

It is observed from the table that, the areas under total cereals were declined over the base year. Among the different cereals, area under, paddy, *kharif* jowar, maize and others cereals were declined for the study period except wheat and *rabi* jowar. The area under *kharif* jowar was decreased and area under *rabi* jowar was increased i.e., 28.25 and 38.40 per cent over base year, respectively. Area under paddy and maize was slightly decreased. Area under total pulses decreased over base year by 17.99 per cent in period II and 14.09 per cent in period III. Area under total pulses was increased from 150390 hectares in period I to 129200 hectares in period III. Among the different pulses, the area under red gram, green gram, black gram and other

pulses were decline during the study period. But area under gram was increased from 63200ha in period I to 78000ha in base year i.e., 23.41 per cent over base year. Area under red gram, green gram and black gram was higher in period I as compared with period II and III. The area under total food grains was found to be 216567ha in period I and 194166ha in period III i.e., decreased by 10.34 per cent over the base year.

In case of oilseeds, the farmers in Nanded district have taken soybean crop on large scale. The area under soybean was increased from to 132390ha in period I to 160000ha in period III i.e., 20.85 per cent over the base year. After soybean, area under groundnut was slightly increased over the base year while area under sesamum and other oilseeds were decreased during the study period.

In Nanded district cotton crop is the major cash crop and the farmers had taken it on large scale. The area under cotton was increased from 240084ha in period I to 266600ha in period III. Area under sugarcane also increased during period III as compared to period II but it was not more than the base year. It was seen that the area under fruits and vegetables were slightly increased while area under fodder crops was decreased during the study period.

The similar results were reported by Nayak (2016).

**Table 4.4 Change in cropping pattern of Nanded district**

(Area in '00'ha)

Sr. No	Crops	Triennium average			Percent change over base year	
		Period I (1990 to 93) Base year	Period II (2003 to 06)	Period III (2016 to 19)	Period II	Period III
1	Paddy	11.04 (0.17)	10.15 (0.16)	9.21 (0.13)	-8.06	-16.57
2	Wheat	180.00 (2.83)	144.6 (2.35)	211.00 (3.18)	-19.66	17.22
3	<i>Kharif</i> Jowar	140.00 (2.20)	116.3 (1.89)	100.45 (1.51)	-16.92	-28.25
4	<i>Rabi</i> Jowar	155.34 (2.83)	190.55 (3.10)	215.00 (3.24)	22.66	38.40
5	Maize	115.00 (1.81)	90 (1.46)	84.00 (1.26)	-21.73	-26.95
6	Other cereals	60.39 (0.95)	51 (0.38)	30.00 (0.45)	-15.54	-50.32
7	<b>Total Cereals</b>	<b>661.77 (10.42)</b>	<b>602.6 (9.81)</b>	<b>649.66 (9.80)</b>	<b>-8.94</b>	<b>-1.82</b>
8	Gram	632.00 (9.95)	700 (11.40)	780.00 (11.77)	10.75	23.41
9	Red Gram	281.00 (4.42)	146.5 (2.38)	170.00 (2.56)	-47.86	-39.50

10	Green Gram	320.00 (5.04)	230.75 (3.75)	168.00 (2.53)	-27.89	-47.50
11	Black Gram	246.50 (3.88)	135.8 (2.21)	156.00 (2.35)	-44.90	-36.71
12	other pulses	24.40 (0.83)	20.17 (0.32)	18.00 (0.27)	-17.33	-26.22
<b>13</b>	<b>Total Pulses</b>	<b>1503.90</b> <b>(23.69)</b>	<b>1233.22</b> <b>(20.09)</b>	<b>1292.00</b> <b>(19.48)</b>	<b>-17.99</b>	<b>-14.09</b>
<b>14</b>	<b>Total Food grains</b>	<b>2165.67</b> <b>(34.12)</b>	<b>1835.82</b> <b>(29.91)</b>	<b>1941.66</b> <b>(29.28)</b>	<b>-15.23</b>	<b>-10.34</b>
15	Groundnut	175.64 (2.76)	119.23 (1.94)	192.00 (2.89)	-32.11	9.31
16	Soyabean	1323.90 (20.86)	1430.98 (23.31)	1600.00 (24.15)	8.08	20.85
17	Sesamum	78.94 (1.24)	48.79 (0.79)	26.00 (0.39)	-38.19	-67.06
18	Other oilseeds	14.13 (0.45)	13.64 (0.27)	11.00 (0.16)	-3.46	-22.15
<b>19</b>	<b>Total oilseeds</b>	<b>1592.61</b> <b>(25.09)</b>	<b>1612.64</b> <b>(26.27)</b>	<b>1829.00</b> <b>(27.60)</b>	<b>1.25</b>	<b>14.84</b>
20	Sugarcane	114.31 (1.80)	96.00 (1.56)	120.00 (1.81)	-16.01	4.97
21	Cotton	2400.84 (37.86)	2520.00 (41.08)	2666 (40.28)	4.96	11.04
22	Fruits and vegetables	25.46 (0.40)	30.66 (0.49)	37.00 (0.56)	20.42	45.32
23	Fodder crops	46.69 (0.73)	42.68 (0.69)	31.00 (0.47)	-8.58	-33.60
<b>24</b>	<b>Gross cropped area</b>	<b>6345.58</b> <b>(100.00)</b>	<b>6137.80</b> <b>(100.00)</b>	<b>6624.66</b> <b>(100.00)</b>	<b>-3.28</b>	<b>4.39</b>

(Figures in parentheses indicate percentage to gross cropped area)

Source: Socio- economic Review and Statistical abstract of Nanded district (1990-91 to 2018-19)

#### 4.4 Changes in production of major crops

The information related to production of major crops in Nanded district is shown in the Table 4.5.

From the table it is revealed that, production of total cereals and pulses were declined in the year 2005-06 and then increased in 2018-19 over the base year. Total food grain production was increased from 2737.42 MT in 1990-91 to 2897.69MT in 2018-19. The production of food grains was less in the year 2005-06 as compared with the base year. Production under paddy and maize were declined in the year 2018-19 while the production of wheat was increased 15.91 per cent over base year. In case of pulses such as gram and black gram, the production was increased while for other pulses such as red gram and green gram it was declined.

In case of oilseeds, the production of soyabean was increased while the production of sesamum was declined during the study period. Overall production of oilseeds was found to be increased from 3515.13MT in 1990-91 to 4096.05MT in 2018-19 i.e., 16.52 per cent change over the base year. The production of sugarcane was slightly decreased in 2005-06 and then it was increased by 12 per cent over base year, while production of cotton was tremendously increased from 1060 MT in 1990-91 to 1460.80MT in period 2018-19.

**Table 4.5 Change in Production of major crops in Nanded**

(Production in '00' MT)

Sr. No	Crops	Year			Percent change over base year	
		1990 to 91 (Base year)	2005 to 06	2018 to 19	2005-06	2018-19
1	Paddy	4.36	3.21	2.67	-26.37	-38.76
2	Wheat	446.30	350.00	517.33	-21.57	15.91
3	<i>Kharif</i> Jowar	150.66	123.19	135.00	-18.23	-10.39
4	<i>Rabi</i> Jowar	300.02	453.56	350.00	51.17	16.65
5	Maize	25.05	12.50	7.89	-50.09	-68.50
6	Other Cereals	9.78	4.33	2.45	-55.72	-74.94
<b>7</b>	<b>Total Cereals</b>	<b>936.17</b>	<b>946.79</b>	<b>1015.34</b>	<b>1.13</b>	<b>8.45</b>
8	Gram	1160.00	1043.59	1462.00	-10.03	26.03
9	Red Gram	400.00	200.00	240.00	-50.00	-40.00
10	Green Gram	128.98	90.46	62.45	-29.86	-51.58
11	Black Gram	105.20	120.61	115.30	14.64	9.60
12	Other Pulses	7.07	5.34	2.60	-24.46	-63.22
<b>13</b>	<b>Total Pulses</b>	<b>1801.25</b>	<b>1460.00</b>	<b>1882.35</b>	<b>-18.94</b>	<b>4.50</b>
<b>14</b>	<b>Total Food grains</b>	<b>2737.42</b>	<b>2406.79</b>	<b>2897.69</b>	<b>-12.07</b>	<b>5.85</b>
15	Groundnut	945.36	990.65	895.30	4.79	-5.29
16	Soyabean	2545.00	2966.00	3190.00	16.54	25.34
17	Sesamum	16.44	9.88	5.15	-39.90	-68.67
18	Other oilseeds	8.33	7.13	5.60	-14.40	-32.77
<b>19</b>	<b>Total oilseeds</b>	<b>3515.13</b>	<b>3973.66</b>	<b>4096.05</b>	<b>13.04</b>	<b>16.52</b>
20	Sugarcane	2459.72	1964.33	2754.91	-20.14	12.00
21	Cotton	1060.00	1230.00	1460.80	16.03	37.81

Source: Socio- economic Review and Statistical abstract of Nanded district (1990-91 to 2018-19)

#### 4.5 Changes in productivity of major crops

The information related to average productivity of major crops in Nanded district is shown in the Table 4.6.

The critical observation showed that productivity of some crops was increased while for some crops it was decreased. The average productivity of total cereals was increased from 1421.23 kg/ha in the year 1990-91 to 1566.98kg/ha in 2018-19. Among different crops, the average productivity of *kharif* jawar (24.88 %), gram (2.11 %), black gram (73.18 %), soybean (3.71 %) had increased over base year 1990-91.

**Table 4.6 Change in average productivity of major crops in Nanded**

(Productivity in Kg/ha)

Sr. No	Particulars	Year			Percent change over base year	
		1990 to 91 (Base year)	2005 to 06	2018 to 19	2005-06	2018-19
1	<b>Paddy</b>	394.92	316.25	289.90	-19.92	-26.59
2	Wheat	2503.66	2420.47	2464.45	-3.32	-1.56
3	<i>Kharif</i> Jowar	1076.14	1059.24	1343.95	-1.57	24.88
4	<i>Rabi</i> Jowar	1931.37	2397.11	1627.90	24.11	-15.71
5	Maize	217.82	138.88	93.92	-36.24	-56.88
6	<b>Total Cereals</b>	<b>1421.23</b>	<b>1576.50</b>	<b>1566.98</b>	<b>10.92</b>	<b>10.25</b>
7	Gram	1835.44	1490.84	1874.35	-18.77	2.11
8	Red Gram	1423.48	1365.18	1411.76	-4.09	-0.82
9	Green Gram	403.06	392.02	371.72	-2.73	-7.77
10	Black Gram	426.77	888.14	739.10	108.10	73.18
11	<b>Total Pulses</b>	<b>1197.71</b>	<b>1183.89</b>	<b>1456.92</b>	<b>-1.15</b>	<b>21.64</b>
12	<b>Total Food grains</b>	<b>1266.01</b>	<b>1255.56</b>	<b>1493.75</b>	<b>-0.82</b>	<b>17.98</b>
13	Groundnut	5382.37	8308.73	4663.02	54.36	-13.36
14	Soyabean	1922.35	2072.70	1993.75	7.82	3.71
15	Sesamum	208.25	202.50	198.07	-2.76	-4.88
16	<b>Total oilseeds</b>	<b>2207.15</b>	<b>2464.07</b>	<b>2239.50</b>	<b>11.64</b>	<b>1.46</b>
17	Sugarcane	21517.97	20461.77	22957.58	-4.90	6.69
18	Cotton	441.51	488.09	547.93	10.55	24.10

Source: Socio- economic Review and Statistical abstract of Nanded district (1990-91 to 2018-19)

The average productivity of sugarcane increased from 21517.97 kg/ha in 1990-91 to 22957.58 kg/ha in 2018-19. This happened particularly due to use of HYV's seeds and use of improved technology in agriculture. However, the overall productivity of total cereals, total pulses, total food grains and total oilseeds were increased (10.25,21.64,17.98 and 1.46 %) over the base year.

In case of pulses productivity of gram was decreased in 1990-91 and then increased in 2018-19. Productivity of red gram and green gram was decreased as compared with the base year while productivity of black gram was increased in 2005-06 and 2018-19. Productivity of total pulses was 1197.11 kg/ha in base year which was increased to 1456.92 kg/ha in 2018-19 i.e., 21.64 per cent over base year. Total food grains showed minor decline in 2005-06 and increase in 2018-19. In case of oilseeds, average productivity was increased to 2239.50 kg/ha in 2018-19 from 2207.15 kg/ha in base year but not more than in year 2005-06.

The productivity of major crops like cotton and soyabean were increased by 24.10 and 3.71 per cent over the base year, respectively.

#### **4.6 Annual compound growth rates in area, production and productivity of major crops in Nanded district**

In the previous section, an attempt has been made to study the agricultural development in terms of changes in the land use, cropping pattern, total crop production and productivity during the last 29 years in Nanded district of Maharashtra. It is believed that the process of agricultural development has pronounced effects on the productivity of agriculture and as result, higher level of agricultural production achieved per unit of available resources. In order to present an overall picture of average productivity of major crops, their relative growth rates examined. The compound growth rate interval wise as well as overall basis were computed for area, production and productivity of major crops *viz.*, paddy, wheat, *kharif* jawar, *rabi* jawar, maize, gram, red gram, green gram, black gram, groundnut, soybean, sesamum, sugarcane and cotton for 29 years from 1990-91 to 2018-19 in Nanded district. For the purpose of scientific assessment of the agricultural development, compound growth rates of the above crops were separately estimated for area, production and productivity for three different periods *viz.*, 1990-91 to 2004-05, 2005-06 to 2018-19 and 1990-91 to 2018-19.

The period wise annual compound growth rates in area, production and productivity of major crops for the period 1990-91 to 2018-19 are presented in the Table. 4.7.

At the overall period, the compound growth rates of area, production and productivity of major crops fluctuated widely during the period under consideration. The annual compound growth rates of area under total cereals were negatively significant. The production and productivity of total cereals were positive and highly significant during the study period. The per annum compound growth rates in productivity of total pulses in district have turned out to be positive over the study period. The annual compound growth rates for area and production of total oilseeds were positively significant but productivity of total oilseeds was negatively significant. The compound growth rate of production and productivity of sugarcane crop was positive and significant, but area of sugarcane was positive and non-significant. The annual

compound growth rates for area, production and productivity of cotton were positive and highly significant had increased at the growth rate of 0.38, 1.26, 0.88.

Table 4.7 Annual Compound Growth Rates in Area, Production and Productivity of major crops in Nanded district

Sr. No	Crop	Period I 1990-91 to 2004-05			Period II 2005-06 to 2018-19			Overall period (Period III) 1990-91 to 2018-19		
		A	P	Y	A	P	Y	A	P	Y
1	Paddy	-0.66 ***	-2.56 ***	-1.91 ***	-0.34 NS	-0.37 NS	-0.04 NS	-0.47 ***	-1.88 ***	-1.41 ***
2	Wheat	-1.47 ***	-2.35 ***	-0.46 ***	2.61 ***	3.59 ***	0.55 ***	0.09 NS	0.03 NS	-0.12 **
3	Kharif jowar	-1.23 ***	-1.63 ***	-0.4 ***	-1.34 ***	0.77 ***	2.15 ***	-1.17 ***	-0.33 **	0.85 ***
4	Rabi Jowar	1.3 ***	2.63 ***	1.31 ***	0.76 ***	-1.41 ***	-2.16 ***	1.37 ***	0.8 ***	-0.56 ***
5	Maize	-1.72 ***	-3.81 ***	-2.12 ***	-0.72 ***	-3.56 ***	-2.86 ***	-1.28 ***	-5.08 ***	-3.85 ***
6	Total cereals	-0.7 ***	-0.4 ***	0.03NS	0.64 ***	0.71 ***	0.08 NS	-0.14 **	0.32 ***	0.46 ***
7	Gram	0.45 ***	-0.45 NS	-0.89 ***	0.83 ***	2.49 ***	1.64 ***	0.81 ***	0.97 ***	0.16 NS
8	Red Gram	-3.73 ***	-4.17 ***	-0.46 NS	1.6 ***	1.22 ***	-0.37 NS	-2.35 ***	-1.77 ***	0.6 ***
9	Green gram	-2.55 ***	-2.72 ***	-0.18 NS	-2.54 ***	-2.97 ***	-0.45 **	-2.29 ***	-2.47 ***	-0.18 **
10	Black gram	-3.2 ***	0.12 NS	3.43 ***	1.24 ***	-0.36 NS	-1.57 ***	-1.83 ***	0.28 **	2.15 ***
11	Total pulses	-1.66 ***	-1.56 ***	0.1 NS	0.39 ***	2.18 ***	1.79 ***	-0.64 ***	0.03 NS	0.67 ***
12	Total food grains	-1.06 ***	-1.25 ***	-0.19 NS	0.65 ***	2.04 ***	1.38 ***	-0.3 ***	0.11 NS	0.41 ***
13	Groundnut	-2.14 ***	0.1 NS	2.29 ***	4.15 ***	-1.27 ***	-5.2 ***	-0.17 NS	-0.32 ***	-0.16 NS
14	Soyabean	0.53 ***	1.16 ***	0.63 ***	0.76 ***	0.28 NS	-0.48 **	0.69 ***	0.91 ***	0.22 **
15	Sesamum	-3.33 ***	-2.94 ***	0.4 NS	-5.26 ***	-4.07 ***	1.26 **	-3.99 ***	-3.72 ***	0.28 *
16	Total oilseeds	-0.02 NS	0.89 ***	0.91 ***	1.11 ***	0.38 **	-0.72 ***	0.79 ***	0.56 ***	-0.22 *
17	Sugarcane	-1.11 ***	-1.71 ***	-0.61 **	1.71 ***	2.83 ***	1.1 ***	0.08 NS	0.53 **	0.45 ***
18	Cotton	0.28 **	0.83 **	0.55 **	0.52 ***	1.55 ***	1.03 ***	0.38 ***	1.26 ***	0.88 ***

(\*\*\*, \*\*, \* indicates 1, 5, 10 percent level of significance respectively)

It indicates that area of major crops has declined due to shift in acreages under other crops during the entire period in Nanded district.

Among the different period, during the Period I, the area and production of total cereals, total pulse and total food grains were negatively significant except total oilseeds and productivity were positively significant of except total food grain. But productivity of total cereals and total pulses were positive and non-significant during the study period. Among period, the production of paddy, wheat, *kharif* jawar and maize crops has declined both by area expansion and productivity improvement in Nanded district whereas, the production of *rabi* jawar, soybean and cotton had increased due to both area expansion and productivity improvement in the district.

In the Period II the area and production of total cereals, total pulses, total food grains, total oilseeds, sugarcane and cotton had positively significantly, whereas the productivity of total pulses, total food grains, sugarcane and cotton were positive and significant except total oilseeds. The growth rate of productivity of total pulses, total food grains, sugarcane and cotton had increased significantly at the rate of 1.79, 1.38, 1.1 and 1.03 per cent per annum, respectively for the Period II. The productivity of total cereals was positive but non-significant and the productivity of total oilseeds was negatively significant during the study period.

Among the period, the performance of area, production and productivity of cotton was quite satisfactory in Period I and II in Nanded districts except other crops. The performance with regard to productivity of major crops was quite satisfactory in Period II as compared to Period I and overall period in the districts. It is interesting to note that the area of paddy has declined during all period due to shifting of area to other substitute crops.

It can be concluded from the CGR analysis of major crops in Nanded district that during the study period of 29 years, growth of major crops like cotton and soybean was satisfactory. But growth rates of minor crops like maize, paddy, red gram, green gram and sesamum was not much satisfactory. These crops need to be promoted for better agricultural production.

From the foregoing discussion it is clearly indicated that there exist wide variability in the performance of individual crops in terms of changes in their performance, total production and productivity in the district over the period under study. It indicates the progress in agriculture as compared to earlier period in Nanded district.

Thus, the hypotheses state that the growth rates in area, production and productivity of major crops are varying has been proved. These findings were similar to the findings of Acharya *et al.* (2012) and Dinesha and Sriramappa (2015).

#### 4.7 Changes in fertilizer consumption in Nanded district

Fertilizer consumption pattern in Nanded district is depicted in Table 4.8. It was observed that consumption of fertilizers was greatly increased by 80.95 per cent over base year. Total fertilizer consumption including nitrogen, phosphorous and potassium was 92534MT in the year 1990-91 which was increased to 134686MT in year 2018-19. For having better agricultural production in available resources, farmers in the district were utilizing high level of fertilizers.

**Table 4.8 Changes in fertilizer consumption in Nanded district**

(Fertilizers in 'MT')

Year	Fertilizers				Per hectare consumption
	N	P	K	Total	
1990-91 (Base year)	45236.00 (100)	28253.00 (100)	19054.00 (100)	92543.00 (100)	105.36 (100)
2005-06	37653.00 (-16.76)	18563.00 (-34.29)	10923.00 (-42.67)	67139.00 (-27.45)	112.33 (6.61)
2018-19	65230.00 (44.19)	40230.00 (42.39)	29226.00 (53.38)	134686.00 (45.53)	190.65 (80.95)

Source: Socio- economic Review and Statistical abstract of Nanded district (1990-91 to 2018-19)

(Figures in parentheses indicate percent change over base year)

#### 4.8 Changes in area under high yielding varieties in Nanded

The information regarding to area under high yielding varieties of crops like jowar, wheat and maize is given in the Table 4.9. From the table, it is revealed that area under high yielding varieties was increased from 30132ha in 1990-91 to 35456ha in 2018-19. During 2005-06, this area was decreased by 19.87 per cent over base year.

**Table 4.9 Changes in area under high yielding varieties in Nanded**

(Area in '00'ha)

Year	Jowar	Wheat	Maize	Total area
1990-91 (Base year)	160.44 (100)	90.65 (100)	50.23 (100)	301.32 (100)
2005-06	135.60 (-15.48)	79.68 (-12.10)	26.16 (-47.91)	241.44 (-19.87)
2018-19	194.21 (21.04)	140.54 (55.03)	19.81 (-60.56)	354.56 (17.66)

(Figures in parentheses indicate percent change over base year)

Source: Socio- economic Review and Statistical abstract of Nanded district (1990-91 to 2018-19)

#### 4.9 Change in agricultural workforce in Nanded

The changes in agricultural workforce of Nanded district is shown in Table 4.10. The total number of cultivators, agricultural labourers, workers of household's production and repairing were increased by 50.60 per cent over base year. According to census of 2011, rural

population was increased over base year. As agriculture is the main occupation in rural area, total agricultural workforce also increased over the base year.

**Table 4.10 Change in agricultural workforce in Nanded**

(In number)

Sr. No.	Particulars	Year			Percent change over base year	
		1990-91 (Base year)	2005-06	2018-19	2005-06	2018-19
1	Cultivators	86456	94321	145672	9.09	68.49
2	Agricultural laborer	79345	95463	125643	20.31	58.35
3	Workers of Households Production and Repairing	66234	75689	98134	14.27	48.16
4	Other	79458	82390	99667	03.68	25.43
<b>5</b>	<b>Total</b>	<b>311493</b>	<b>347863</b>	<b>469116</b>	<b>11.67</b>	<b>50.60</b>

Source: Socio economic Review and District Statistical abstract of Nanded (1990-91 to 2018-19)

#### 4.10 Changes in the use of implements and machinery in Nanded

It is observed from the table 4.11 that number of various implements such as wooden ploughs, iron ploughs, bullock carts, tractors, oil engines, electric motors, sugarcane crushers were increased during the study period. With the upcoming new modern technology, farmers were allocating their resources in order to have better utilization. They were becoming curious about the electronic machines which will reduce the manual work. It is seen from the table that, number of tractors, oil engines and electric motors were greatly increased over the base year by 76.28, 198.48 and 223.91 per cent, respectively. But still some farmers who cannot afford the machineries were found to be using wooden ploughs, iron ploughs and bullock carts.

**Table 4.11 Changes in the use of implements and machinery in Nanded**

(In number)

Year	Wooden Plough	Iron Plough	Bullock Carts	Tractors	Oil engines	Electric motors	Sugarcane Crushers
1990-91 (Base year)	45585 (100)	5158 (100)	33756 (100)	965 (100)	312 (100)	3167 (100)	230 (100)
2005-06	76905 (68.70)	9836 (90.69)	43051 (20.40)	1143 (18.44)	450 (44.23)	6345 (100.34)	458 (99.13)
2018-19	74568 (63.58)	10089 (95.59)	72348 (102.33)	2465 (155.44)	750 (76.28)	9453 (198.48)	745 (223.91)

(Figures in parentheses indicate percent change over base year)

Source: Socio economic Review and Dist. Statistical abstract of Nanded (1990-91 to 2018-19)

#### 4.11 Changes in Average Annual Rainfall

The changes in average annual rainfall of Nanded district during the study period is shown in Table 4.12. Most of cultivated area in the district comes under rainfed condition. Hence, rainfall can be considered as most important parameter affecting agricultural development. The weather of Nanded district was observed to be warm and pleasant. It can be seen from the table that, the average rainfall in the district was increased in year 2005-06 and then slightly decreased in 2018-2019. The Nanded district receives annual rainfall between 900-1300mm. The range between rainfall received was 1216mm in the year 2005-06 and 1013mm in year 2018-19.

**Table 4.12 Change in the average annual rainfall in Nanded**

<b>Period</b>	<b>Rainy days</b>	<b>Rainfall (mm)</b>	<b>Percent change over the base year</b>
1998-99 (Base year)	49	998	100.00
2005-06	58	1216	21.84
2018-19	56	1013	1.50

**Source: Socio economic Review and District Statistical abstract of Nanded (1990-91 to 2018-19)**

#### 4.12 Changes in Livestock Population

It is noted from the Table 4.13 that, the population of indigenous cows was increased by 7.86 per cent, and the bullock and calf were decline during the study period.

The exotic bullock, cows and calf were increased by 4.37, 103.83 and 9.93 per cent over base year. By looking towards population of buffaloes, it was declined over the base year. The population of sheep, goats and poultry was declined by 60.30, 8.54 and 23.20 per cent over base year. It was noted that though number of some kind of livestock slightly increased total livestock population was decreased over study period by 6.76 per cent during the study period. Number of milking cows and buffaloes was increased.

**Table 4.13 Changes in Livestock Population in Nanded district**

Year	Cattle						Buffaloes			Sheep	Goats	Total livestock	Poultry
	Indigenous			Exotic/Crossbreed			He Buffalo	She Buffalo	Calf				
	Bullock	Cows	Calf	Bullock	Cows	Calf							
1990-91 (Base year)	355781 (100)	214533 (100)	186418 (100)	1646 (100)	5777 (100)	7935 (100)	76041 (100)	55098 (100)	48568 (100)	3708 (100)	102200 (100)	1059205 (100)	1199033 (100)
1997	314538 (-11.59)	243212 (13.36)	206881 (10.97)	1765 (7.22)	4534 (-21.51)	5321 (-32.94)	65436 (-13.94)	41233 (-25.16)	39765 (-18.12)	6324 (70.75)	121780 (19.15)	1052039 (-0.67)	1345604 (12.22)
2002	283641 (-9.82)	209886 (-13.70)	175431 (-15.20)	1856 (5.15)	5437 (19.91)	6468 (21.55)	60870 (-6.97)	43210 (4.79)	40668 (2.27)	8934 (41.27)	116658 (-4.20)	955605 (-9.16)	1236786 (-8.08)
2007	264653 (-6.69)	254321 (21.17)	236640 (34.89)	1578 (-14.9)	3210 (-40.96)	4660 (-27.95)	54389 (-10.64)	39865 (-7.74)	32682 (-19.63)	5432 (-39.19)	99876 (-14.38)	997024 (4.33)	1345687 (8.80)
2012	213043 (-19.50)	274321 (7.86)	209876 (-11.31)	1647 (4.37)	6543 (103.83)	5123 (9.93)	49223 (-9.49)	45600 (14.38)	28905 (-11.55)	2156 (-60.30)	91341 (-8.54)	929604 (-6.76)	1033419 (-23.20)

(Figures in parentheses indicate percent change over base year)

Source: Socio economic Review and District Statistical abstract of Nanded (1990-91 to 2018-19)

#### 4.13 Changes in infrastructure facilities

##### 4.13.1 Change in number of Agro- based industries in Nanded

The information related to different agro based industries in the district is represent in Table 4.14.

From the table, it is seen that sugar factories, cotton mills and handicraft industries was found to be highly increased over base year by 314.28, 126.41 and 204.76 per cent, respectively. The rural population in the district worked in these industries for livelihood.

**Table 4.14 Change in number of Agro- based industries in Nanded**

(In number)

Sr. No.	Particulars	Year			Percent change over base year	
		1990-91 (Base year)	2005-06	2018-19	2005-06	2018-19
1	Sugar factories	14	36	58	157.14	314.28
2	Cotton mills	53	82	120	54.71	126.41
3	Other industries	64	49	96	-23.43	50.00
4	Handicraft industries	105	210	320	100	204.76

Source: Socio economic Review and District Statistical abstract of Nanded (1990-91 to 2018-19)

##### 4.13.2 Change in number of Warehouses and their capacity in Nanded

From the Table 4.15, revealed that the information about warehouses in Nanded district. Number of government warehouses and private warehouses were increased from 15 in 1990-91 to 57 in 2018-19 over the base year. The warehouse capacity was increased during the study period from 12234MT in 1990-91 to 24564MT in 2018-19.

**Table 4.15 Change in number of Warehouses and their capacity in Nanded**

(In number)

Sr. No.	Particulars	Year						Percent change over base year	
		1990-91 (Base year)		2005-06		2018-19		2005-06	2018-19
1	No of Warehouses	15		32		57		113.33	280.00
		<b>G</b>	<b>P</b>	<b>G</b>	<b>P</b>	<b>G</b>	<b>P</b>		
		10	5	19	13	40	17		
2	Capacity (MT)	12234		19543		24564		59.74	100.78

(G- Government warehouses, P-Private warehouses)

Source: Socio economic Review and District Statistical abstract of Nanded (1990-91 to 2018-19)

#### 4.13.3 Change in number of fair price shops and APMC's in Nanded

From the Table 4.16 depicted change in number of fair price shops and APMC's in Nanded district. Fair price shops and APMC's were found to be increased over base year. In 1990-91, there were 1694 fair price shops which was found 2065 in the year 2018-19 while the APMC's increased in number from 5 in 1990-91 to 19 in 2018-19.

**Table 4.16 Change in number of fair price shops and APMC's in Nanded**

(In number)

Sr. No.	Particulars	Year			Percent change over base year	
		1990-91 (Base year)	2005-06	2018-19	2005-06	2018-19
1	Fair Price Shops	1694	1927	2065	13.75	21.90
2	APMC's	5	10	19	100.00	280

Source: Socio economic Review and District Statistical abstract of Nanded (1990-91 to 2018-19)

#### 4.13.4 Changes in Credit disbursed through PACS in Nanded

The changes regarding disbursement of credit through PACCS in Nanded district are depicted in Table 4.17.

The credit is considered to be an important input needed by the farmer for agricultural development. Supply of credit should be time bound as it provides boost to agricultural development. Hence, an attempt was made here to know about financial strengths of the district. Credit disbursed was found to be increased during study period. It was increased by 45.27 per cent in 2005-06 while it was tremendously increased by 285.44 per cent in 2018-19. The overall picture concludes that the farmers in Nanded district are taking huge advantage of credit disbursed through PACCS.

**Table 4.17 Changes in Credit disbursed through PACCS in Nanded**

Year	Credit disbursed through PACS (in lakhs)	Per cent change over base year
1990-91 (Base year)	8574.00	-
2005-06	12456.10	45.27
2018-19	17535.98	285.44

Source: Socio economic Review and District Statistical abstract of Nanded (1990-91 to 2018-19)

#### 4.13.5 Changes in Media and Communication devices in Nanded

From the Table 4.18 it can be observed that, the media and communication device such as telephone connection and PCO/STD were declined over the base year due to increases in use of mobile devices. The use of post offices communication was increased from 215 in 1990-91 to 470 in 2018-19.

**Table 4.18 Changes in Media and Communication devices in Nanded**

(In number)

Sr. No.	Particulars	Year			Percent change over base year	
		1990-91 (Base year)	2005-06	2018-19	2005-06	2018-19
1	Telephone Connections	39614	43591	15621	10.03	-60.56
2	Post Offices	215	468	470	117.67	118.60
3	PCO/STD	505	921	150	82.37	-70.29

Source: Socio economic Review and District Statistical abstract of Nanded (1990-91 to 2018-19)

#### 4.13.6 Changes in the development of road and railway length in Nanded

The information about changes in road and railway length is representing in Table 4.19. It is seen from table that railway length was not changed from the base year 1990-91 as new railway line had not been added in the recent one. So, it was 208 km and constant during the study period. In 2005-06, length of national highway was 94 km which was increased to 848 km in 2018-19. The length of state highways was found to decreased by 24.94 due to merging with other roads. Length of major district roads was also increased during study period. Villages in the district were observed to be developed with concrete roads.

**Table 4.19 Changes in the development of road and railway length in Nanded**

(Length in Km)

Year	National Highway	Main And Other State Highway	Major District Roads	Village Roads	Other Roads	Total	Railway Length
1990-91 (Base year)	-	1271 (100)	1625 (100)	3403 (100)	793 (100)	7092 (100)	208 (100)
2005-06	94	1273 (0.10)	2517 (54.89)	4580 (134.58)	2244 (182.87)	10708 (52.98)	208
2018-19	848	953 (-24.94)	2645 (62.76)	5065 (48.83)	4813 (506.93)	11324 (59.67)	208

(Figures in parentheses indicate percent change over base year)

Source: Socio economic Review and District Statistical abstract of Nanded (1990-91 to 2018-19)

#### 4.13.7 Changes in development of educational and health facilities in Nanded

Table 4.20 shows the changes in development of educational facilities in Nanded district. There were 1861 primary schools in 1990-91 and 289 secondary schools which were increased to 3147 and 810 during year 2018-19, respectively. Colleges for higher education were also increased from 25 in 1990-91 to 117 in year 2018-19.

From Table 4.21, it was observed that during year 1990-91, number rural hospitals were 53 which increased to 160 while the number of private hospitals were increased to 110 in year 2018-19. During year 1990-91, total number of PHC's and sub PHC's was 278 which increased to 545 in year 2018-19.

**Table 4.21 Changes in development of educational facilities in Nanded**

(In '000' number)

Sr. No.	Particulars	Year			Percent change over base year	
		1990-91 (Base year)	2005-06	2018-19	2005-06	2018-19
<b>1.</b>	<b>Primary Schools (1<sup>st</sup>-8<sup>th</sup>)</b>					
1.1	Total Schools	1861	2338	3147	25.63	69.10
1.2	Students	300000	463000	496000	54.33	65.33
1.3	Teachers	6000	11000	14000	83.33	133.33
1.4	Students per teacher	50	43	36	-14	-28
<b>2.</b>	<b>Secondary Schools (9<sup>th</sup> - 12<sup>th</sup>)</b>					
2.1	Total Schools	289	410	810	41.86	180.27
2.2	Students	140000	243000	198000	73.57	41.42
2.3	Teachers	4000	6000	7000	50.00	75.00
2.4	Students per teacher	35	40	29	14.28	-17.14
<b>3</b>	<b>Higher education</b>					
3.1	Colleges	25	22	117	-12.00	368.00
3.2	Students	11000	27000	49000	145.45	345.45
3.3	Teachers	1000	1100	900	10.00	-10.00
3.4	Students per teacher	11	24	54	118.18	390.90

Source: Socio economic Review and District Statistical abstract of Nanded (1990-91 to 2018-19)

**Table 4.20 Changes in development of health facilities in Nanded**

(In number)

Sr. No.	Particulars	Year			Percent change over base year	
		1990-91 (Base year)	2005-06	2018-19	2005-06	2018-19
1.	Civil hospital	1	1	1	-	-
2.	Rural hospitals	53	98	160	84.90	201.88
3.	Private Hospitals	61	88	110	44.26	80.32
4.	Primary health centers	48	63	95	31.25	97.91
5.	Sub PHC	230	374	450	62.60	95.65
6.	Public health centers	6	9	16	50.00	166.6

Source: Socio economic Review and District Statistical abstract of Nanded (1990-91 to 2018-19)

**4.13.8 Changes in consumption of electricity in Nanded**

The changes in the consumption of electricity use in Nanded district is given in Table 4.22

The electricity use was taken in unit of ten lakhs kw.hr. and electricity use in household, agriculture and commercial sector was increased by 223.60, 38.29 and 294.27 per cent over base year, respectively. Industrial use of electricity was decreased in 2005-06 and then increased in 2018-19.

**Table 4.22 Changes in consumption of electricity in Nanded**

('10' lakh kw.hr)

Sr. No.	Particulars	Year			Percent change over base year	
		1990-91 (Base year)	2005-06	2018-19	2005-06	2018-19
1.	Household purpose	23	53	74.73	130.43	223.60
2.	Industrial use	101	113.28	286.00	12.15	183.16
3.	Agriculture use	399.14	493.00	552.00	23.51	38.29
4.	Commercial use	25.87	29.00	102.00	12.09	294.27
5.	Other	14.57	18.00	33.00	23.54	126.49
6.	<b>Total</b>	<b>627.59</b>	<b>664.00</b>	<b>1026</b>	<b>5.80</b>	<b>63.48</b>

Source: Socio economic Review and District Statistical abstract of Nanded (1990-91 to 2018-19)

#### 4.14 Factors affecting agricultural production

In the earlier part of this chapter, we have discussed about changes in land use and cropping patterns, infrastructure, annual compound growth rates in area, production and productivity of major crops, and input consumption in Nanded district. The sample mean, percentage, and proportion of specific items in the total of respective varieties were used in this analysis. However, the sort of study used for the goal had its own limits, as it was unable to determine the relative contribution of specific factors in the context of other variables impacting total agricultural development in Nanded district. In this study, multiple linear regression equation fitted to the data to know which factors are responsible for agricultural development in Nanded district.

#### Multiple Linear Regression Analysis

The results of multiple linear regression model are presented in Table 4.23. indicating the contribution of nine independent variables in development of Nanded district.

To know whether the multiple linear regression production functions were differ from each other, the Chow's 'F' test was carried out.

It is noted from table, that total agriculture production (Y) was taken as dependent variable and the nine variables in viz., percentage of gross irrigated area to gross sown area ( $X_1$ ), consumption of total fertilizers (NPK) per hectare of gross sown area in Kg ( $X_2$ ), percentage of net sown area to gross sown area ( $X_3$ ), area under HYV seeds in '00' ha ( $X_4$ ), area under commercial crops in '00' ha ( $X_5$ ), amount of loan disbursed through PACCS per year in lakh rupees ( $X_6$ ), average annual rainfall in the Nanded in mm ( $X_7$ ), area under fruits and vegetables in '00' ha ( $X_8$ ), number of milch animals in lakh ( $X_9$ ) included in production function analysis have jointly explained 97 per cent variation in the development of district in overall period and the F value was 8.86.

For overall period (1990-91 to 2018-19), coefficient of the variables viz., average annual rainfall in mm ( $X_7$ ), area under fruits and vegetables in '00' ha ( $X_8$ ), number of milch animals in lakh ( $X_9$ ) were positive and highly significant at 1 per cent level of significance. The area under commercial crops in '00' ha ( $X_5$ ) was positive and highly significant at 10 per cent level of significance. Another variable of percentage of gross irrigated area to gross sown area ( $X_1$ ), percentage of net sown area to gross sown area ( $X_3$ ), area under HYV seeds in '00' ha ( $X_4$ ) and amount of loan disbursed through PACCS per year in lakh rupees ( $X_6$ ) were positive and non-significant during the study period while the variable of consumption of total fertilizers (NPK) per hectare of gross sown area in Kg ( $X_2$ ) was negative and non-significant. It is concluded from the results that if average rainfall in the district increases by one unit, then the

total agricultural production will increase by 1.93 lakh rupees. If Area under fruits and vegetables were increased by 1 ha value the output will increase by 29.32 lakh rupees. Similarly, if we increased by Number of milch animals of one unit, the output will increase by 620.94 lakh rupees.

It is clearly indicated that the variables, area under commercial crops, average annual rainfall in the Nanded in mm ( $X_7$ ), area under fruits and vegetables in '00' ha ( $X_8$ ) and number of milch animals in lakh ( $X_9$ ) have importance in agricultural development if Nanded district.

Similar findings were recorded by Shaikh (2013) and Saleena (2017) in their study.

**Table 4.23 Results of multiple regression analysis for agricultural development in Nanded**

Sr. No.	Particulars	Overall Period 1990-91 to 2018- 19 (N=29)
1	Intercept	1622.07
2	Percentage of gross irrigated area to gross sown area ( $X_1$ )	1.0295 (178.55)
3	Consumption of total fertilizers (NPK) per hectare of gross sown area in Kg ( $X_2$ )	-5.8006 (9.4667)
4	Percentage of net sown area to gross sown area ( $X_3$ )	20.9622 (13.2366)
5	Area under HYV Seeds in 00 ha ( $X_4$ )	0.2890 (0.3110)
6	Area under commercial crops ('00' ha) (x5)	1.0078* (0.5408)
7	Amount of loan disbursed through PACCS per year in lakh rupees ( $X_6$ )	0.1459 (0.1519)
8	Average annual rainfall in the Nanded in mm ( $X_7$ )	1.9319*** (0.5246)
9	Area under fruits and vegetables in 00' ha ( $X_8$ )	29.3235*** (9.5609)
10	Number of milch animals in lakh ( $X_9$ )	620.9431*** (195.7962)
11	<b>R<sup>2</sup></b>	<b>0.9790</b>
12	F value	8.86

(Figures in parentheses are standard errors of respective regression coefficients)

(\*\*\*, \*\*, \* indicates 1, 5, 10 percent level of significance respectively)

**4.15 Problems in Development of Agriculture in Nanded**

Scanning of various literatures published by state and district Government, following obstacles were identified

1. The area under forest is smaller than the district's total gross cultivated area.
2. The area irrigated has been slightly enlarged, but not to the degree that is required. As a result, this can be viewed as a stumbling block on the road to agricultural modernization.
3. Agro based industries are not to the extent which are needed for better agricultural development.
4. Farmers are still utilizing traditional implements for sowing, ploughing and harvesting.

**4.16 Suitable measures to overcome the problems in agricultural development**

1. Because Nanded is a rain-fed district, the government should implement a large-scale social forestry programme to increase the district's forest area. This would also ensure that the district receives consistent and adequate rainfall.
2. Water storage structures, such as nala bunding, counter bunding, bench terraces, dams, and so on, are built to store rainwater. This will allow Nanded district to enhance its net sown area by delivering water during times of scarcity.
3. The law governing the digging of wells should be strictly enforced. The ground water table will be preserved for irrigation purposes as a result of this.
4. Use of modern irrigation techniques such as sprinklers and drip irrigation to make efficient use of available water. This improves water efficiency per acre while also helping to boost agricultural output.
5. Schedule farm visits for farmers in the developed region, as well as agricultural demonstrations for farmers so that they will gain knowledge about new modern technologies, implements and machineries.
6. Social forestry program should be implemented on large scale to increase the area under forest and sustain the environmental balance.

## 5. SUMMARY AND CONCLUSIONS

Agricultural development is a critical component of a country's economic growth. It has already contributed significantly to the advanced countries' economic growth. Given that India is primarily an agricultural and overpopulated country, increasing agricultural output and productivity would contribute significantly to the country's total economic growth.

Agriculture is India's most important economic activity, accounting for 17.32% of GDP in 2018-19, providing jobs to both literate and illiterate people, and contributing to exports. Agriculture continues to play a significant part in India's economic development as a food provider, an employment of around two-thirds of the workforce, and a source of purchasing power for much of the economy's non-agricultural consumer products and services. As a result, high agricultural expansion is now regarded as a necessary condition for India's economy to flourish and develop appropriately. During the post-independence period, the agricultural sector, on the other hand, has had a mixed record.

Nanded district in eastern Maharashtra is one of the most advanced districts in terms of agricultural development. The focus of the research was on the trend in land use and cropping patterns, growth rates of main crops, infrastructure development, and identification of major determinants influencing agricultural production. During the green revolution, changes in acreage, yield, and productivity of important crops due to the application of modern technologies were also investigated. In view of this, the present study “Economic Appraisal of Agricultural Development in Nanded District of Maharashtra” has under taken with following objectives.

- a. To study the changes in land use and cropping pattern.
- b. To estimate the growth rates of area, production and productivity of major crops.
- c. To study the changes in infrastructural development in agriculture.
- d. To assess the factors responsible for agricultural development.
- e. To identify the problem in agricultural development and suggest suitable measures.

The current study is based on secondary data on various aspects of agricultural development from 1990-91 to 2018-19, a period of 29 years, including land use patterns, cropping patterns, area, production and productivity of major crops, inputs such as fertilisers, HYV seeds, implements, livestock population in district, agricultural machinery, and so on. The information was gathered from the Nanded Socio-Economic Review and District Statistical Abstract, Economic Survey Reports, Mahatma Phule Krishi Vidyapeeth, Rahuri library, and the Departmental database.

Land usage, cropping patterns, and input consumption were analysed for 29 years, beginning in 1990-91 and ending in 2018-19, by estimating proportions to the corresponding

base year at the selected points in time. The impact of agricultural development on agricultural production has been assessed by estimating annual compound growth rates of area, production, and productivity of crops such as paddy, jowar, bajra, maize, wheat, total cereals, gramme, tur, mung, urid, total pulses, total food grains, groundnut, sunflower, safflower, total oilseeds, sugarcane, and cotton in Nanded district for three periods, namely Period I (1990-91 to 2004-05), Period II (2005-06 to 2018-19) and Overall period (1990-91 to 2018 -19).

The multiple linear regression equation was fitted for data from 1990-91 to 2018-19 to investigate the functional relationship between the aggregate value of crop output in lakhs of rupees in Nanded district as the dependent variable and nine independent variables, including the percentage of gross irrigated area to gross sown area ( $X_1$ ), consumption of total fertilisers (NPK) per hectare ( $X_2$ ), and the percentage of gross irrigated area to gross sown area ( $X_3$ ) area of HYV seeds ('00' ha) ( $X_4$ ), area under commercial crops (00'ha) ( $X_5$ ), amount of loan (short-term and medium-term) loan disbursed through PACS per year ( in lakh rupees) ( $X_6$ ) average annual rain fall in the Nanded (mm) ( $X_7$ ), area under fruits and vegetable crops ('00'ha) ( $X_8$ ), number of milch animals (in lakh number) ( $X_9$ ).

### Summary of findings

1. A thorough examination of changes in land use patterns in Nanded district revealed that area under forest had decreased by 33.33 per cent during the study period. Over a 29-year period, the area under barren and uncultivated land increasing from 3.59 to 4.68 per cent of geographical area. During the study period, the area under cultivable waste land decreased from 4.33 to 2.54 per cent of the overall geographical area.
2. The net sown area of Nanded district had increased by 8.35 per cent over the base period of 1990-91 to 2019 over the last 29 years. Over the base period, the gross cropped area had expanded by 4.39 per cent. In 1990-91, the districts net irrigated area was 55643ha which was declined to 39500ha in 2005-06, a 29.01 per cent decline and then increased to 68100ha 2018-19, 22.38 per cent growth over the base period.
3. The percentage of surface irrigation other than wells to the net irrigated area in Nanded district had increased from 43.13 to 45.52 per cent during 29 years. The actual area irrigated by wells increased form 18943ha in 1990-91 to 24700ha in 2018-19.
4. In comparison to other crops in Nanded district cotton and soyabean are the most prominent in cropping patterns over the study period. The area under total cereals and pulses declined while the area under total oilseeds increased over the last 29 years. It was noticed that area under *rabi* jowar increased from 15534ha to 21500ha since the base year. Area under paddy greatly declined by 16.57 per cent over the base year. Area under gram also increased by 23.41

per cent over base year. Area under total food grains was decreased by 15.23 per cent and 10.34 per cent in period II and period III, respectively over the base year. But area under total oilseeds was found to be increased from 159261ha in 1990-91 to 182900ha in 2018-19. Area under sugarcane was shown decrease in period II and then increase 4.97 per cent in period III. Area under cotton was greatly increased from 240084ha to 266600ha over the base year.

5. In terms of major crop production, it was discovered that wheat and *rabi* jowar production had increased while that of paddy and maize decreased during the study period. Total cereal production increased by 8.45 per cent compared to the base year. During the study period, the production of red gram and green gram reduced. In case of pulses, production of groundnut and soyabean increased. Cotton and sugarcane production also increased from the base year.

6. The productivity of paddy, wheat, maize, red gram, green gram, groundnut and sesamum declined while the productivity of *kharif* jowar, gram, black gram, soyabean, cotton and sugarcane increased over the base year. During the last 29 years, the average productivity of soyabean and cotton was greatly increased by 3.71 and 24.10 per cent. The productivity of paddy, maize and groundnut was significantly decreased by 26.59, 15.71 and 13.26 per cent over the base year.

7. The period wise compound growth rates of area, production and productivity of major crops in Nanded district were calculated. Growth rates indicated that area, production and productivity of paddy decreased significantly during the period under study. The total cereals had negative growth rate in area at 0.14 per cent while the production and productivity experienced positive growth rate of 0.32 and 0.46 per cent per annum, respectively. The area under pulses showed negative growth rate of 0.64, production showed non-significant increase while the productivity was found positive at the rate of 0.67 per cent per annum. Over the study period, growth rates of area and production of total oilseeds were increased by 0.79 and 0.56 per cent, respectively. But productivity showed declining growth rate of 0.22 per cent per annum. Area under sugarcane showed negative growth rate in period I while positive growth rate in period II. The area, production and productivity of cotton showed positive growth rate over the research period.

8. The overall consumption of fertilizers (NPK) in Nanded district was 92543MT in 1990-91 rising to 134686MT in 2018-19, per hectare of gross area sown indicated that consumption of NPK rose during the study period.

9. Over the base year of 1990-91, the adoption of high yielding varieties of jowar and wheat increased in 2018-19. But area under HYV's of maize has declined significantly, from 5023ha in 1990-91 to 1981ha in 2018-19.

10. Over the base year 1990-91, there was a massive increase in tractors, electric motors and sugarcane crushers. Throughout the period number of wooden ploughs, iron ploughs and bullock carts slightly raised. The reason was that most of the farmers in district are small and marginal farmers who cannot afford tractors and machineries for cultivation. They still continued to use traditional implements.

11. Throughout the study period of 29 years, annual rainfall shown slight variations. The total annual rainfall increased in the year 2005-06 and then slightly decreased in year 2018-19.

12. The number of indigenous and exotic cows and she buffaloes increased while the number of bullocks, he buffaloes, sheep, goats and poultry were decreased during the study period. It was noticed that increase in number of milking animals lead to increase in milk production of the district.

13. In Nanded district, credit distribution through PACS has climbed from 8574 lakhs in 1990-91 to 175335.98 lakhs in 2018-19. Throughout the research, PACS continued to raise the amount of money it loaned out.

14. Over the entire period, the length of national highways, major district roads, and village roads had expanded significantly. Throughout the research period, the length of the train line remained constant. Over the base year of 1990-91, the total road length has expanded by 61.52 per cent.

15. The nine resource variables included in the model described jointly 97 per cent variation in value of aggregate crop production in Nanded district, according to a careful study of multiple linear regression analysis for agricultural development in Nanded district. During the study period, regression coefficients of variable such as area under commercial crops in '00'ha ( $X_5$ ) were significant at 10 per cent level of significance while that of average annual rainfall in the Nanded in mm ( $X_7$ ), area under fruits and vegetables in '00' ha ( $X_8$ ) and number of milch animals in lakh ( $X_9$ ) were significant at 1 per cent level of significance.

16. Reduced area under forest, rainfall, total food grains, increase in barren and uncultivated land, extensive use of chemical fertilizers are some major problems in agricultural development in Nanded district. While the implementation of social forestry program, water harvesting, use of

modern technology, extension programs on improved farming, multiple cropping etc. are some of the measures to tackle the problems in district.

### **Conclusions**

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

1. For the study period, the area under forest declined by 33.33 per cent during the period under study in Nanded district. The area cultivable land had also declined and permanent pasture and grazing land along with orchard and miscellaneous were increased during study period.
2. The area under uncultivable waste land had increased from 3.59 per cent to 4.68 per cent of total geographical area in study period. The gross cropped area increased by 4.39 per cent over base year. The net sown area was increased but cropping intensity was declined during the research period.
3. The area under irrigation found to be significantly increased. In the year 1990-91 gross irrigated area was 76740 hectares which had increased to 95061 hectares in year 2018-19. The net irrigated area was also increased by 22.38 per cent during entire period under study.
4. The results revealed that area, production and productivity of major crops i.e., soyabean and cotton had increased during the study period and other crops showed variations in compound growth rates.
5. The tremendous increase in credit disbursement reveals that the farmers of Nanded district was taking advantage of institutional finance to fulfil financial needs.
6. The results of multiple linear regression analysis indicates that the factors viz., average annual rainfall in mm( $X_7$ ), area under fruits and vegetables ( $X_8$ ) and number of milch animals in lakh( $X_9$ ) had positive association in increasing value of aggregate crop output of Nanded district during study period.

### **Suggestions**

1. The irrigated area is slightly increased, thus the irrigation development in the district should be given top priority. As most of the district's land comes under the rainfed area therefore, there is a need to increase the irrigation projects.
2. Extension programs for farmers should be conducted so that they will become aware of new modern technologies.

## 6.LITERATURE CITED

- Acharya, S. P., Basvaraja, H., Kunnal, L. B., Mahajanashetti, S.B. and Bhat, A.R. 2012. Growth in area, production and productivity of major crops in Karnataka. *Karnataka Journal of Agricultural Sciences*, 25 (4): 431-436.
- Ahmed, I., Azam A. and Aziz B., 2016. Rural infrastructural development and it's role in poverty reduction: Evidence from Pakistan. *Pakistan Journal of Applied Economics: Special Issue*: 3(4): 185-204.
- Ali, J., 2007. Livestock Sector Development and Implications for Rural Poverty Alleviation in India. *Livestock Research for Rural Development*, 19(2): 1-15.
- Anonymous,2016, <http://en.m.wikipedia.org>.
- Anonymous,2019. Agricultural statistics at a glance.
- Anonymous,2019. Economic survey of Maharashtra.
- Anonymous,2019.Nanded district statistics at a glance.
- Bairwa., K. C, Varadan R. J., Jhahria A. and Meena, D. K. 2013. An economic appraisal of livestock sector in India. *Indian Journal of Animal Research*, 47(2) : 105-112.
- Basnet, S. K., 2006. An economic appraisal of agricultural development in Nepal. Unpublished M. Sc.(Agri) Thesis submitted to M.P.K.V., Rahuri,
- Bhatt, K., 2012. An Economic appraisal of agricultural development in Himachal Unpublished M.Sc.(Agri) thesis submitted to MPKV., Rahuri.
- Bissa, G. and Vyas V., 2014. Study of infrastructural status in agriculturalmarketing. *Indian Journal of Research*, 4(1): 90.
- Borthakur, A and Singh P., 2012. Agricultural research in India: An exploratory study. *International Journal of Social Science and Interdisciplinary Research*,1(9): 2277-3630.
- Chandrachud, S. and Gajalakshmi N., 2015. Impact of infrastructure development on Indian agricultural growth (prospects and perspectives). *Indian Journal of Applied Research*, 5(4):23-35.
- Choudhary, M. G., 1994. Transformation of agriculture, Food self-sufficiency and prospects for surpluses: The case of South Asia. *Contemporary South Asia*, 3 (1) : 37-52.
- Denholm, J., Jodh N.S. and Pratap T., 1992. Agroforestry an option for mountain agricultural development. In : Jodha, N. S. and Bonshota, M. (Eds.), sustainable mountain agriculture : Farmer's strategies and innovative approaches, 2: 773-790.

- Dhakre, D.S and Sharma A., 2010. Growth analysis of area, production and productivity of maize in Nagaland. *Agricultural Science Digest*, 30(2): 142-144.
- Dinesha, M. V. and Srirramappa, K. E., 2015. Growth in Area, production and productivity of vegetables and fruits in India with special reference to Karnataka. *International Journal of Applied Research*, 1(8): 288-293.
- Doke, A. B., 2017. Land use/cover mapping of Konkan region, Maharashtra. *International Journal of Current Research Review*, 9(10): 1-4.
- Gaddi, G. M. and Kunal, L. B., 1996. Source of output growth in new milk production technology and some implications to return on research investment. *Indian Journal of Agri. Economics*, 51 (3): 89-395.
- Gaikwad, D. N., 2018. Economic analysis of Maharashtra agricultural growth and development. Unpublished Ph.D. (Agri.) thesis submitted to M.P.K.V., Rahuri.
- Ghosh, B. K., 2010. Growth and variability in the production of crops in West Bengal, India. *Trench in Agricultural Economics*, 3(3): 135-146.
- Ghosh, S. and Kumar A., 2010. Performance of irrigation and agricultural sector in Orissa. *Indian Research Journal of Extension Education*, 10(2): 36-38.
- Gill, S. S., 2002. Rapporteur's report on institutional reforms for agricultural growth. *Indian J. of Agril. Econ.*, 57(3) : 637-652.
- Goswami, S. N., 1996. Policy implications and recommendations. Economic appraisal of indigenous fall farming systems in West Garo hills district, Meghalaya (V), pp.60-62.
- Jaypatre, G. S., Patel, K. S., Gajbhiye, S.B. and Awaghad, P.R., 2010. Performance of mango in South Gujrat region. *Agriculture Updates*, 5(3): 480-482.
- Jodha, N. S., 1996. Sustainable mountain agriculture: Some predictions in : S.L. Shafi ed. *Agricultural development in Hilly Areas*. Indian Society of Agricultural Economics, Bombay, 7-17.
- Johnson, D., 2018. Cropping Pattern Changes in Kerala, 1956-57 to 2016-17. *Review of Agrarian Studies*, 8(1): 65-99.
- Kalaskar, P. S., 2015. Economic appraisal of agriculture development in Yavatmal district of Maharashtra. Unpublished M.Sc. (Agri). Thesis submitted to MPKV., Rahuri (MS).
- Korem, S., Gowda, D. M. and Rajashekar K., 2018. Analysis of growth rates in area, production and productivity of rice crop in Telangana state. *International Journal of Chemical Studies*, 6(3) : 283-286.
- Krishnan, S., 2017. Micro analysis on changes in land use and cropping pattern in TamilNadu. *American Journal of Information Management*, 2(2) : 30-36.

- Kumar D. S. and Palanisami K., 2010. Impact of drip irrigation on farming system : evidence from Southern India. *Agricultural Economic Research Review*, 23 (2).
- Kumar, P., Mrothyunjaya and Birthal P. S., 2003. Changing consumption pattern in South Asia. Paper presented at FICCI-ICRISAT-IFPRI, International workshop on “Agril. Diversification and vertical integration in South Asia”, New Deilhi.
- Lokesha, M. N and Mahesha M., 2016. Impact of road infrastructure on agricultural development and rural road infrastructure development programmes in India. *International Journal of Humanities and Social Science Invention*, 5(4):01-07.
- Malik, S., 2017. Identifying Trends in Land-use/Land-cover Changes in Hisar Tehsil: A LCM Based Approach. *Journal of Remote Sensing and GIS*, 8(1) : 18-22.
- Mangalagowri, B. and Nagaraj H., 2017. Changing pattern of land use and its impact on agriculture: A case study of Mysore district. *Scholarly Research Journal for Interdisciplinary Studies*, 4 (37): 8569-8586
- Nayak, D. K., 2016. Changing pattern, agricultural diversification and productivity in Odisha- A district wise study. *Agricultural Economics Research Review*, 29(1): 93-104.
- Pandey, G. and Ranganathan T., 2018. Changing land-use pattern in India: has there been an expansion of fallow lands. *Agricultural Economics Research Review*, 31(1):113-122.
- Parmar, P., 2019. Economic Appraisal of Agricultural Development in Raigad District of Maharashtra. Unpublished M.Sc. (Agri.) Thesis submitted to M.P.K.V., Rahuri (MS).
- Prajapati, T., 2017. Rural infrastructure, availability and it’s impact on wellbeing with special reference to Uttar Pradesh. *International Journal for Innovative Research in Multidisciplinary Field*, 3(6) : 128-131.
- Raypure, P. G., 2016. Economic appraisal of agricultural development in Gadchiroli district of Maharashtra. Unpublished M.Sc. (Agri.) Thesis submitted to M.P.K.V., Rahuri (MS).
- Reij, C.P. and Smalling, E. M. A., 2008. Analyzing successes in agriculture and land management in Sub- Sahara Africa. *Land Use Policy*, 25: 410-420.
- Rejula, K and Singh, R., 2015. An analysis of changing land use pattern and cropping pattern in a scenario of increasing food insecurity in Kerala state. *Economic Affairs*,60(1): 123-129.
- Saika, A., 2006. Present statue, potentials, problems and strategies for agricultural development in North-Eastern states. *Indian J. of Agricultural Economics*, Vol. 61: 343.

- Saleena, E. C., 2017. Performance appraisal of Indian agricultural system with special reference to agricultural scenario in the state of Kerala. *IOSR Journal of Business and Management*, 19(10): 5-11.
- Shaikh, M. M., 2013. Economic appraisal of agricultural development in Andhra Pradesh Unpublished M.Sc. (Agri.) Thesis submitted to MPKV, Rahuri (MS).
- Sharma H., Burark S. S., 2021. Some aspects of agriculture and marketing development in Rajasthan. *Indian J. of Agril. Marketing*, 35(2).
- Shrivastava, S. K., Sivaramane, N. and Mathur, V. C., 2010. Diagnosis of pulses performance of India. *Agricultural Economics Research Review*, 23(1):56-65.
- Singla, A., Ahuja, I.S. and Sethi, A.P.S., 2018. Technology push and demand pull practices for achieving sustainable development in manufacturing industries. *Journal of Manufacturing Technology Management*, 29(2):240-272.
- Sreedhar, A., Nagaraju and Gurram, M. K., 2016. An Appraisal of land use and land cover change scenario of Tummalapalle, Cuddapah region, India- A remote sensing and GIS perspective. *Scientific Research Publishing*, 5: 232-245.
- Yadav, R., (1990). Mountain agriculture and crop genetic resources. In: Riley, K. W., Maleo, N. and Hawtin, G. C. (Eds.). *Aspect publishing*, London, U. K. 330.