A GEOGRAPHICAL STUDY OF AGRICULTURAL LANDUSE PATTERN IN SHIRUR TAHSIL, PUNE DISTRICT, MAHARASHTRA STATE BY USING GIS AND REMOTE SENSING TECHNIQUES

A Thesis Submitted to

Tilak Maharashtra Vidyapeeth, Pune

For the Degree of Doctor of Philosophy (Ph. D.)

In

GEOGRAPHY

Under the Faculty of Moral, Social and Earth Sciences

Submitted By

MR. KALE NILESH ASHOK

Under the Guidance of

DR. AHER ANKUSH BHAGUJI

February – 2016

CERTIFICATE

This is to certify that the thesis entitled**, "A GEOGRAPHICAL STUDY OF AGRICULTURAL LANDUSE PATTERN IN SHIRUR TAHSIL, PUNE DISTRICT, MAHARASHTRA STATE BY USING GIS AND REMOTE SENSING TECHNIQUES"** Which is being submitted herewith for the award of the Degree of Vidyavachaspati (Ph. D.) in Geography of Tilak Maharashtra Vidyapeeth, Pune is the result of original research work completed by **Mr. Nilesh Ashok Kale** under my supervision and guidance. To the best of my knowledge and belief the work incorporated in this thesis has not formed the basis for the award of any Degree or similar title of this or any other University or examining body.

Place: Pune **Dr. Aher Ankush Bhaguji**

Date: **Research Guide**

Principal
Savitribai College of Arts,
Pimpalgaon Pisa, Shrigonda, Ahmednagar.

DECLARATION

I hereby declare that the thesis entitled "A GEOGRAPHICAL STUDY OF AGRICULTURAL LANDUSE PATTERN IN SHIRUR TAHSIL, PUNE DISTRICT, MAHARASHTRA STATE BY USING GIS AND REMOTE SENSING TECHNIQUES" is the original research work carried out by me under the guidance of Principal Dr. A.B. Aher for the award of Ph.D. degree in Geography to the Tilak Maharashtra Vidyapeeth, Pune. This has been not submitted previously for the award of any degree or diploma in any other university.

Place: ***Pune*** ***Mr. Nilesh Ashok Kale***
Date: ***Research Student***

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Mr. Nilesh Ashok Kale

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ABSTRACT

Agriculture is the backbone of Indian economy. And it is most important of all the economic activities of man. Agriculture is related to domesticated plants and animals as activity to satisfy man's needs. Nowadays agriculture has become the world's most important industry. Agricultural geography has thus become a unique branch of geography in which the physical environment and man's response to it have become cardinal points of research and regionalization. The human being has been modifying land to obtain food and other essentials from thousands of years. Landuse and Landcover changes are far greater than ever in history deriving unprecedented changes in ecosystem and environmental processes at local, regional and global levels. These changes encompass the environmental concerns of human population, climate change, biodiversity loss and the water, soils and airpollution.

This study is concerned with theA Geographical Study of Agricultural landuse Pattern in Shirur Tahsil, Pune district and Maharashtra State by using GIS and Remote Sensing Techniques. to assess and analyses geographically, to describe and interpret the patterns of agricultural land use in a selected area. Thus, the study of agricultural pattern and its spatial variation form the central idea of the study. With respect to investigations certain physical and socio-economic variables involved in landuse patterns provide proper results landuse. This is useful in result demand of food for increasing population and describing and interpreting the variation in agricultural landuse patterns with crop combination, crop diversification, and agriculture region

The expansion of agriculture areas, double cropping of existing farm lands, using High Yielding Varieties of seeds are the three basic elements of the Green Revolution. During the five year plans, more emphasis was given to bring more and more area under agriculture and increasing per hectare yield. Even then the process of agricultural growth has not been properly channelized due to imbalanced distribution of resources such as physical, socio-economic conditions in different regions. The present study is on a Geographical study of agricultural land use pattern in Shirur Tahsil. The choice and topic under investigation is influenced by many considerations. Shirur Tahsil is my homeland. I am interested to do some work for my region. I think this is a good opportunity for me to investigate some new things for the community where I was born and where I am on the way of progress. Agriculture continues to sustain millions of people in India. Agriculture has always occupied an

important place in Indian economy. There are some considerations regarding choice of the study area. Firstly, the study area lies in rain-shadow zone of Deccan trap of Maharashtra and prone to drought. Secondly, the land use pattern of Shirur Tahsil is poor and needs to be improved. Thirdly, in this region irrigation facilities are not sufficient and should be improved. And lastly, the study region has well potentials of agricultural growth**.** All these considerations have led to the choice of Shirur Tahsil as the region for this study in order to understand the agricultural land use of the region in a time-space perspective.

The Shirur Tahsil comprises of 117 villages and one urban center. Spread over1552 Square kms. The absolute geographical location of study area can be expressed as from 18º 49'. N. to 19º 34' N. latitude and74º 22' E. to 75º 03 E. longitude. ShirurCity is located on the boundaries of the Pune and Ahmednagar districts on the bank of the River Ghod. The area of Shirur Tahsil extent from north to south 24 kms and 50 kms from east to west. Agriculture is the main occupation of this region. The most commonly grown crop is Bajara and vegetables like, tomato, onion, sugarcane, etc. Tribes are found in big number in this region. The study area shows low rainfall with high variability. Average rainfall in the district is 600mm to 700 mm. This is usually during the monsoon season from July - October. Moderate temperature is mainly observed here. The rainfall is usually unpredictable in June with the Indian monsoon. Summers here begin from early March to July. and are dry and hot. The temperature ranges from 20°C to 38°C, though at the peak, they may reach 40°C.

The present study of A Geographical Study of Agricultural land use Pattern in Shirur tahsil by evaluating following objectives:

Objective:

1. To study the physiographic profiles of the study area
2. To study the land use and land cover and Agricultural pattern
3. To analyses the changes in the levels of Agricultural Development in the villages between 2001 and 2011
4. To collect the information for all the objective using village base level
5. To delineate agricultural regions of study region
6. To prepare the plan for proper land use planning for study region

The present study is based on primary and secondary sources. The published sources, namely, Tahsil Socio-economic Abstract, District Census Handbook, Department of Irrigation, and Tahsil Land Record Office have been used in present study. Primary data has been obtained from eight sample villages through questionnaires. The data for general landuse and agricultural land use have been taken for the years. The questions in questionnaires are consists of crop land use, farmers' caste structure, income from various sources and problems regarding agriculture and allied sectors. Besides this, information from Talathi, Gramsevak and Sarpanch were gathered. The obtained data is then transferred in to and graphs for showing land use pattern. For delineating crop region, the present study has been arranged into seven chapters.

The opening chapter put forth objectives of study, review of literature, data sources, methodology of the study.

The chapter second has attempted to present the background of study area with respect to location, physiography, climate, geology, soil, and natural vegetation, transportation to weekly market, occupation and socio-economic profile of the population.

The chapter three has unfolded the general land use land cover of study area. In this study, an attempt has been made to study the changes in land use and land cover in Shirur Tahsil over the span of 13 years from 2001 and 2013. The study has been done through remote sensing approach using three time series data. The findings revealed that the study area experienced drastic change in land use and land cover during 2001 to 2013. The Tahsil was classified using Supervise classification Technique in to six land use and land cover classes:Water body, Vegetation, Cropland, Fallow land, Baran land and Settlement in study region.

The chapter four has assessed the agricultural landuse pattern of 12 selected crops both spatial and temporal variations in study area. The chapter five has studied crop region, by applying techniques like crop ranking, crop combination, crop diversification. The present study Random sample has used for selected eight villages in a four circle include for the village information system in Shirur Tahsil. In the present study, random samples were taken from eight villages in four circles in Shirur Tahsil. These villages were chosen on the basis of circle in the specific tahsil. These villages are from entire Shirur Tahsil. The present work also studied caste wise population of the villages. It also studied the land irrigated and unirrigated area in the

villages. In these villages, most of the farmers give priority to cash crops. Various type of crops are taken in this villages. Sugarcane crop is cover most dominant of crop area, after that onion ranks the second crop. Bajara, jawar, groundnut, crops cover area were found in this region. Irrigation facility in villages is more dominant. In these villages Lift Irrigation, well, canals and Tub well irrigation facilities are found in these villages.

The chapter seventh has summarized the results. This last summarizes the summary of chapters and findings have been given. The suggestions of better landuse study have put forth in present study.

CHAPTER - I

INTRODUCTION

INTRODUCTION

1.1 General Introduction:

Agriculture is considered as the most important of all the economic activities of man. Agriculture is related to domesticated plants and animals as activity to satisfy man's needs. Nowadays agriculture has become the world's most important industry.

Agricultural geography has thus become a unique branch of geography in which the physical environment and man's response to it have become cardinal points of research and regionalization.

Agriculture is one of the oldest economic activities of man. Demand for food will further increase in the 21st century (Dyson, 1999; Johnson, 1999; Rose grant et al., 2001and FAO, 2003) which can only be met through increase in production area or in the amount of production per unit land area, henceforth ''productivity''. However, limited available land, expansion of other land use types and environmental sustainability issues restrict further extension of agricultural land in large parts of the world. In fact, agricultural land use in Europe has declined over the last four decades by about 13percent (Roosevelt et al., 2003). At the same time, crop productivity has increased considerably and food production even exceeded demand for food. Further increase in the productivity of crops are likely to have substantial implications for agricultural land use.

Agriculture is the largest private enterprise in India, has been and will continue to be the lifeline of the Indian economy, at least the foreseeable future. It contributes nearly 17percent to the national GDP (Gross Domestic Product), sustains livelihood of about two-thirds of the population, accounts for 52 percent of the national work force and forms the backbone of the agro-based industry. Besides, agriculture is a social sector where non-trading concerns like food and nutritional security, employment and income generation, poverty, alleviation, gender equity, ecology and environment plays a significant role.

Agriculture sector occupies a key position in the Indian economy. It provides employment for nearly 64 percent of the working population of India. Around one third of India's national income origin from the agricultural sector. Agriculture was developed at least 10,000 years ago, and it has undergone significant development since the time of the earliest cultivation. Independent development of agriculture occurred in northern and southern China, Africa's Sahel, New Guinea and several regions of

America. Agriculture was practiced around 7000 BC in the basin of the rivers Tigris and Euphrates in Iraq and in parts of the Indus Valley as well.

Agricultural practices such as irrigation, crop rotation, fertilizers, and pesticides were developed long ago but have made great strides in the past century. The Haber-Bosch method for synthesizing ammonium nitrate represented a major breakthrough and allowed crop yields to overcome previous constraints. In the past century, agriculture has been characterized by enhanced productivity, the substitution of labour for synthetic fertilizers and pesticides, selective breeding, mechanization, water pollution, and farm subsidies. In recent years, there has been a backlash against the external environmental effects of conventional agriculture, resulting in the organic movement.

The farm productivity and production levels were quite low and import of food grains was a compulsion to meet the domestic needs of food items. At the time of India's independence, the first and the foremost challenge was to overcome food shortages through enhancement in domestic agricultural production and minimum dependence on food imports. "Everything else may wait but not agriculture."- these words of Pandit Jawaharlal Nehru, our first Prime Minister, bear ample testimony to the concerns of our national leadership towards strengthening agriculture. These were made possible by providing farmers with sound scientific knowledge, technology and improved inputs to enhance farm productivity. High priority was accorded towards developing national capacity wherein along with infrastructure a far greater role of agricultural research and education was realized and emphasized.

In 1950-51 in Maharashtra the area under food grains cultivation was 97.32percent of which only 18percent was irrigated, the productivity and production stood at 522 kg per hector and 51 million tons respectively The population was 361.1 million with modest growth rate of 1.25percent. Then day by day the momentum of building and strengthening the infrastructure was sustained to develop an effective agricultural research and education system in the country. The Indian NARS (National Affordability Rental Scheme) has developed more than 3300 improved varieties of various field crops, and over 700 varieties in horticultural crops. The five year plan scheme gave importance of the agricultural development. Agriculture is also the source of raw material for agro based industries including textiles, tobacco products, jute, sugar, paper, processed food, pulses, rice, dal mill, biscuits, bakery milk, dry fruits, jam, jelly, sweet oil and vegetation. Moreover, agricultural sector provides market for capital

goods i.e. tractors, electric material, pump sets and other agricultural machinery, inputs chemical fertilizers, pesticides and light consumer goods. The nation has invested huge resources for the development of the agricultural under various plants.

Agriculture has always been India's most important economic sector. In the mid of 1990, it provided approximately one third of the GDP and employed roughly two third of the population. Agriculture production has kept pace with the food needs of the growing population as the result of increased yields in almost all crops, but especially in cereals. The growth in food grain production is a result of concentrated efforts to increase all the Green Revolution inputs needed for higher yields, better seeds, right proportion fertilizer, improved irrigation and education of farmers. After the independence in 1947, the cropping pattern became more diversified and cultivation of commercial crops received a new impetus in lieu with domestic demands and export requirements.

Due to Green Revolution the sustainable development of high yielding varieties, irrigation facilities, pesticides, chemical, fertilizers, and market facilities, availability of capital, transportation and education of advance technology changed the view about the cropping pattern in the study area.

Generally, it is understood to mean both, cultivation of food and fiber crops and the rising of livestocks' It has remained an important source of livelihood even today in spite of growing industrialization and urbanization in the world and nearly fifty percent working population is still engaged in agriculture (Gigg, 1974). In the developing countries, agriculture sector has been a principal source of employment and largest source of income. However, it provides raw material to industry and much of export items (Davis, 1982). Agriculture in India is a major source of economy. It contributes fifty percent to national income and gives direct employment to about 68 percent of total population and nearly 90 percent population of rural area (India, 1983) and provides nearly 35 percent of country's export, besides supplying of wage goods required the non-agricultural section in industry.

Hence it is not surprising that agriculture in India has been receiving much attention in the sectorial allocation of inputs in the Five Year Plans in India and therefore the top priority has been assigned to develop agriculture sector in our country. Demographic characteristics change as the time passes and this gives rise to changes in agricultural pattern. Agricultural phenomena is analyzed and synthesized for a particular area. Even in a smallest area marked degree of variations in agricultural

phenomena. This is because of the interrelated factors and the complexity of the entire system. These can be classified as independent factors. These vary from location to location in a region. The regional approach is widely used in Europe. It is more suitable to India because major economic problems and policies have been concerned with the development of area and improvement of agriculture. It is also adopted in Australia where it is used in regional planning of the country.

1.2 Review of Literature

The word 'agriculture' comes from a Latin term 'Ager Cultura' which has its origin in the words 'ager' meaning a field and 'cultura' meaning to culture or cultivate. Ager means plough. Agriculture word formed by the plough. Ploughing land and sowing the seed in land. When seed become into plant and from that plant when we get the production that means agriculture. Cropping Pattern means in specific period of the areas in cropping fields.

In China land use survey was undertaken by John Loosing Buck in 1929. This has been a unique and fundamental contribution in the field of land use study. The regional survey of land use and its mapping was made by Patrick Geddes. But the practical work on Land use study was carried out in 1930 by Late Stamp L. D. in Britain. This was perhaps first exercise to survey the land which was, later on, adopted by many geographers, economists and planners.

Chatterjee S. (1940) stresses the needs of land use survey and he carried out the study on land utilization of twelve villages in Uttar Pradesh (1951) and has contributed many valuable papers. The land use Programmed has been extensively carried out in Aligarh University (Uttar Pradesh) in 1962. In 1953, Van Volkenberge was appointed chairman for Land use study at International Geographical Congress and proposed to carry out land use survey in many parts in world. Great Britain, United States of America, China and Poland have carried out land use survey and played commendable role in further land use studies. Mohammod Shafi in India has made pioneer work by adopting sampling method for land use study.

Weaver J. C. in 1954 applied least standard deviation techniques for computing crop combination regions. This method is based on the comparison of the actual percentage of cropped areas occupied by the different field crops with theoretical distribution. Is calculated for all possible crop and a regional unit is designated with crop combination or combinations showing least variance or standard deviation using

the same principle of least square. Raffiullah (1956), Doi's (1959), Thomas (1963), Coppack (1964), Johnson's (1958), Bhatia (1960), Athawale (1966), Ayyar (1909) and Singh (1974) and many others have modified crop combination formula. Mishra (1956) has prepared a model of agricultural land use for Central Ranchi Plateau. M. Ameen (1956) and Ellefseen studied the land use of Delhi State.

Dayal P.(1957) studied the Agricultural Geography of Bihar. Amani K.Z. (1968) presented two studies to find out the changes that took place during the period of forty years (1926-1966) in agricultural land use and crop production of Aligarh District (1968). In 1967, Siddiqui M.S. and Ahmed A. studied the crop land use in Luni Basin and identified the crop combinations and scheme of regional classification in agricultural geography. Shafi Mohammad (1960), Mohammed Ali (1967), Ganguli (1964), Karimi (1950) and Lahiri (1950) have concentrated on land use survey. Later, World Land use Survey was brought forward by Volkenberge S. V. Clark University, and Massachussettes in 1949. The United Nations Educational, Social and Cultural Organization supported this idea and appointed a commission in December 1949 at Clark University.

Bhatia (1965) has evolved a simple formula by taking into account the cropped area, to make an objective measurement of crop diversification. In such a case diversification is a very high degree and may be taken as an extreme case of crop diversification. In contrast, if a particular crop occupies 10% of the crop area, then there is no diversification at all. Here crop specialization or monoculture is the rule rather than an exception. Cropping patterns are not the same all over the world. In some areas, these are superior while in others these are inferior, moreover, no cropping pattern can hold good for all time to come. It has to change with the improvement in farm technology and eco factors. For instance, Punjab-Haryana plans when prices are favorable for wheat and rice and vice versa.

Bhatia (1965) adopted and introduced crop diversification technique in order to understand crop competition in the region followed by Jasbir Singh (1976); Ayyer (1969) modified Bhatia's method of crop diversification with accounting for those crops which occupy at least one per cent of the gross cropped area.

Weaver in (1954) has applied least standard deviation techniques for computing crop combination regions. This method is based on the comparison of the actual percentage of cropped areas occupied by the different field crops with theoretical distribution. Is calculated for all possible crop and a regional unit is designated with

crop combination or combinations showing least variance or standard deviation using the same principle of least square. Raffiullah (1956), Doi's (1959), Thomas (1963), Coppack (1964), Johnson's (1958), Bhatia (1960), Athawale (1966), Ayyar (1909) and Singh (1974) and many others have modified crop combination formula.

Jasbir Singh (1971) dealt with the optimum carrying capacity of Punjab. B.N., Ganguli (1955) has attempted for land use in Burki village. In 1964, Misra studied land use planning directed for better adjustment for optimum utilization of resources in Khadarand ravines of lower middle Gomati valley.

To overcome this difficulty the least squares techniques may be adopted. The use of this technique was suggested by Coppack (1964) and Jasbir Singh (1976) applied it for the derivation of crop combination.

The notable work on land use studies in this regards are made by Pawar C. T. (1978), Odilla Coutinho (1980), Shinde S. D. (1989), Saptarshi P. G. (1993) and Vaidya B. C. (1997). Gibb Martin (1974) has used diversification concept in computing measurement of diversification of employment in industry. Among geographers, The techniques of identifying crop concentration are largely comparable to the methods employed by some urban geographers like Pownall. Buckingham and et al. (1987) defined, "Information System as a system which assembles, stores, processes and delivers information relevant to an organization or to society in such a way that the information is accessible and useful to those who wish to use it." An Information System can support monitoring procedures as it provides current and changing patterns of land use in the area.

The measurement of crop productivity was assessed by Varsha Vaid (1989) and Patil . A (2002) both made study for Maharashtra. Mukherjee B. B. (1942) has made an attempt by studying agricultural regions of Uttar Pradesh. Later on, Dayal (1950), Shafi (1960), Bhatia (1965), Ayyer (1961), Jasbir Singh (1967), Saxena (1968) and Majid Husain (1970) have made land use studies in India.

Datye V.S. (1984) have explained the effect of fourteen variables on land use types of Poona district.

Maji et al. (1998) reported that the land information generated through soil resources mapping can be used to prepare thematic maps suggesting suitable land use plans at various level. In a case of land use study, the soils of Maharashtra were mapping with GIS technique and were found suitable for growing most annual crops in shallow soils. Perennials may be grown in the deeper soils. The notable work on land use studies in

this regards are made by Pawar C.T. (1978), Odilla Coutinho (1980), More K.S (1980), Karmarkar P.R (1981), Shinde S. D (1989), Saptarshi P.G (1993), Bapat (1997), Jadhav (1997), Vaidya B.C (1997), Rakhand (1997), Bhargav (2001), Bhagat V. (2002), Ugale V. (2006),

Aher A.B (2006) and More J. C (2008) observed the significant relationship between slope and the land use study of various parts.

B.C Vaidya (1997) has attempted to study the Yashoda Basin in Wardha district at micro level where he suggested many solutions for better agricultural landuse. Other similar studies have made on agricultural landuse in Maharashtra State by Kumbhar (1978), Shinde (1989), Pawar (1984) and Karmarkar (1981). These studies in agricultural geography are based on the data collection and generalizations at micro and macro levels.

J.C More (2008) has been estimated available water resources in Karmala tahasil and suggested suitable cropping pattern based on available water resources.

Saptarshi (1993) has estimated groundwater on the basis of cropping pattern. Mohammad Ali (1967), have attempted to study land use survey and its studies.

Chowdary et al. (2001) studied the IRS LISS-III images of 1988 and 1996, pertaining to the pre and post treatment periods of each watershed. Classified and NDVI outputs of two years were compared to derive information on changes that occurred over a period of time in watershed. The study revealed an increase in the area under cultivation, water bodies, plantations and tree cover as result of watershed management.

Kale N. A (2009) The VIS is a digital system with spatial and non-spatial data for each land holding and every household mainly based on 'Land Records Computerization' or 'Cadastral System' providing knowledge about old type of lands comprised in the village.

More, J.C. (2008) has been estimated available water resources in Karmala tahasil and suggested suitable cropping pattern based on available water resources. He considered eight variables, namely, percentage of irrigated land to total, amount of fertilizers used, amount of seeds, amount of annual rainfall, soil types and relief, Landform and land use, etc. changes in land use and land cover in the catchment area. Desai .R. G (1998) Agricultural Economics Models, Problems and Policy Issues.

Desai .R. G(2008) and Stated that technologies of Remote Sensing (RS) and Geographic Information System (GIS) can play an imperative role to explores the study of urbanization growth of Pune city using RS data and GIS. Prakasam (2010) studied

the changes in land use and land cover in Kodaikanal Taluk over 40 years period (1969 to 2008) through Remote Sensing (RS) approach. Forest area that occupied about 70 percent of the Taluk's area in 1969 decreased to 33percent in 2008. Agricultural land, built up area, harvested land and waste land also experienced change. Kodaikanal area is identified as one of the biodiversity area in India. Proper land use planning is essential for a sustainable development of Kodaikanal Taluka.

Mohammad and Adam (2010) investigated the effects of different vegetation types on runoff generation and soil erosion. The results indicated that there are significant and important differences in runoff generation and sediment production with respect to the different types of vegetation cover. According to Aher S. P (2012), "Management of the information about the village in a web-based environment is called Village Information System (VIS)". It deals with both spatial and non-spatial data at village level and comprises of all information related to households, population, infrastructure, amenities, utility services etc.

Review of literature on relevant aspects under study forms is an integral part of systematic research work. This review helps in highlighting the methodology as well as results obtained by different researchers and serves as guidelines for the research to be carried out. The literature closely related to the present investigation has been briefly presented.

1.3 Choice of Region:

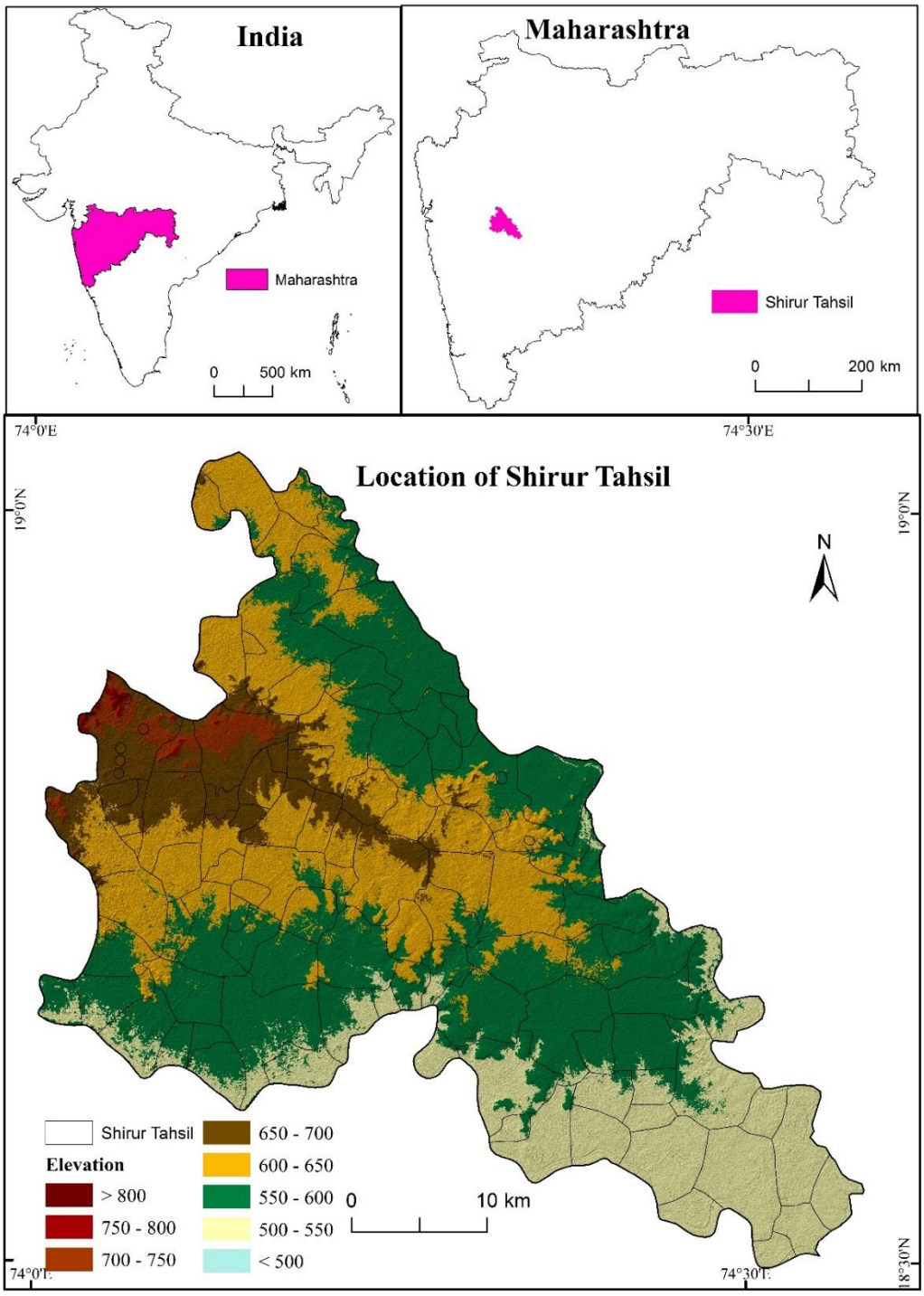
Shirur Tahsil is my hometown. I am interested in carrying out some research work for my region as I think this is good opportunity for me to investigate some new finding for the community where I was born and where I am on the way of progress. Agriculture continues to sustain millions of people in India. Agriculture has always occupied an important place in Indian economy. There are some considerations regarding choice of the study area. Firstly, the study area lies in rain-shadow zone of Deccan trap of Maharashtra and prone to drought. Secondly, land use pattern of tahsil is poor and needs to be improved. Thirdly, in this region irrigation facilities are not sufficient and should be improved. And lastly, the study region has well potentials of agricultural growth**.** All these considerations have led to the choice of Shirur Tahsil as the region for this study in order to understand the agricultural land use of the region in a time-space perspective.

1.4 Study Region:

Shirur tahsil of Pune district in Maharashtra state has been selected for the proposed work. The tahsil comprises of 118 villages and one urban center. The absolute geographical location of study area can be expressed as from 18º49’00” N to19º34’00”N latitude and74º22’00” E to 75º03’00” E longitude. Shirur City is located on the boundaries of the Pune and Ahmednagar districts on the banks of the River Ghod. The town Shirur is also known as Ghodnadi. Shirur has a significant historical and cultural reference.

The area of Shirur tahsil extent form north to south 24 km and 50 km from east to west. Agriculture is the main occupation of this region. The most commonly grown crop is Bajara and vegetable like potato, tomato, onion, sugarcane etc. Tribes are found in large number in this region. The study area shows low rainfall with high variability. Average rainfall in the district is 600 mm to 700 mm. This is usually during the monsoon season from July - October. Moderate temperature is mainly observed here. The rainfall is unpredictable in June with the Indian monsoon. Summers here begin from early March to July. Summers are usually dry and hot. The temperature ranges from 20°C to 38°C, though at the peak, it may reach 40°C.

Location Map of Study Region



Fig, No. 1.1 Location of Study Area (Source-Aster DEM)

1.5 Objectives of the Study:

The major objective of the present study is to evaluate the agricultural land use pattern in Shirur tahsil. This objective will be fulfilled by studying following sub-objectives :

1. To study the physiographic profiles of the study region
2. To study the land use and land cover and agricultural pattern
3. To analyses the changes in the levels of agricultural development in the villages between 2001 and 2010
4. To collect the information for all the objective using village base level.
5. To delineate agricultural regions of the study region
6. To prepare the plan for proper land use planning for the study region

1.6 Database and Methodology:

Following methodology adopted to investigate the different aspects mentioned above:

1.6.1 Micro-level approach:

The Remote sensing techniques uses by the Shirur Tahsil of land use and land cover changing pattern. The images of the geo-referenced using Topo sheet of study area. In this Study uses of unsupervised and supervised image classification for detecting Land use and Cover classes. Landsat ETM+ images of March, November 2001 and March, November 2013 were used to test the Supervise classification. Supervise classification involves developing training patterns using unsupervised classification followed by classifying the pixels using supervised classification. The technique utilizes the spectral recognition of the unsupervised classification in the performance mode and the selection of sampling sites from a Principal Component Analyzed image of the supervised classification in the training mode. The classified images are verified its accuracy. The unsupervised and supervised classification algorithms are used the generalized form of Heckbert quantization and Maximum Likelihood (ML) respectively. There are some villages with strength to accept, implement agricultural regions and improve the agricultural productivity. However, it is the wisdom of the planners to identify such villages. The proposed study will attempt to gain this kind of wisdom on the basis of village level data. It is in this sense

the study will adopt a micro level data. The secondary data will be at village level and primary at family level to understand grass root level problems and prospects.

1.6.2 Collection of secondary data

I. Village level population statistics, Demographic parameters [Population data]

II. Agricultural parameters. [Crop production)

District statistical abstracts, District planning map, District resource map, SOI topographical maps for the study region, village level amenities and facilities data to be collected for sample villages, irrigation system, and canals water rotation data for the analysis of water distribution system.

1.6.3 Primary Survey:

It is also proposed to collect information at the farmer's level.

1. **Village level database** of preparation and information Identification of micro-regions
2. **Fieldwork** includes collection of above said data by different methods such as GPS survey, questionnaire survey, discussion with local people; planning strategy includes preparation of draft plan for different villages having different status.

Methodology:

The methodology adopted in the present study has been summed up under following headings:

a) Crop Ranking Method
b) Crop Diversification Method
c) Crop Combination

In the present study GIS Software's namely Arc GIS, ERDAS Imagine, Arc view and Autodesk has been used.

Database:-

The present study has been carried out by using primary and secondary data sources

Data Sources

a. Primary data - The primary data collected through survey

b. Secondary Data - Agricultural Department (Shirur Tahsil Office)

1. Survey of India (SOI) toposheet (47J/1, 47J/2, 47J/5, 47J/6, 47J/10 and 47J/11) at 1:50000 scale

1.8 Summary

The present chapter deals with the put fourth objectives of study, review of literature, sources of data, methodology and limitations of the study. Shirur tahsil of Pune district in Maharashtra state has been selected for the proposed work. The tahsil comprises of 117 villages and one urban center. Shirur City is located on the boundaries of the Pune and Ahmednagar districts on the bank of the river Ghod. The town Shirur is also known as Ghodnadi. Shirur has a significant historical and cultural reference. The area of Shirur tahsil extends from north to south 24 km and 50 km from east to west.

Agriculture is the main occupation of this region. The most commonly grown crop is Bajara and vegetable like potato, tomato, onion, sugarcanes etc. Bhill, Scheduled Tribes are distributed in this region. The study area shows low rainfall with high variability. Average rainfall in the district is 600 to 700 mm. This is usually during the monsoon season from July - October. Moderate temperatures are mainly observed here. The data collected were then converted into percentage. Weaver's crop combination technique was applied to compute crop combination regions computed for 108 villages in Shirur tehsil. This chapter has given the introduction to the topic and the study area. It includes agricultural regionalization and types, review of previous literature, need of the study or choice of the topic, hypothesis, objectives, data base and methodology. This is followed by exhaustive literature survey of previous work and which is beneficial for understanding the background of the topic followed by methodology adopted for present work in cropping pattern. The cropping pattern and land use study of total (117 villages) in Shirur tahsil with the help of secondary data is obtained from agriculture department, Panchayat Samiti and Village Talathi Offices of Shirur Tahsil.

This review is important to compare the work on agricultural land use types as well as changes occurred in the cropping pattern in the study region. It also gives the information regarding choice of the topic and also the hypothesis of irrigation facilities, adopts modern techniques; geographical and climatic condition, government policies and economic factors that mostly effect of the land use and changed cropping pattern.

CHAPTER-II

PHYSICAL AND SOCIO-ECONOMIC PROFILE OF STUDY AREA

2.1 General Introduction:

Agriculture is the most important primary economic activity which is closely related to physical environment relief, climate and soils. In any scientific and viable inquiry into agricultural phenomena, it is perquisite to pay attention to the basic relation between these physical determinants and agriculture (Singh and Dhillon, 1994). In the country like India, where the rainfall is both inadequate and unpredictable, it affects badly on agricultural productivity. The study of development process has found a limited place in geographic literature in the past (Gilbert A.1971).

The study of economic development was viewed differently by geographers and economists while geographers have tended to emphasize the role of physical environment (Munton R.J.C.1969). Land is the basic resource of human society. Its utilization shows a reciprocal relationship between ecological conditions of region and man. Agriculture is the most important primary economic activity, which is closely related to physical environment relief, climate and Soils. Visher (1932) has rightly put forward the specific field of geography concerns itself with the study of the influence of natural environment on the nature and distribution of men's activities. (Hettnerr, 1947). It is therefore, necessary to evaluate the agricultural land use of the study region needs to unfold the nature of ecology of the Shirur Tahsil.

This chapter covers the profile of physical background of the tahsil, i.e. relief, geology, geomorphology, climate, drainage, soil and vegetation. McHarg (1966) on the basis of principles of ecological determinism has shown how nature can impose limits, provide guides and assist man in solving environmental problems in a manner which is most compatible with natural problems. Hence, efforts need to be made to qualify the environmental attributes to meet various for future ecological planning, modification and adjustment. Although, natural factors are far from explaining everything Vegetation covers, soil Pollution, climate have a very important effects on the cultivation of crops and preference of a particular agricultural system.

Economist on the other hand, had laid overwhelming emphasis on economic factors in conditioning the distribution of geographic phenomena, where by the natural relationships between the phenomena, the phenomena have been under-emphasized (Chisholm, M.1966). There is increasing appreciation by geographers of the fact that physical and nonphysical (biotic or living) factors influence overall economic development and that factors contributing to agricultural growth must also be sought in the same perspective. However, one cannot ignore the impact of the vast multiplicity

of interrelated physical or nonphysical factors on agriculture, notwithstanding the fact that all of them are not equally significant in influencing the regional variations and temporal development of agricultural phenomena in an area. To avoid dissipating one's efforts, it is desirable to choose the primary factors that may be decisive in the creation of different agricultural elements from place to place and time to time.

In this sense only must analyze the distributional patterns of decisive factors in order to understand the distinctive regional characteristics of the dependents so that the regional division of an area may be tailored purpose of a particular study (Jasbir Singh, 1976). Each part of the world virtually lacks homogeneity in the primary bases of farming because the degree of their effectiveness in the spatial perspective markedly varies.

2.2 Location, Site and Situation

The Shirur Tahsil lies in the eastern part of Pune district of Maharashtra. The tahsil comprises of 118 villages and one urban centers. The absolute geographical location of study area can be expressed as from 18º.49'.00" N to19º.34'.00"N latitude and74º.22'.00" E to 75º.03'.00" E longitude. Shirur City is located on the boundaries of the Pune and Ahmednagar districts on the banks of the River Ghod. The town Shirur is also known as Ghodnadi. Shirur has a significant historical and cultural reference. The area of Shirur tahsil extent form north to south 24 km and 50 km from east to west. The study area is included in Survey of India Topographic Index Numbers 47J/1, 47J/2, 47J/5, 47J/6, 47J/10 and 47J/11on 1: 50,000.This tehsil is confined by Ahmednagar District to east and north-east, Ambegaon tahsil to north-west and Haveli tahsil to South. Its total area occupied was1552 sq.km.

2.3 Physiography

Physiography is one of the dominant parameters of physical environment and its impact on patterns and density of agriculture is immense (Chouhan T. S., 1987). Agriculture in mountains, plateaus and plains is different from scarps, pediments valleys, flanks, flood plains ridges, alluvial flanks, drumlins, monodnocks, levees and dunes. The relief features are essentially the product of geological past, the nature of geological composition mantle (Deshpande C. D., 1971). A number of small bands of crushed conglomerate are noticed especially between Niwati village and Malvan town (Sahsrabuddhe Y. S.). Relief of the land influences land use, particularly through the

elevation, ruggedness and slope. Relief also influences farming by modifying climate and by affecting the ease of cultivation (Sing, 1974).

The relief varies remarkably from place to place and the broad and relief changes are seen in the west-east direction with local variations. These variations in land are due to the geographical evolution (Deshpande C. D. 1971). The Shirur tahsil covers 1552 square kilometers area. The Sahyadri mountain range lies from north to south in west part in the study region. Shirur tahsil constitutes an area of 155811 hectors. Ghod, Bhima and Kukadi rivers go through the tahsil from three directions Shirur Tahsil may be divided into two physiographic region according to altitude. The one is gently sloping belt along Ghod and Bhima there are two water divides; one divides the Ghod the Bhima basin while the other runs from west to east. The hilly zone locally called as Malran (open, non-cultivated land) shows that agriculture is poor.

The riverine belt along Ghod and Bhima occupy 40 percent area of the Shirur This region offers favorable situation for irrigation and hence agro based development, topographically it is almost a plain region with alluvial soil. The black colour of the soil is indicator of high fertility status. The generalized direction of slope is from Northwest to southeast in the Ghod River's basin of another direction of slope is from northwest to Southeast in the Bhima River. Shirur Tahsil is mainly drained by river Ghod. Ghod Rivers it is natural boundary is between Pune and Ahmednagar District. The Shirur city is located on the bank of the river Ghod and the river is non perennial.

2.3.1 Geology:

Land utilization of any region is the direct product of its geological structure and man is the main source behind molding land use according to their need and the geological ingredients of the region **(Mandal, 1982)**. Detailed geological study helps to understand the land use of the study area. According to Hawaiian terminology, the basaltic flows are classified into 'aa' and 'Pahoehoe' types. Pahoehoe flows are smooth or rolling surfaces with local presence of 'ropes' or 'cords'. The 'aa' flows are rough, jugged, spinose and clinker. There is a gradation from 'aa' type to blocky lava. Geologically the entire study area is underlined by basalt rock and horizontally bedded lava flows commonly referred as "Deccan Trap".

The basaltic lava flows belonging to the Deccan traps of late cretaceous to palaeogene age and mainly of Upper Ratangarh and Indrayani formation stratigraphic status. The lava flows generally consist of "Pahoehoe" and "aa" type. Both "pahoehoe"

and “aa” types are found in the Bhima and Bhama basin within the tahsil. Central part of the Shirur Tahsil is covered by the Indrayani formation which comprises a thick succession of five “aa” basaltic lava with 50 to 180 m thicknes

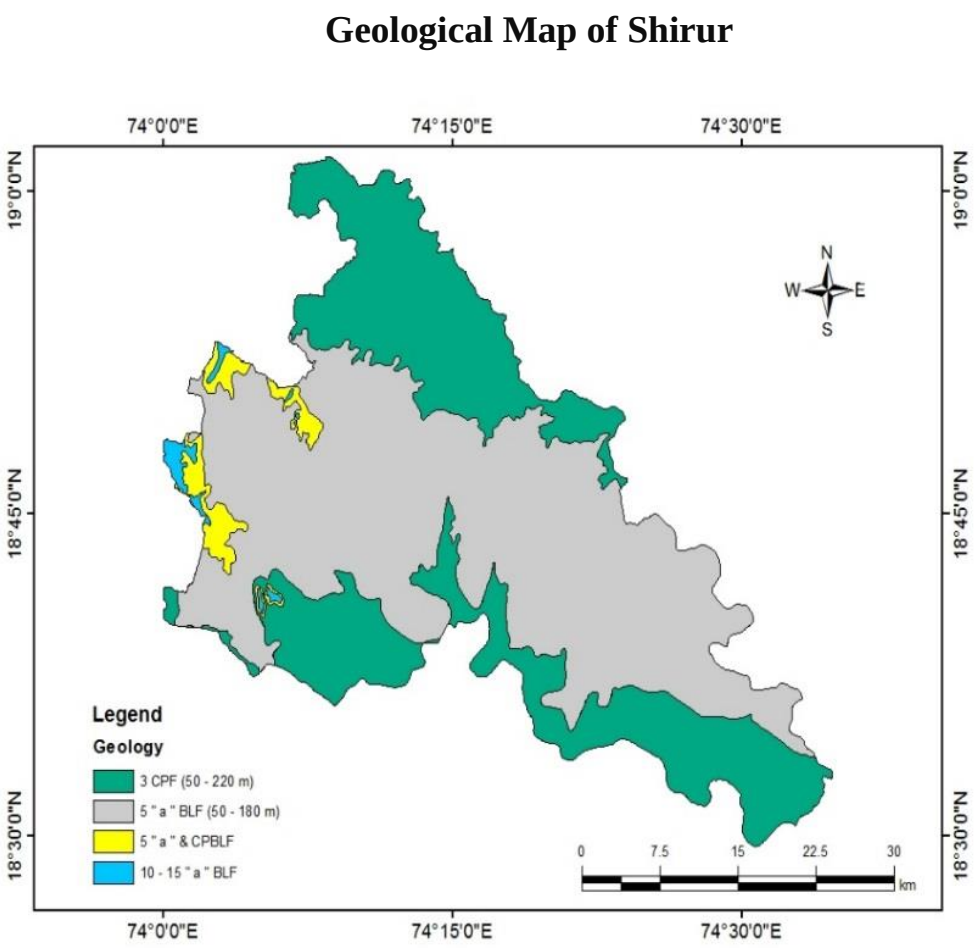


Figure No.-2.1 Geological Map of Shirur
(Source : Geological Map of Pune District)

Most of the part of Takali Haji Circle and northern part Shirur Tahsil is of three compound pahoehoe flows with 50 -220 m thickness. The southern part of the Vadgaon Rasai Circle of Shirur Tahsil is bounded by river Bhima and it is also made up of the same geological strata. It is the upper Ratangarh formation which is observed in the valley of Ghod, Kukadi and Bhima Rivers. The five “aa” and compound pahoehoe basaltice lava flows with 50 to 220 m thickness and ten to fifteen “aa” and simple basaltic lava flows with 50 to 350 m thickness are found on a very minor scale in the circle of Pabal mainly in the western part of Shirur Tahsil.

2.3.2 Geomorphology:

Shirur Tahsil has very less diversified geomorphology. Geomorphologically it can be categorized into two categories – the middle level plateau and the older flood plain of Ghod, Bhima and Vel Rivers. Most of the part of Nhawara, Vadgaon Rasai and Talegaon Dhamdhere is made up of Bhima, Vel and Ghod Rivers older flood plain. Northern part of Pabal circle, western part of Shirur circle and Takali Haji circle have middle level plateau region while Nahavra, Vadgaon Rasai circles have older flood plain region.

GEOMORPHIC MAP OF SHIRUR TAHSIL

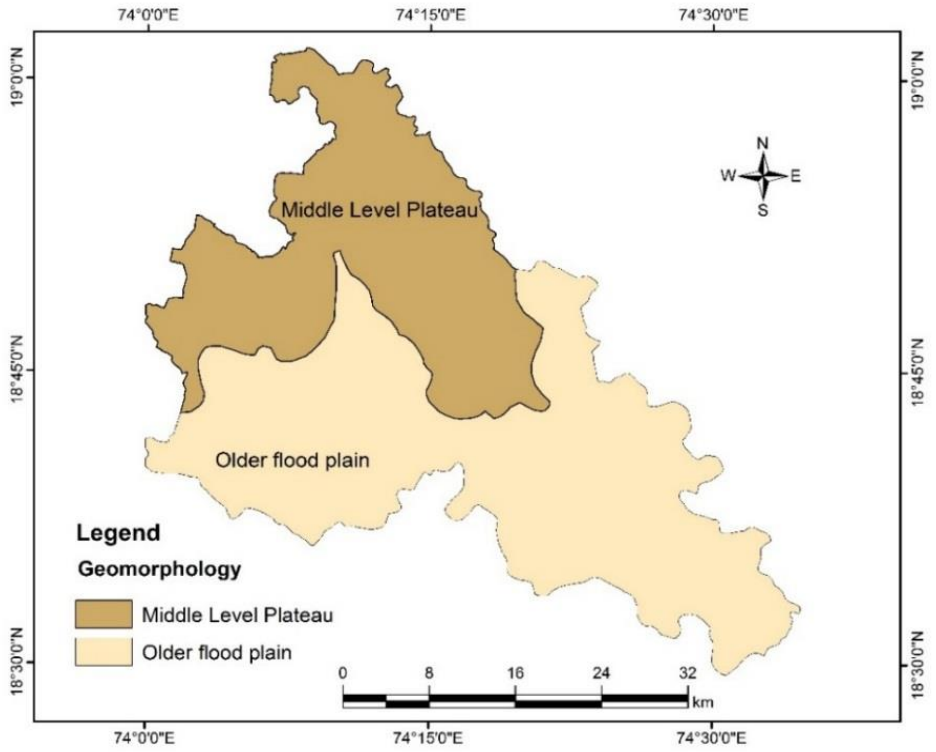


Figure No.- 2.2 Geomorphology Map of Shirur

2.3.3 Relief:

Relief indirectly influences farming by modifying the climate and by affecting the case of cultivation, the degree of accessibility and the consequential changes in soil, erosion and patterns **(Singh, 1974)**. Physiographically, Shirur Tahsil represents plateau and plain region. The western part of the study area is having an altitude of more than 751 m, the central part has an altitude between 601 to 750 m and the eastern part has

less than 560 m elevation. Thus, on the basis of altitude Shirur Tahsil is divided into 2 major physical divisions namely, Plateau region and flood plain region of Bhima-Ghod River.

Plain area is distributed along the bank of Bhima River that is the southernmost part of the Shirur tahsil and also at the confluence of Bhima and Ghod River in the south-eastern part of the Shirur Tahsil. The height is ranging between 540 to 560 meters above the mean sea level. The maximum proportion of Vadgaon Rasai circle is occupied by plain area. The plateaus of 600 -750 m elevation are known as region of middle level plateaus. Such plateaus are located in the central and northern part of the study area. It is distributed in Takali Haji, Shirur, Nahavra and in the northern part of Talegaon Dhamdhere circle.

DEM (Digital Elevation Model) OF SHIRUR TAHSIL

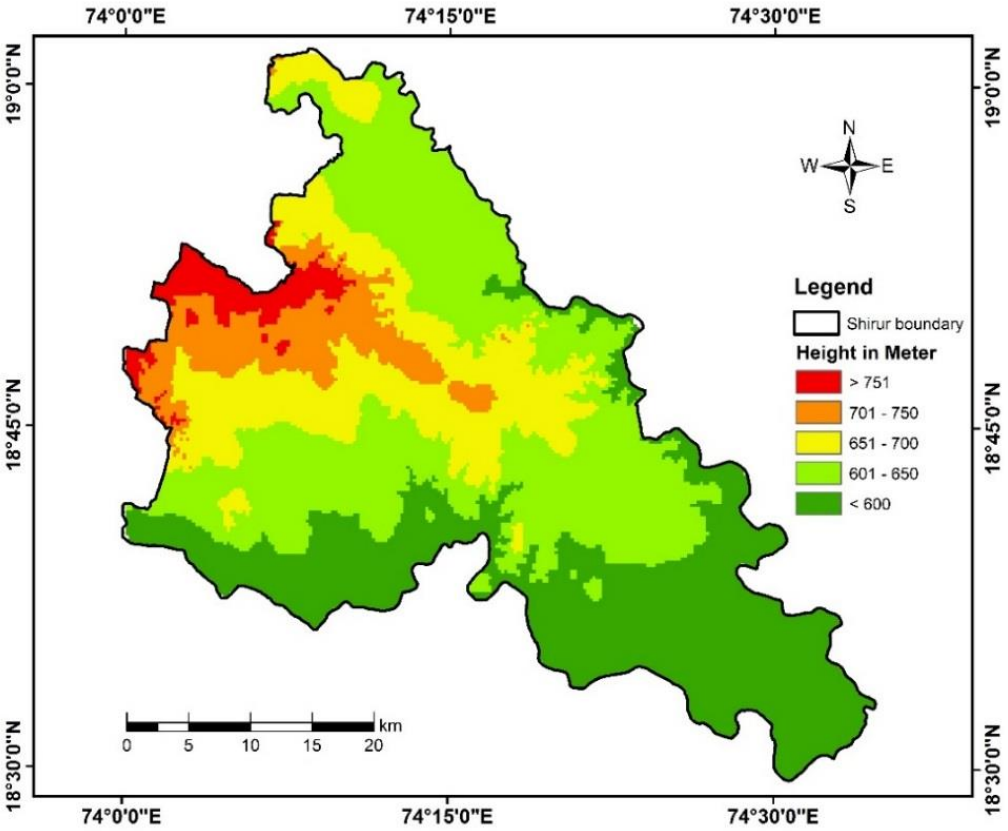


Figure No.- 2.3 DEM of Shirur Tahsil (Source : SOI Toposheets)

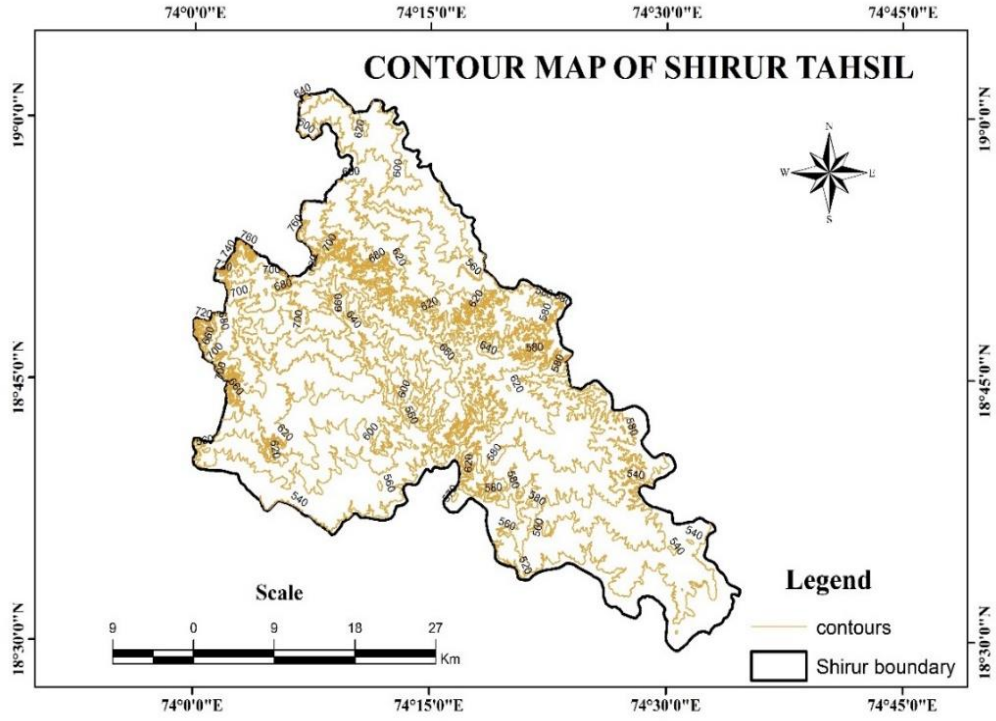


Figure No.- 2.4 Contour Map (Source : SOI Toposheets)

2.3.4 Slope:

Slope of a land is one of the important physiographic aspects that influence the overall suitability of the natural elements. The southern and south-eastward slope of the study area has gentle and it is less than 5^0. The central part has occupied by the eastern offshoots of the Sahyadri ranges and this area has 5^0 to 10^0 slope with undulating topography. The eastern part of Shirur circle, southern and western part of the Takali Haji circle and the eastern part of Nahavra circle have 10^0 to 15^0 slope. The direction of the slope of this study region is from north-west to south-east as is seen in Fig 1.5.

SLOPE MAP OF SHIRUR TAHSIL

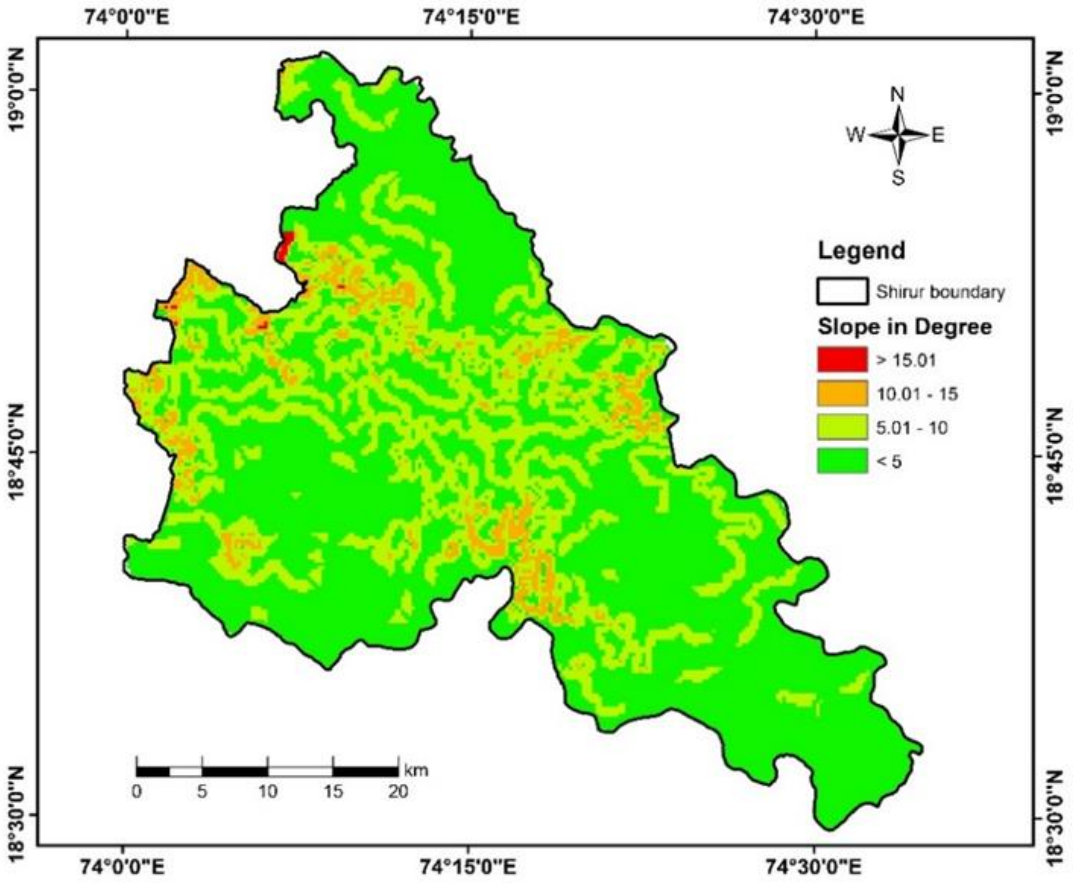


Figure No.- 2.5 : Slope Map of Shirur Tahsil (Source: SOI Toposheets)

2.4 Soil:

In any agricultural operation soil is of the almost important as it is the cradle for all crops and plants. The top soil having an ever age depth of about 15 to 20 cm on the face of the land, is the natural body of soil on which plants grow and the farming

activities flourish. The standard of living of the people depending on agricultural is often determined by the fertility and productivity of the soil. The word soil is derived from the latin word Solum. In general, soil refers to the loose surface of the earth, is distinguished from solid rock. It is the material that nourishes and support grooving plants. According to the soil scientists, soil means that part of the earth crust which has been changed as a result of soil forming process. It is a natural aggregate of mineral grains with or without organic situates, formed by the chemical and mechanical weathering of rock.

The earth as a result of a complex combination of the interaction of rock, the organic macro and microorganism of vegetable and animals worlds, the climate, the local relief and the production activities of man. It consists of their three phase solid minerals matter, water and air or gases.

Jainendra Kumar (1986) has rightly pointed out the need of study of soil types for efficient landuse as it provides basic nutrients for the growth of plants. Deep black, medium deep black lateritic and coarse shallow soils are observed in the study region. The development of soil in any region depends mainly upon parent material, climate, living organism, land utilization and physiography.

2.4.1 Soil Types

The study of soil has been carried out on the basis of the data from Department of Agriculture, Maharashtra State and Tahsil Office.

According to the map procured from tehsil office, there are four types of soil in the study area. Characteristics of each types and its areal extent are discussed in the following paragraphs.

2.4.1.1 Deep Soil (Alluvial Soil)

It is observed in the narrow belt along the rivers Bhima and Ghod. This is nothing but the alluvial deposits subjected to the development of deep black soil. This is the most fertile belt in the tehsil. It has the advantage of nearness to the river and hence lift irrigation project are quite feasible.

2.4.1.2 Moderately Deep Soil (Black Soil)

Deep black soil is identified in central and south parts in the study region. This soil is mainly found along river Bhima and its tributaries. The colour of this soil varies from brown to dark black.

This soil is well drained, clayey and it appears dark brown to grayish black in colour owing to excessive predominance of humus content. This soil varies in depth from 5 to 20 feet. The crop cultivation is supplemented by irrigation. Vegetables, sugarcane, wheat, fodder crops are grown in this soil. Medium deep black soil is observed in Vadgaon, Mandavgan, Sadalgav, Babalsar, Koregav Bhima, etc. villages. This soil is deep, well drained and fine textured and it suffers from moderate erosion and has saline, clayey and calcarious in nature but found comparatively less fertile than deep black soil. Sugarcane, wheat and vegetables are common crops grown on this soil in study region.

2.4.1.3 Medium shallow:

These soils are found between hilly tract and riverine belt. Deep brown colour indicates good fertility status. These soils originate from colluvial deposits from the hilly tract. There are some patches showing black colour indicating high fertility status. The thickness of soil varies from 0.5 mm to 1mm depending upon slope.

2.4.1.4 Shallow soil (Coarse Sandy Soil)

Hilly tract is marked by flat topped hills, indicating tract topography is hard in nature and locally known as ‘Murmad’. This soil is semi-fertile and its water holding capacity is less than black soil. Basaltic soil is turned into laterite soil due to oxidation process which is caused by heavy rainfall and high temperature. Chemical and mechanical weathering result laterite soil. This soil contains excessive iron oxide resulting reddish in colour. Laterite coarse shallow soil is found in north in Pabal, Kendur, Amdabad, Uralgav, Shindodi, Chinchani, Central part in Navare Villages. Coarse shallow high hill soil, which is laterite, found in west part in the study region. This soil is well drained and calcarious in nature. Jowar and bajra crops are well grown in this soil. Is found in Khannur Mesai, Takali haji, Kendur Pabal, Bhabarde, Dahivadi, and central part of Nimone village. Sahyadri and its ranges are covered with shallow laterite soil.

SOIL MAP OF SHIRUR TAHSIL

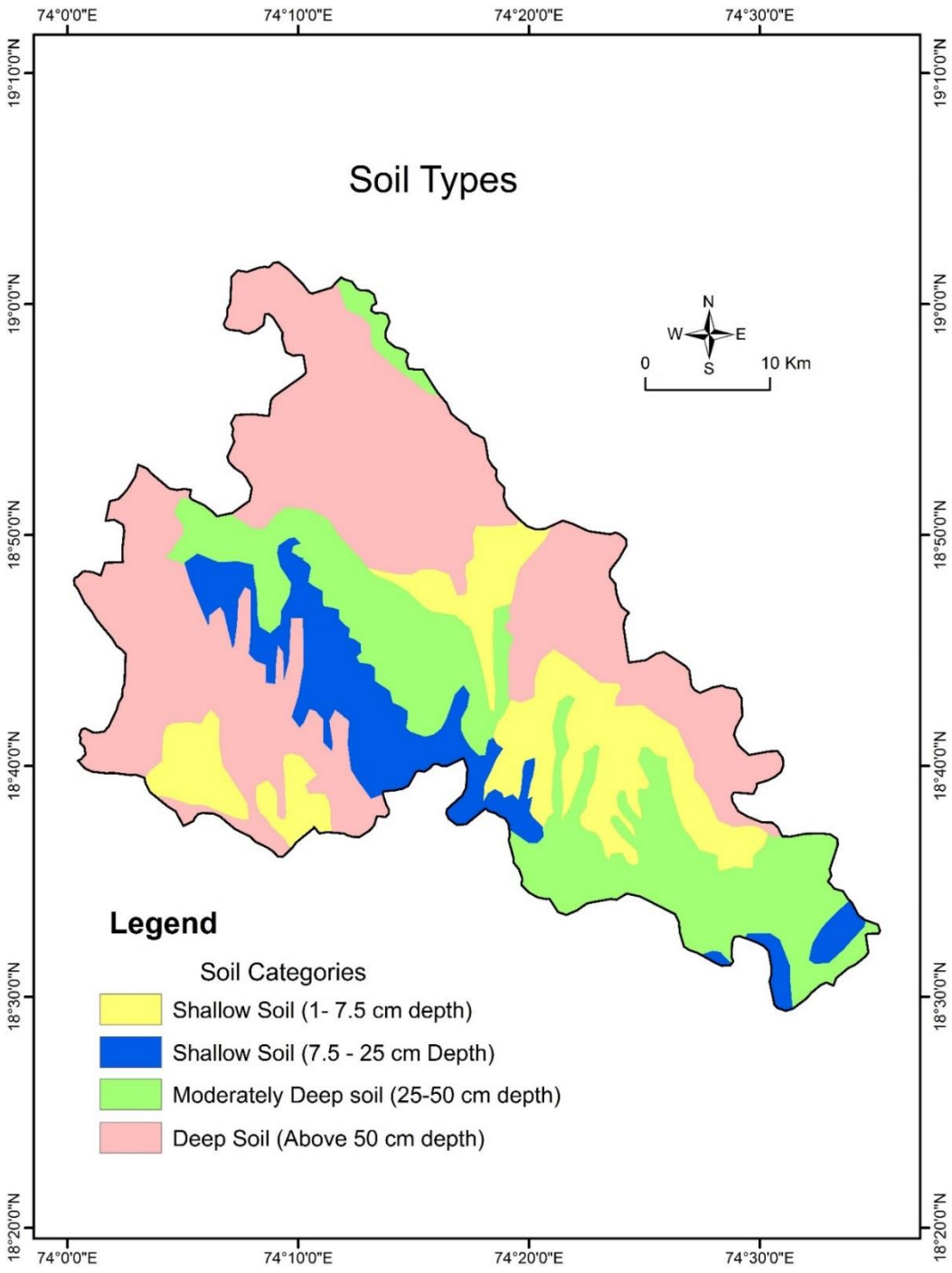


Figure No.- 2.6 Soil Map (Source Agricultural Dept. Pune)

2.5 Drainage

Drainage is a comprehensive expression in geography. Drainage is one of the most important components of physical environment which influences the agriculture directly as well as indirectly. Ground water influent becomes the base flow that maintains the flow of streams in fair weather. It includes surface as well as ground water. The Shirur tahsil is well drained by Bhima, Ghod Rivers. The tahsil is a part of three major river basins such as Bhima, Ghod, and Vel River. Vel River is flowing through Pabal to Shikrapur and then Talegaon Dhamdere and then exits from the tehsil. This area is almost plain. The study of drainage can be systematically presented according to these two basins. Generalized slope of the area is from northwest to south. The rainfall in the tahsil is about 700mm to 1250mm.

The tahsil has part of three major basins of the rivers Bhima Ghod and Vel. Bhima observed in the tehsil is a part of upper Bhima basin as defined by Jog (1990). The course of the rivers Bhima and Ghod basin in the tahsil about 120km. & 75 km. respectively. The availability of water is only for eight months. Various Kolhapur types (K.T.) weirs constructed on the river provide the water for irrigation and drinking purpose.

2.5.1 Bhima and Ghod Rivers:

The river Bhima has formed the border between Shirur and Daund, Bhima River originates near Bhimashankar in western part the study region. The major tributaries of Bhima River are Kukdi, Meena, Ghod, Vel, Bhama, Indrayani, Mula, Mutha, Karha and Nira. The river Bhima orginates in the Sahyadri ranges and follows the path between Balaghat and ShambboMahadev ranges. The reach of Bhima observed in the tahsil is a part of upper Bhima basin as Defined by Jog (1990).The cource of the river in the tehsil is about 120 km. The availability of water is only for eight months. There are a various village along the banks of the river namely Apti, Vadhubudruk, koregaon, Vittalwadi, Takalibhima and Dhanore. Various K.T. Weirs are constructed on the river near Vadhubudruk, Dhanore, Takali Bhima, Sangavi, Ranjangaonsandas, Alegaonpaga. These Dams provide the water for irrigation and drinking water purpose. During rainy season, these rivers flow with sample water and during dry season water shrinks in narrow channel. The eastern part in the study region has found broad valley. Most of these rivers have found terraces and alluvial depositions along the flood plains such land is fertile. Ghod Main River in my study region.

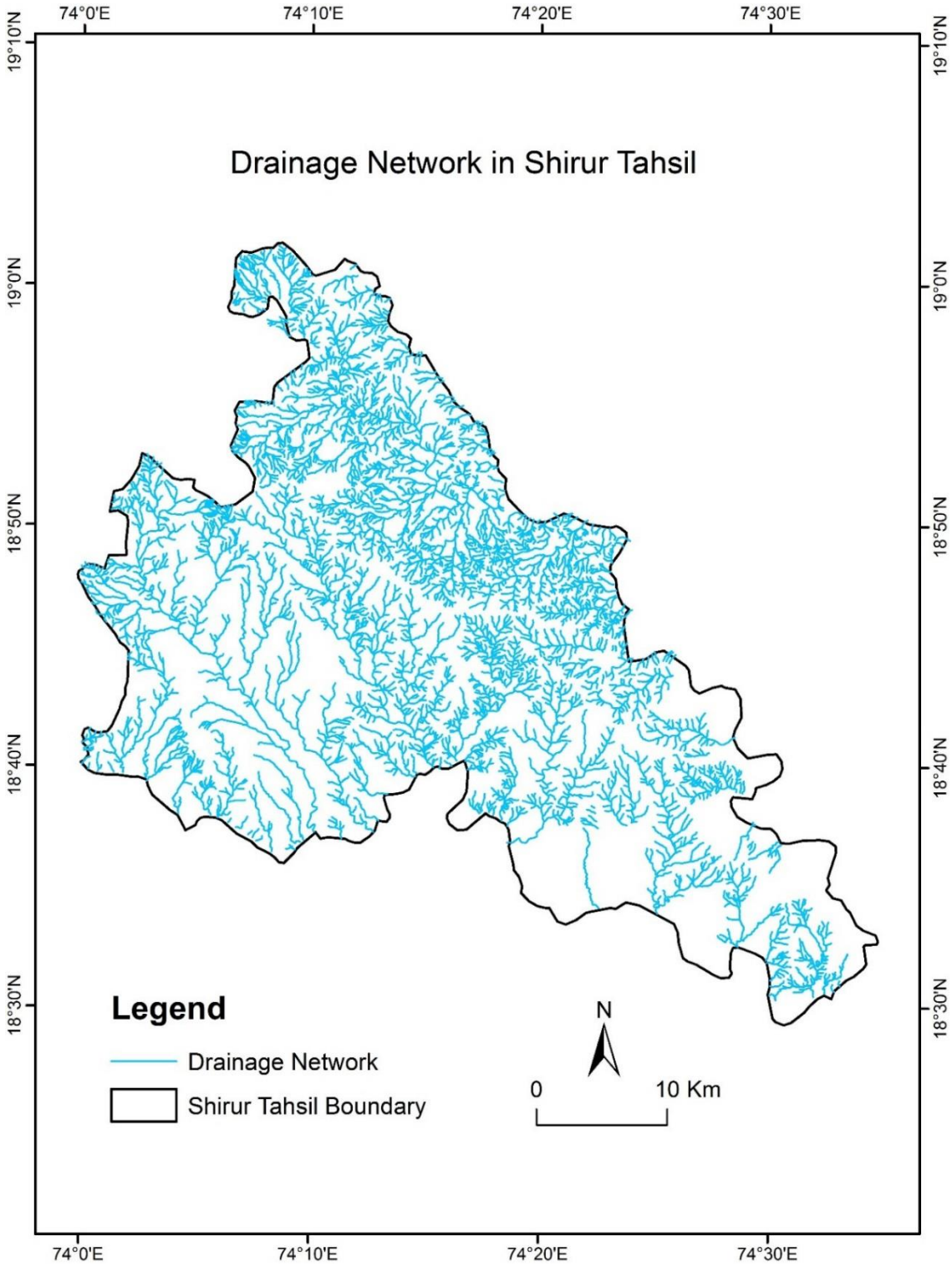


Figure No.-2.7 Drainage Network Map (Source: SOI Toposheet)

2.6 Climate:

Climatic conditions are the most importance factors in determining the distribution and performance of crops. For healthy growth and good yields, certain optimum conditions of rainfall, temperature, wind, sunshine, soil and moisture are essential. Climatic factors exert mainly a regional influence on plant life, the difference in the behavior area as in a given state or a group of states may be considered as due primary to differences in climatic rather than soil condition (Kalges, K.H. W. 1958). Climate plays an important role in influencing the characteristics of agricultural economy in a region. It can influence the choice of farming system indirectly through such as the length of the growing season, the occurrence of frost and availability of water for crop growth (Shirlaw D.W., 1971) Three most important factors of climatic conditions for the standard of plant response are, temperature, water supply and soil as primary determinants of crop growth (Hildereth A.C. et al 1941). In large measure climate determines where man may live and thrive what crops he may raise? What type of home he may appropriately build? What sort of clothing he may wear? And what pests and diseases he must combat? (Whitback, R. H., 1932).

The average of weather condition at a place over a long period is called climate. The climate is one of the important factor that determines the runoff, overland flow and drainage composition in the study area. The climate of the study area is more or less pleasant, characterized by wet and dry most of months. The climatic elements temperature, rainfall, humidity, wind have great influence of human life. It also influence a distribution of population.

Rainfall is one of the factors to determine the land use pattern in study region. The study region experiences tropical monsoon climate. Due to uneven topography, rainfall is unevenly distributed in study region. Mostly rainfall receives from southwest monsoon accounting 87 percent during from June to September. The average rainfall in Pune district is 700 millimeters. In study region, summers are dry and hot and it begins from early March to June. Then temperature ranges from 100 to 380 centigrade and it reaches to 400 centigrade in May. May is the hottest month in study region. Humidity is low during the summer months as it increases evaporation losses from the atmosphere. It reaches lowest up to 50 percent in summer. The diurnal variation in humidity during this period is high and water vapors gets condensed due to falling night time temperature and daytime it finds high. During rainy season, it is usually high and it reaches up to 88 percent.

2.6.1 Rainfall

Rainfall as the primary ecological parameter has created a variety of farming enterprises types or systems in the world. It is dominant single weather element influencing the intensity and location of farming system and the farmer's choice. It also becomes a climatic hazard to farming when it is characterized with scantiness, concentration, intensity, variability and unreliability. Thus, variations in rainfall characteristics affect agriculture as a whole. Moisture conditions affected to the stages of crops at sowing, germination, shooting, stalking and heading maturing, harvesting and threshing. It is all the more important in the minimal regions, here average or normal rainfall is generally necessary for successful crop production. In such areas the system of crop production must be correlated more or less to the moisture factor (Klages, 1958). Rainfall has control and for this reason is a seasonal rhythm of conditions influencing the patterns of land use (SimkinsEthal, 1933). shows the rainfall records of 10 years for the seven tahsil in the study region.

The rainy season extends from the months of June to September receiving about 84 percent of annual rainfall is received in southwest monsoon period. The remaining rainfall is received in October from the north east retreating monsoon. Rainfall is the single dominant weather parameter that affect plant growth, plant production, location of farming system and farmer selection of crop.

Table No 2.1 Rainfall in mm

Sr. No	Month	Rainfall in mm 2012 (Shirur Station)
1	January	0
2	February	0
3	March	0
4	April	0
5	May	0
6	June	1
7	July	20
8	August	89
9	September	107
10	October	104
11	November	0
12	December	0

(Data Source IMD, Pune.)

The rainfall is recorded in four months such as July, Aug, Sep, Oct. in 2012 of Shirur Station. In 2012, highest Rainfall is recorded 107mm in September.

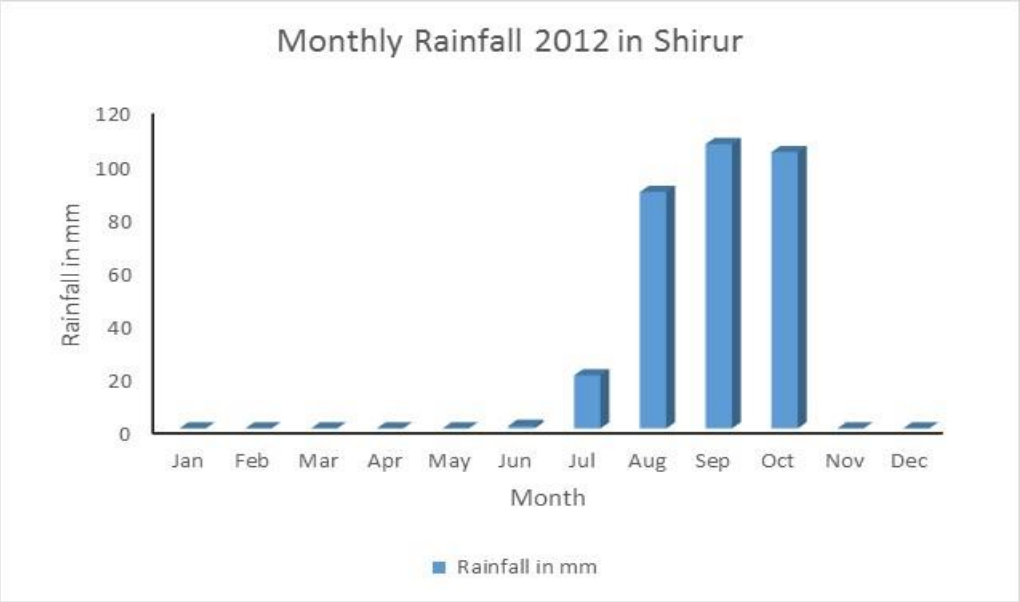


Figure No.-2.8 Monthly Rainfall-2012

Table No 2.2 Average Rainfall 2001 to 2013

	Year	Average Rainfall 2001 to 2013
1	2001	422.8
2	2003	266
3	2004	374
4	2005	460
5	2006	760
6	2007	674
7	2008	492
8	2009	859.6
9	2010	849.5
10	2011	441.8
11	2012	321
12	2013	558.6
13	Average	539.94

(Data Source IMD, Pune.)

The thirteen years average rainfall of Shirur is 539.94 mm. Shirur recorded the highest rainfall of 859.6 mm in 2009 in the last thirteen years. (2002 Data is not available).

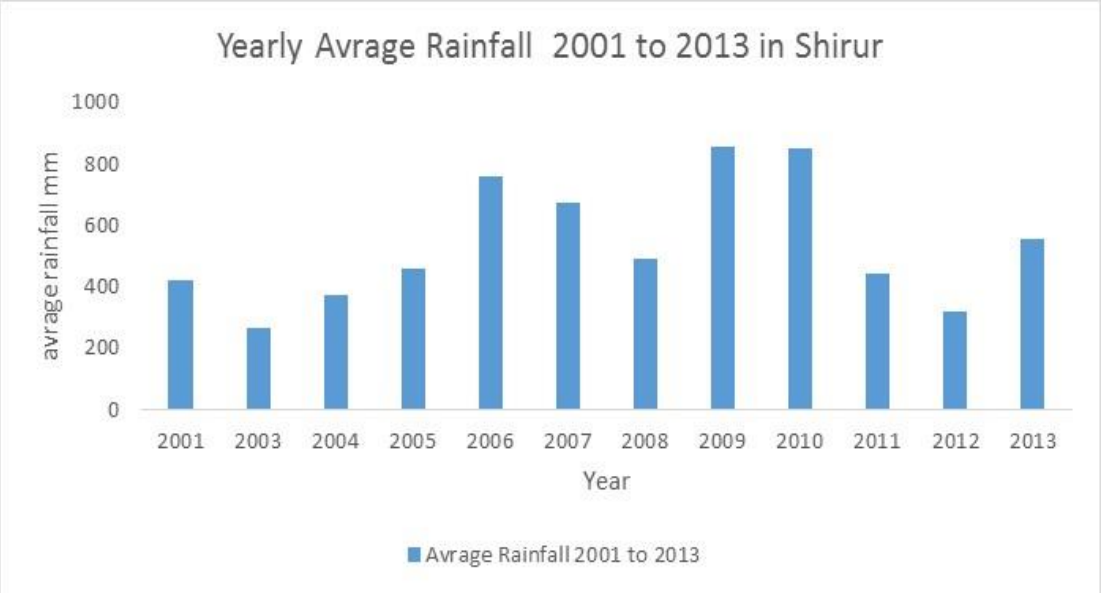


Figure No.- 2.9 Yearly average rainfall 2001-2013

2.6.2 Temperature:

Each crop needs a certain quantity of effective heat units for germination, growth, stalking, maturity and ripening. This is called as the thermal constant and it varies from crop to crop. Temperature above the minimum is therefore, effective in furthering the growth of plant towards maturity and ripening. The crucial air temperature is 60 C and above which degree plant grows (Schimper, 1903). Without suitable temperature conditions, germinations of seed and growth of plant are retarded.

Temperature regulates all the chemical and physical processes of plant metabolism. The metabolic processes begin at a certain minimum temperature and increase with rise of temperature until they reach a maximum at a temperature called the optimum temperature. Further with rise in temperature above the optimum level, metabolic activity is slowed down until ceases at a temperature called the maximum. Each plant species has its own minimum and maximum temperature beyond which its life activity ceases (Kochhar, 1967). For the agricultural geographer two of the best indicators of regional differences in temperature currently available or derived are:

i. Length of the growing season

ii. Accumulated temperature

Table No 2.3 Mean Maximum & Minimum Temperature

Sr. No	Month	Mean Maximum Temperature	Mean Minimum Temperature
1	January	29.5	10.4
2	February	32.8	11.8
3	March	35.9	14.1
4	April	37.8	20.6
5	May	37.3	21.9
6	June	33.1	23.4
7	July	29.7	22.6
8	August	28.3	21.7
9	September	28.8	20.9
10	October	31.3	18.9
11	November	30.9	14.6
12	December	31.1	13.5
	Average	**32.20833333**	**17.8**

(Data Source IMD, Pune.)

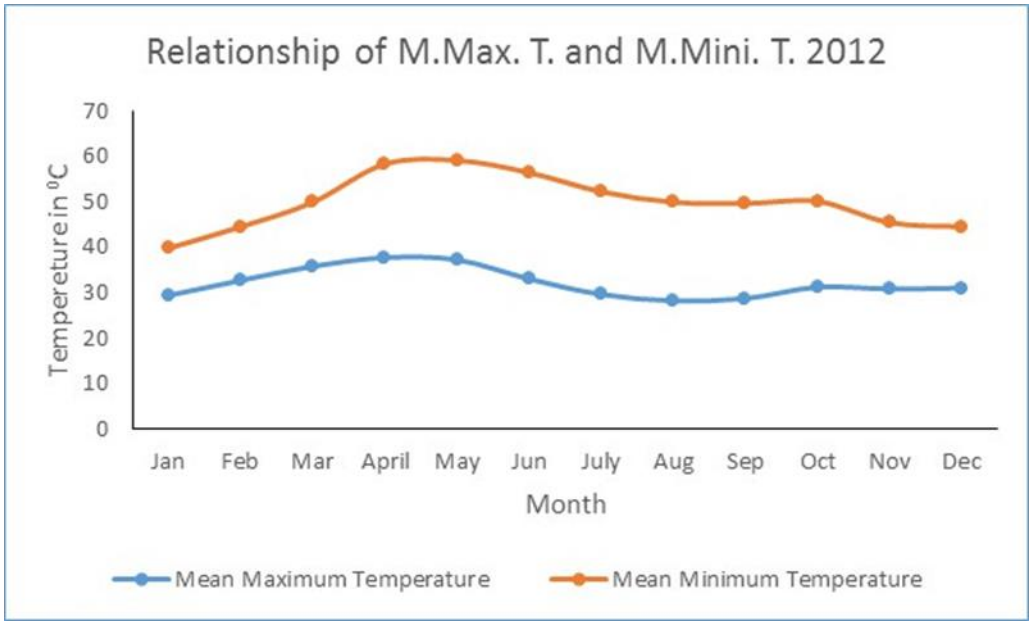


Figure No.-2.10 Relationship of M.Max.T.and M.Mini. T.2012

The range of Mean Max. Temperature and Mean Mini. Temperature is high recorded in months of April to October. Compare to other months range is low and stable in month of November to December.

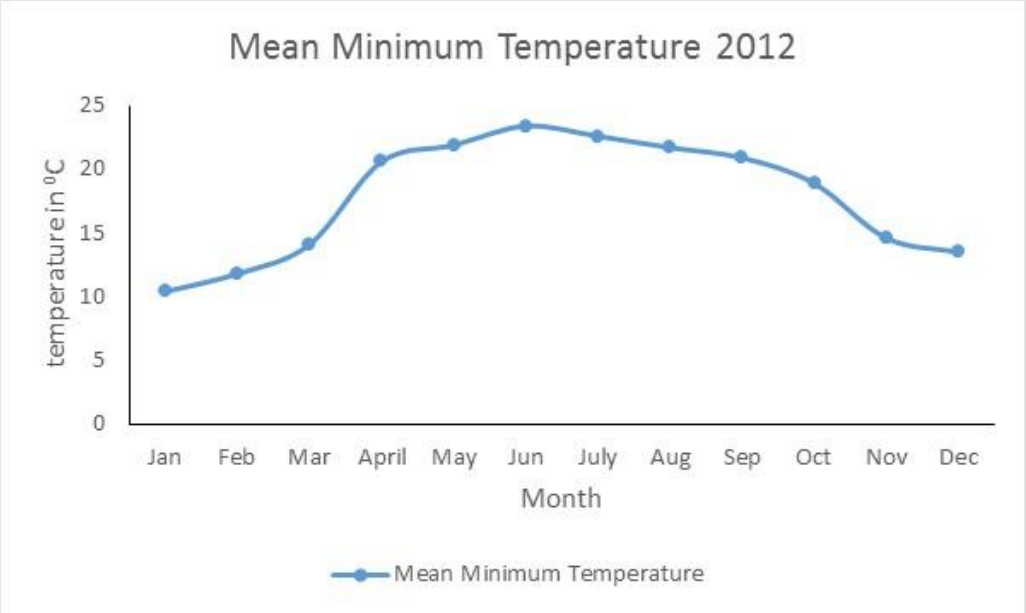


Figure No.-2.11 Mean Minimum Tem.2012

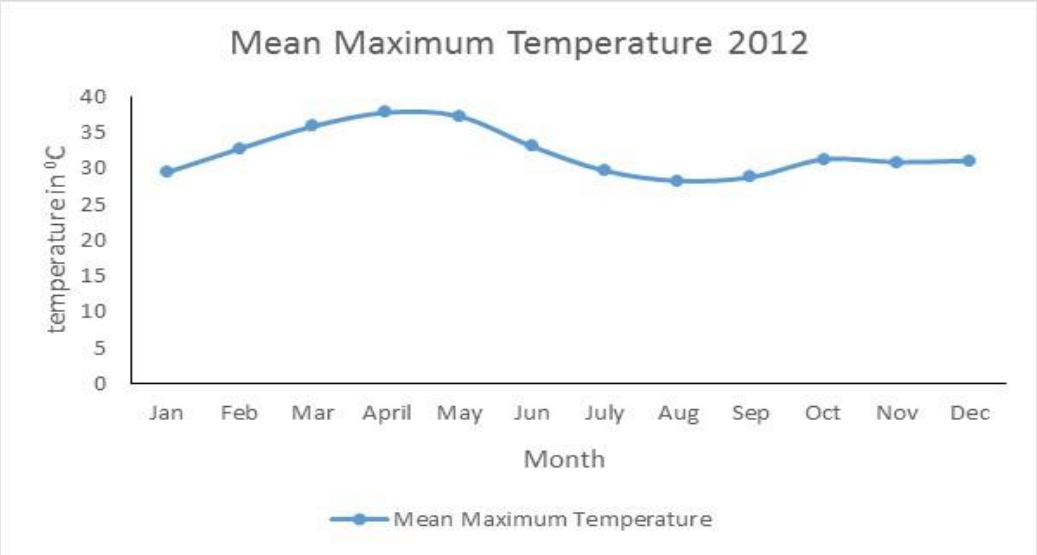


Figure No. 2.12 Mean Maxi. Temp. 2012

The temperature and other metrological data at Agricultural Research Station at Shirur tahsil may be taken as a representative of the conditions over the tahsil as a whole. Temperature means atmospheric temperature. Indirectly the sun is the major source of atmospheric temperature. Temperature is one of the element of climate and

it plays important role in germination of the seed and growth of plant. April and May are the hottest months in the tahsil.

2.6.3 Humidity:

Water vapor in the atmosphere is known as humidity. Water from different water bodies like oceans, sea, river, lake and snow and soil moisture is evaporated continuously. Similarly, water is transpired and subsequently evaporated from the plants, trees and forest vegetation. The percentage of water vapor in the atmosphere is highly variable and changes according to season and place. Normally 1 Percent moisture is assumed in the atmosphere; however, it can be up to 4 Percent by volume. The ratio of actual vapor pressure to saturated vapor pressure under fixed conditions of temperature expressed in the percentage is known as "Relative Humidity" which is used universally as a measure of humidity. Humidity is one of the prominent elements of weather from the farmers' point of view and plays a significant role in changing agro climatic conditions from place to place.

Fortanier (1957) has found that the rate of flowering of peanuts increase with increase I humidity. High humidity at night is considered most beneficial to the growth and maturity of plants. During the dry summer, crops often exhibit a distinctly different growth response to showers that are by low humidity (Chang, 1968). Humidity, cloudiness and frost conditions are interrelated elements of climate influence fruit farming. Frost at the time of flowering is injurious to plants. A Mango trees does not bear adequate fruit if humidity is high throughout the year (Singh, 1969).

Humidity of the air refer to the content of water vapor present in air at particular time and place. Water vapor present two percent of the total composition of the atmosphere but this percent various both spatially and temporally as it ranges from 0 to 5 percent. The atmospheric humidity is obtained through various process of evaporation from the land water surface of the earth. The atmospheric humidity is expressed in number of ways absolute humidity, specific humidity, relative humidity etc.

Table No 2.4 Relative Humidity in Percentage

Sr. No	Month	Relative Humidity in Percent
1	January	32
2	February	21
3	March	17
4	April	26
5	May	30
6	June	58
7	July	72
8	August	76
9	September	72
10	October	57
11	November	43
12	December	40
Average		**45.3**

(Data Source IMD, Pune.)

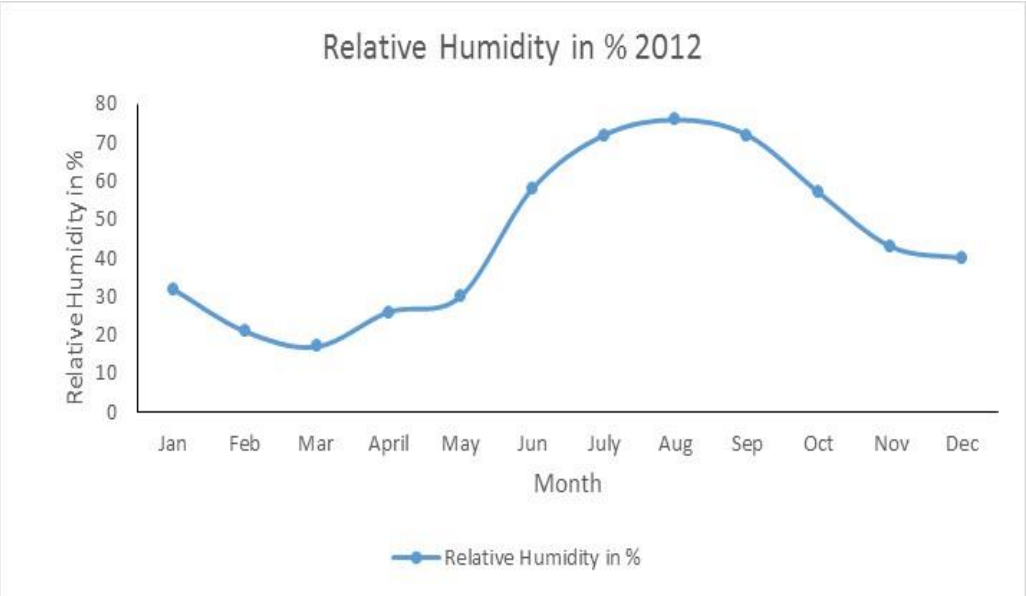


Figure No.-2.13 Relative Humidity in Percent

Relative humidity is defined as a ratio of the amount of water vapor actually present in the air. It has definite volume temperature to the maximum amount of the air can hold. Relative Humidity is expressed in percentage. In the study area relative humidity is higher in the month of June to September in the period of south west

monsoon. After September relative humidity decreases gradually during the months of May.

2.6.4 Wind:

The direction of wind is between South west to North east in June to September months. In the winter season wind blows from North east direction during October to February. In the months of March to May wind is strong and dry. Upper part of the Shirur tahsil has wind cool and wet comparatively low laying study region.

2.6.5 Seasons:

a. The Hot season (March to May)
b. The Rainy season (October to November)
c. The Post Monsoon Seasons (December to February)

2.6.5.1 The Hot Season (March to May)

The beginning of March month and the end of May witnesses continuous increase in temperature. During the summer season, due to continuous rise of temperature many important changes take place over the study. The lower part of Shirur Tahsil has a higher temperature in the summer season than upland part of Kannur Mesai, Pabal, Takali Haji, and its surrounding area. May is the hottest month in the tahsil. During these months a very small amount of rainfall occur in the study area.

2.6.5.2 The Rainy Season (October to November)

The rainy season from start of June to the end of September. In the study area rainfall is erratic and uneven. The rainfall in the second week of June is the advent of the south west monsoon winds. The months of July, October, are the highest rainy months.

2.6.5.3 The Post Monsoon Seasons (December to February)

The cold season is from December to end of February. The December and January months are the coldest months in whole year. The direction of the winds is mainly from the North- East.

2.7 Natural Vegetation:

Forest is the renewable natural resource and it is the most striking feature of the landscape. Indirectly the forest ameliorates the extremes of climate, regulates the flow of rivers and checks soil erosion, controls floods and other determining factors affecting the soil. Thus, no one can deny the importance of forest in the regional ecology as well as in the economy (Mamoriya, C.B., 1973).

The natural vegetation reflects the influence of climatic factor and it is therefore surprising the vegetation zones coincide closely with climatic zones. Forest cover is directly dependent on temperature, rainfall and soil types. It gives raw material and by-products to agro-based industries. Dry mixed deciduous forest are found in the study region. The hilly portion of west side is covered by forest in Takali Haji Kahannur Masai, Shikrapur, Koregaon Bhima, Pabal. Small patches of forest are found in Shirur tahsil. The largest forest cover is identified in Vadgaon, Nagargaon, Mandavgan, Andalgaon, Ranjangaon Sandas, etc. areas.

Open Forest is areas of mostly barren and vegetation has been degraded due to human interference like garaging, cutting fire wood, timber etc. are found in this region The growth of forest in this area is poor. The trees like Bar, Hiver, Palas, Khair etc. are found in this region the patches indicate the ecological potential of biodiversity in the region.Dry deciduous forest is observed in eastern part of tahsil. The species include Anjan, Apta, Babal, Bhokar, Bor, Bundara, Chinch, Pimpal, Neem etc.

2.8 Irrigation:

Water is a significant input for successful agriculture. Water may be available to crops in the natural course by rainfall or it may be supplied to the agriculture field artificially by human efforts. In the study area of supplying water to crops by artificial means such as canal, well, tub well, tanks etc. from the source of the water such as river, tank, ponds, of underground water is called irrigation. Irrigation plays important role for agriculture development in region. Nowdays agriculture production increased due to use of irrigation facility. It has built up left and right canal system. Therefore, the land under cash crop has increased. The study area is includes main source of irrigation like well, tub well, canal and tank etc. The Dams like Chinchani has been constructed. Upstream of Ghod have improved the availability of water resources for agriculture in the extra monsoon season.

Canal irrigation is important factor in agriculture. The tehsil covers four major canal system sush as, Chaskaman, Dimbe, Mina and Ghod Canal provide water to major proposition area.

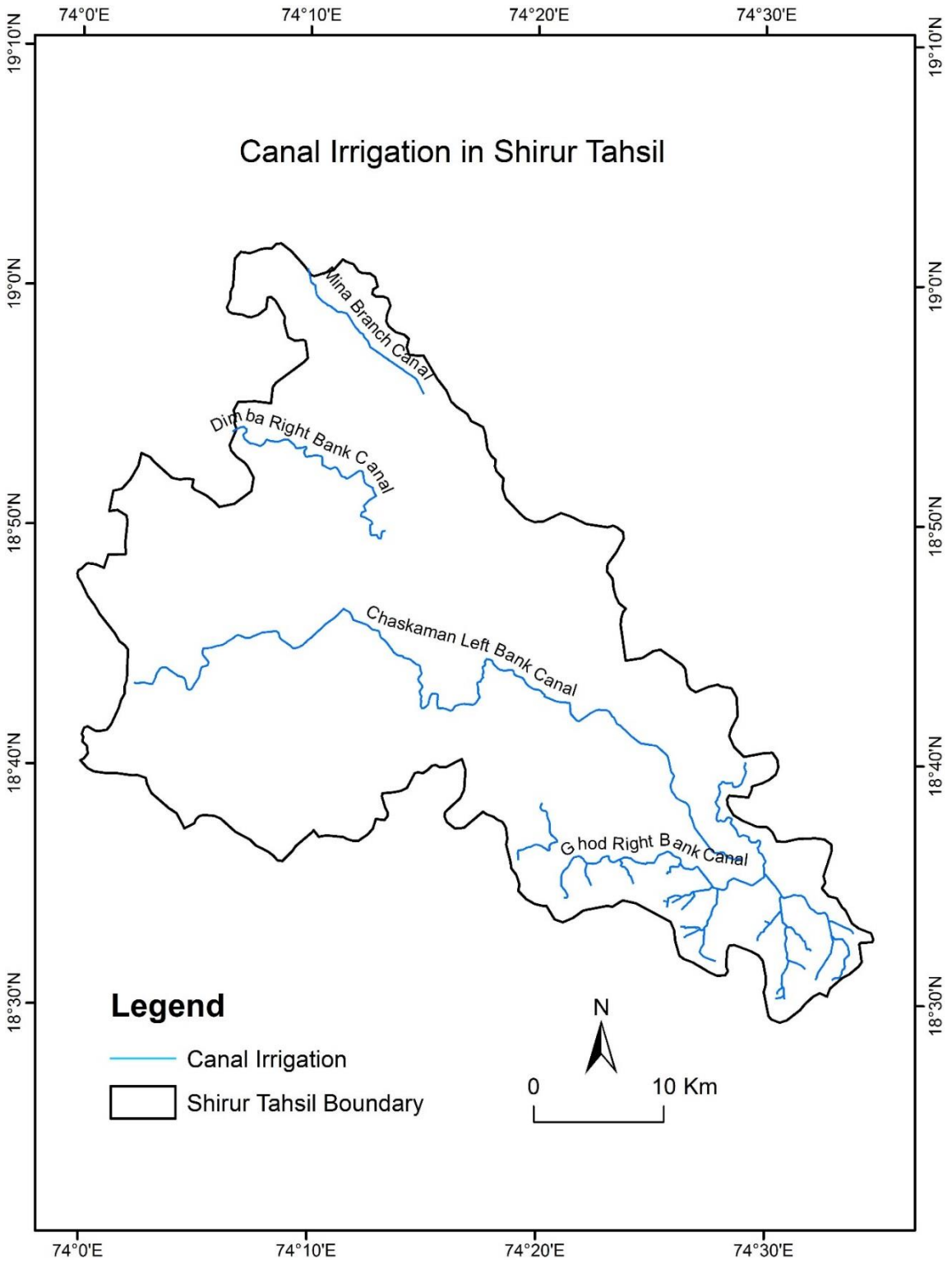


Figure No.-2.14 Canal Irrigation Map (Source: SOI Toposheet)

2.9 Transportation

In there is only one state road and the total length of this MSH 5 is 45 km which connects Pune –Aurangabad. Shirur is located on Pune –Ahmednagar Major State Highway (MSH) 5. It is only 67 km from Pune and 55 km from Ahmednagar. Koregaon Bhima, Sanaswadi, Shikrapur, kondhapuri, Ranjangaon, Khandale, Pimpri Dumala, Kardilwadi, Ganegaon, Karegaon, Saradwadi and Shirur villages are located on this MSH 5. State Highway 55, 103, 117, 118, 128 and 129 are well distributed in the study area. Shikrapur, Ranjangaon, Shirur, Nhawara, Malthan, Kawathe, Kanhur and Pabal villages are well connected by MSH and State Highway (SH).

The network of road transportation provides more potentials of tourism development to these villages mainly Ranjangaon, Shikrapur and Shirur. There are also other motorable roads from Ghodnadi to Kawathe, Kendur to Shikrapur and Ghodnadi to Andhalgaon.

ROAD NETWORK IN SHIRUR TAHSIL

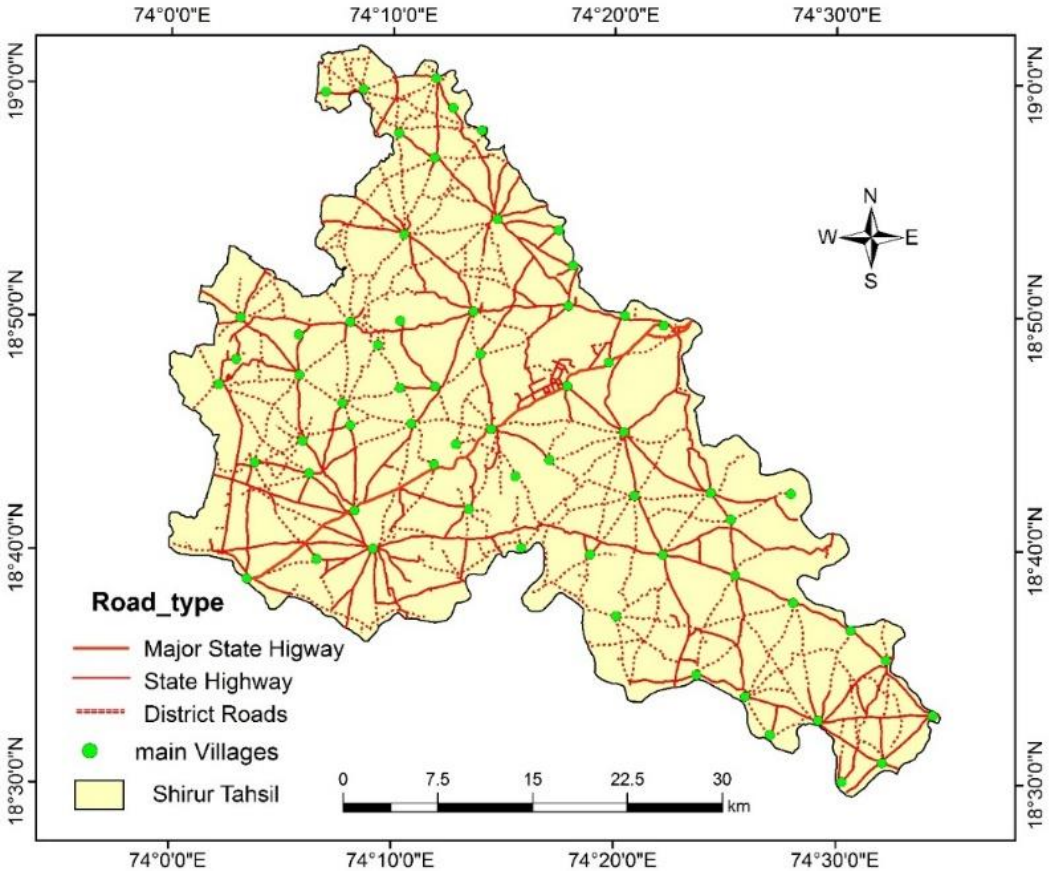


Figure No.-2.15 Road Network in Shirur Tahsil

(Source: SOI Toposheet)

2.10 Population:

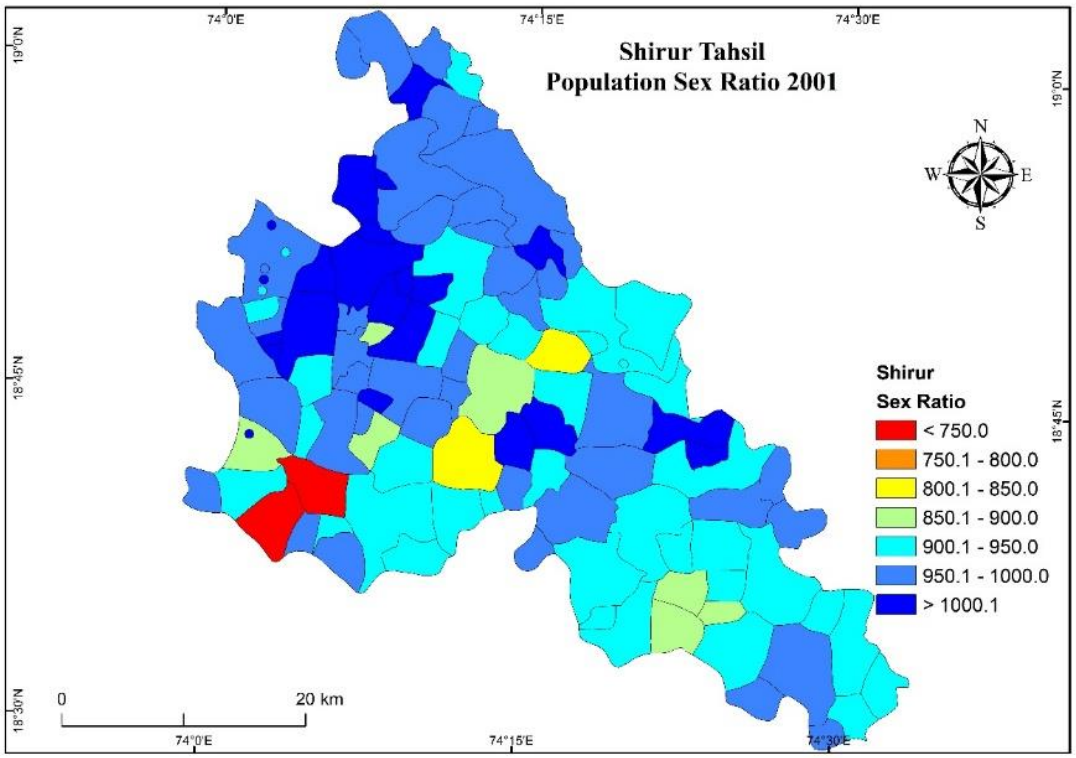
It is the study of the ways in which spatial variations in the distribution, composition, migration, and growth of populations are related to the nature of places. Population geography involves demography in a geographical perspective. It focuses on the characteristics of population distributions that change in a spatial context.

2.10.1 Sex Ratio:

The numerical measurement of sex composition of a population is often expressed in terms of sex ratio. This ratio is calculated differently in different countries. The term of sex ratio has been used to represent number of female per thousand male. The sex composition of population is the basic demographic characteristic depending on directly incidence of birth, death and marriage. The sex ratio consists of three factors. Many sex ratio of birth differently in mortality of two sexes and sex selectively among migrants. The change in sex composition is largely reflecting the underlying socio-economic and cultural patterns of society. The ratio between male and female is called as sex ratio. In India, sex ratio defines the number of females per 1000 males in the population. The abortion of female is the main reason for the low sex ratio. A strong attitude towards son preference continues in Indian society (Gupta et. al 2003). The lowest sex ratio recorded in Koregaon Bhima and Sanaswadi village which is below 700 because urbanization and industrialization. The most of the out migrate people come for job opportunities. In the study area highest sex ratio is observed including KhaireNagad, Golegoan, Chavanwadi, Khairewadi, Kahnnur Mesai, Chandoh etc.

Overall, Shirur tahsil has decline in sex ratio from 2001 to2011.The girl child was discriminated earlier also and a boy's birth was celebrated with greater joy. People could intervene and terminate a pregnancy, when a women was found to be pregnancy with a girl child (Kavr 2011). Nowadays sex selective abortion has become the primary method used to after the sex composition of population. The abortion of female is the main reason for the low sex ratio. A strong attitude towards son preference continues in Indian society (Gupta et. al 2003). The main reason for son preference is that the son lends support to his parents in their old age, fetches a large amount of dowry at the time of marriage, the amount spent on the bringing up and career result in multiplication of their money and as per Hindu belief, he is required to perform the last rates of his parents.

Figure No.-2.16 Sex Ratio 2001



(Data Source census of India2001&2011), Computed by researcher,

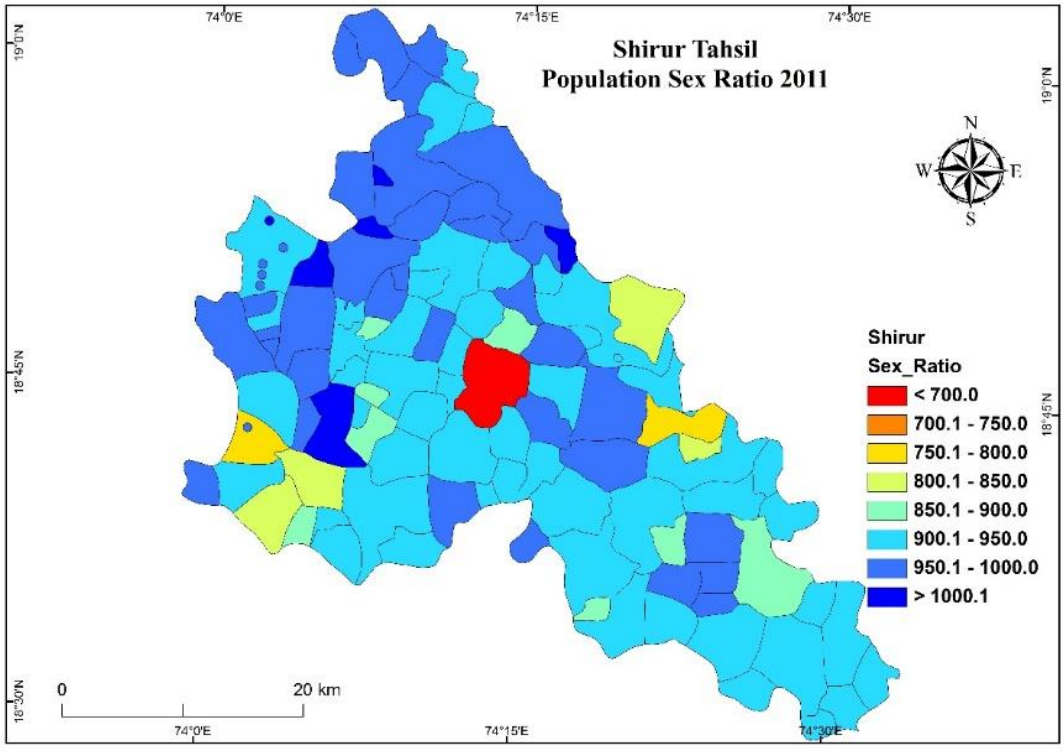


Figure No.-2.17 Rex ratio 2011
(Data Source census of India2001&2011), Computed by researcher

2.10.2 Growth of population:

According to the 1981 census the population of Maharashtra was 62.8 million. As per the 2001 census, the population of Maharashtra was 96.75 million making it the second most populous state in the country, after Uttar Pradesh. In 1981 the study region had a population of 7, 80,891 and in 2001, it was 868825. The growth of population in any area is an index of its economic development, social awaking and many other characters (Chandana R.C. and Siddhu M.S., 1980). Growth of population is one of the significant factors associated with human occupancy. In other words, it flows in size from time to time and people migrate temporarily or permanently both within the administrative boundaries and across them (Bajaj Nirmal, 1963).

Population Growth Rate in Shirur Tahsil (Growth rate in Percentage)
Total Population (growth rates)
Table No. 2.5

Sr.no.	Population parameter	2001	2011	Growth Rate in percent
1	Total population	385414	310590	24.90
2	Male Population	160583	201152	25.26
3	Female population	150007	184262	22.00

(Source: -India Population Censes (2001 & 2011), computed by researcher)

The formula used to calculate the growth rate of population is given below:

$$r = \frac{Pn - Po}{Po} \times 100$$

Where,

r = Growth rate of population

Pn = Current year population

Po = Base year population

The previous table shows that the male population growth (24.9%) is higher than female population growth (22%) from 2001to 2011. The study region's has population growth rate is high than Indian national average and that of Maharashtra State.

2.11 Settlements:

A network of settlement is a primarily agrian society is bound to be different from that in an industrial society due to basic differences in the needs of the two situation (Chandana, 2008) In most of the Indian villages, street and lanes are so crooked and dwelling are arranged in such an irregular manner, that the villages do not possess well defined shapes and no specific patterns of rural settlement is observed. In the study area most of the settlement situated in left bank and right bank of Ghod river channel. The north western and north eastern site of 45 tahsil have sparsely population settlement. Along the foot hill settlement are located. As the north western and north east part of tahsil shows uneven topography and hilly area mainly rural settlement of dispread pattern. The major Settlement are Shirur city, Talegaon Dhamdhre, Nhavara, Mandavgaon Farata. Vadgaon,, Rasai, Malthan, Pabal, Takali Haji, Shikarpur, Koregaonbhima, Sanaswadi, Ranjangaon, Karegaon, Sanaswadi, etc.

The lower part of tahsil has plain area therefore population density is high. Many large number of villages are situated in this region in the one urban center Shirur, physiographical, climatic factor have influenced on distribution of population and settlement patterns.

2.12 Weekly Market Centers:

In defining the weekly market centers in country like India, which is undergoing the process of development and where socio-economic bonds of the societies are very rigid, one has to be careful in defining a market center. A market center is an authorized public gathering of buyers and sellers of commodities meeting at an approved place at regular intervals (Hodder B.W., 1965). Rural markets not only facilitated economic transactions, but also bring about a flow of ideas. People from different villages come to a market place with goods and news.

These periodic gathering, thus provide a medium of mass communication in addition to their primary functions of presenting a channel for the agricultural and other commodities (Bromwich K.L., and Chaudhari K.K., 1972). The tahsil has rural areas weekly market where the major sources are provided to people facility. The major markets are Shirur city, Talegaon Dhamdhre, Nhavara, Mandavgaon farata. Wadgaon Rasai, Malthan, Pabal, Takali Haji, Shikarpur, Koregaon Bhima, Sanaswadi, Ranjangaon, Karegaon and Nimone etc.

2.13 Occupational structure:

In the present study area, most of the Population is engaged in primary activity such as agriculture, poultry farm, fishing, etc. Some people are engaged in small scale secondary industries and tertiary activities in Ranjangaon, Karegaon, Shirur city, Koregaon Bhima, Shikrapur, Sanswadi and Kondapuri. Occupational structure of any region determines the level of economic development. This occupational structure shows the employment status of particular area. Working and non-working population determine the stage of economy. Agricultural laborers are the main workforce in study region.

2.14 Summary:

The present chapter deals with the profile of physical and socio-economic aspects in the study area, namely relief, drainage, soil types, climate, irrigation, forest, transportation, population, settlement, and occupational structure in the study region. The Sahyadri mountain range lies from north to south in west part in the study region. Shirur tahsil constitutes an area of 155811 hectors. Ghod, Bhima and Kukadi rivers go through the tahsil from three directions Shirur Tahsil may be divided into two physiographic region according to altitude. The one is gently sloping belt along Ghod and Bhima there are two water divides; one divides the Ghod the Bhima basin while the other runs from west to east. The hilly zone locally called as Malran (open, non-cultivated land) shows that agriculture is poor.

The riverine belt along Ghod and Bhima occupy 40 percent area of the Shirur This region offers favorable situation for irrigation and hence agro based development, topographically it is almost a plain region with alluvial soil. The black colour of the soil is indicator of high fertility status. The generalized direction of slope is from Northwest to southeast in the Ghod River's basin of another direction of slope is from northwest to Southeast in the Bhima River. Shirur Tahsil is mainly drained by river Ghod. Ghod Rivers it is natural boundary is between Pune and Ahmednagar District. The Shirur city is located on the bank of the river Ghod and the river is non

The basaltic lava flows belonging to the Deccan traps of late cretaceous to palaeogene age and mainly of Upper Ratangarh and Indrayani formation stratigraphic status. The lava flows generally consist of "Pahoehoe" and "aa" type. Both "pahoehoe" and "aa" types are found in the Bhima and Bhama basin within the tahsil. Central part

of the Shirur Tahsil is covered by the Indrayani formation which comprises a thick succession of five “aa” basaltic lava with 50 to 180 m thicknes.

Most of the part of Takali Haji Circle and northern part Shirur Tahsil is of three compound pahoehoe flows with 50 -220 m thickness. The southern part of the Vadgaon Rasai Circle of Shirur Tahsil is bounded by river Bhima and it is also made up of the same geological strata. It is the upper Ratangarh formation which is observed in the valley of Ghod, Kukadi and Bhima Rivers. The five “aa” and compound pahoehoe basaltice lava flows with 50 to 220 m thickness and ten to fifteen “aa” and simple basaltic lava flows with 50 to 350 m thickness are found on a very minor scale in the circle of Pabal mainly in the western part of Shirur Tahsil.

Shirur Tahsil has very less diversified geomorphology. Geomorphologically it can be categorized into two categories – the middle level plateau and the older flood plain of Ghod, Bhima and Vel Rivers. Most of the part of Nahavra, Vadgaon Rasai and Talegaon Dhamdhere is made up of Bhima, Vel and Ghod Rivers older flood plain. Northern part of Pabal circle, western part of Shirur circle and Takali Haji circle have middle level plateau region while Nahavra, Vadgaon Rasai circles have older flood plain region.

Plain area is distributed along the bank of Bhima River that is the southern most part of the Shirur tahil and also at the confluence of Bhima and Ghod River in the south-eastern part of the Shirur Tahsil. The height is ranging between 540 to 560 meters above the mean sea level. The maximum proportion of Vadgaon Rasai circle is occupied by plain area. The plateaus of 600 -750 m elevation are known as region of middle level plateaus. Such plateaus are located in the central and northern part of the study area. It is distributed in Takali Haji, Shirur, Nahavra and in the northern part of Talegaon Dhamdhere circle.

Slope of a land is one of the important physiographic aspects that influence the overall suitability of the natural elements. The southern and south-eastward slope of the study area has gentle and it is less than 5^0. The central part has occupied by the eastern offshoots of the Sahyadri ranges and this area has 5^0 to 10^0 slope with undulating topography. The eastern part of Shirur circle, southern and western part of the Takali Haji circle and the eastern part of Nahavra circle have 10^0 to 15^0 slope. The direction of the slope of this study region is from north-west to south-east.

It is observed in the narrow belt along the rivers Bhima and Ghod. This is nothing but the alluvial deposits subjected to the development of deep black soil. This

soil varies in depth from 5 to 20 feet. The crop cultivation is supplemented by irrigation. Vegetables, sugarcane, wheat, fodder crops are grown in this soil. Medium deep black soil is observed in Vadgaon, Mandavgaon, Sadalgaon, Babulsar, Koregav Bhima etc. villages. These soils are found between hilly tract and riverine belt. Deep brown colour Indicates good fertility status. These soils originate from alluvial deposits from the hilly tract.

The Shirur tahsil is well drained by Bhima, Ghod Rivers. The tahsil is a part of three major river basins such as Bhima, Ghod, and Vel River. Vel River is flowing through Pabal to Shikrapur and then Talegaon Dhamdere and then exits from the tehsil. This area is almost plain. The study of drainage can be systematically presented according to these two basins. Generalized slope of the area is from northwest to south. The rainfall in the tahsil is about 700mm to 1250mm.

The tahsil has part of three major basins of the rivers Bhima Ghod and Vel. Bhima observed in the tehsil is a part of upper Bhima basin as defined by Jog (1990). The course of the rivers Bhima and Ghod basin in the tahsil about 120km. & 75 km. respectively. The availability of water is only for eight months. Various Kolhapur types (K.T.) weirs constructed on the river provide the water for irrigation and drinking purpose.

The largest forest cover is identified in Vadgaon. Nagargaon, Mandavgaon, Andalgaon and Ranjangaon sandas etc. Open Forest is areas of mostly barren and vegetation has been degraded due to human interference like cutting fire wood, timber etc. The growth of forest in this area is poor the tress like Bar, Hiver, Palas, Khair etc. the patches indicates the ecological potential of biodiversity in the region. Dry deciduous forest is observed in eastern part of tehsil, the species include Anjan, Apta, Babal, Bhokar, Bor, Bundara, Chinch, Pimpal, Neem etc.

In there is only one state road and the total length of this MSH 5 is 45 km which connects Pune –Aurangabad. Shirur is located on Pune –Ahmednagar Major State Highway (MSH) 5. It is only 67 km from Pune and 55 km from Ahmednagar. Koregaon Bhima, Sanaswadi, Shikrapur, kondhapuri, Ranjangaon, Khandale, Pimpri Dumala, Kardilwadi, Ganegaon, Karegaon, Saradwadi and Shirur villages are located on this MSH 5. State Highway 55, 103, 117, 118, 128 and 129 are well distributed in the study area. Shikrapur, Ranjangaon, Shirur, Nhawara, Malthan, Kawathe, Kanhur and Pabal villages are well connected by MSH and State Highway (SH).

The abortion is the main reason for low sex ratio of female. The lowest female sex ratio recorded in Koregaon Bhima and Sanaswadi village's below 700 Sex ratio as compare 1000 male population.

In the decade of 2011 total population increased by 24.9 per cent. The study region has population growth rate higher than National as well as Maharashtra state.

The major markets are Shirur city, Talegaon dhamdhre, Nhavara, Mandavgaon f. Vadgaon Rasai, Malthan, Pabal, Takali haji, Shikarpur, Koregaon Bhima, Sanaswadi, Ranjangaon, Koregaon and Nimone etc.

In the present Study area most of Population are engaged in primary activity such as Agriculture, poultry farm and fishing etc. Some peoples are engaged in small scale secondary industries and tertiary activities are more dominant in Ranjangaon, Koregaon, Shirur city, Koregaon Bhima, Shikrapur, Sanaswadi and. Kondapuri.

CHAPTER – III

GENERAL LAND USE LAND COVER OF STUDY AREA

3.1 Introduction:

Agricultural is the backbone of Indian economy. It is important of all the economic activities of man. Land use and land cover is an important component for understanding the interactions of the human activities with the environment changes. The concept of land use has been defined by Saver (1919) as the use to which the entire land is put. Vink (1975) has described land use as any kind of permanent or cyclic human intervention to satisfy the human needs, either material, or artificial resources which together are called the land. Change detection is the process of identifying differences in the state of an object phenomenon by observing it at different times (Singh, 1989). Mohammad and Adam (2010) investigated the effects of different vegetation types on runoff generation and soil erosion. The results indicated that there are significant and important differences in runoff generation and sediment production with respect to the different types of vegetation cover. Desai et al. (2009) stated that technologies of Remote Sensing (RS) and Geographic Information System (GIS) can play an imperative role to explore the study of Urbanization growth of Pune city using RS data and GIS.

3.2 Image classification:

In this Digital Images Classification is identified to help in the delineating and mapping of the Land Use and Land Cover into a various number of classes. Such as Water body, Vegetation, Cropland, Fallow land, Barren land and Settlement.

The changes in land use and land cover in Shirur Tahsil over the span of 13 years (2001 to 2013). The present study uses three time data of Remote Sensing. The study will try to find out the changes in land use and land cover during the last 13 years. There are six classes of land use and land cover in the study area. The tahsil was classified using Supervise classification technique. In Shirur tahsil, the distribution of land use and land cover include Water body, Vegetation, Cropland, Fallow land, Barren land and Settlement. The land use and land cover images show the spatial and temporal variation in the study area. Studded at Landsat ETM+ images of March, November 2001 and March, November 2013 were used to test the supervise classification.

3.3 Methodology and Data:

The Remote Sensing techniques is used in Shirur Tahsil for analyzing land use and land cover changing pattern. The images of the geo-referenced using Topo sheet of study area. In this study, use of unsupervised and supervised image classification is

done for detecting Land use and Cover classes. Landsat ETM+ images of March, November2001 and March, November 2013 were used to test the Supervise classification. Supervise classification involves developing training patterns using unsupervised classification followed by classifying the pixels using supervised classification. The technique utilizes the spectral recognition of the unsupervised classification in the performance mode and the selection of sampling sites from a Principal Component Analyzed image of the supervised classification in the training mode. The classified images are verified its accuracy. The unsupervised and supervised classification algorithms are used the generalized form of Heckbert quantization and Maximum Likelihood (ML) respectively.

Table No. -3.1 Types of Satellite Image

Date of acquisition	**Type of satellite image**	**Spatial resolution (m)**
19Nov.2001	Landsat-7 Enhanced Thematic Mapper plus (ETM+)	30
25 March 2001	Landsat-7 Enhanced Thematic Mapper plus (ETM+)	30
31March 2013	Landsat-7 Enhanced Thematic Mapper plus (ETM+)	30
28 nov.2013	Landsat-7 Enhanced Thematic Mapper plus (ETM+)	30

Database:

The researcher has used primary data sources and secondary data sources in this study. The primary data is collected through survey uses dissection of people, questioner's method. And Secondary data collected from the government offices, such as agricultural department, and Gram panchayat Office.

3.3.1 Filed work:

Using in Field Survey method first is choice of the topic and second is Primary field visit study area to select locations and I have studded in literature survey then collection of the Topo sheets. Lastly Preparation of base map and database

Firstly, the researcher selected the topic by studying the available literature. Secondly, the researcher visited the identified the location and then prepared the base map and the database of the selected region.

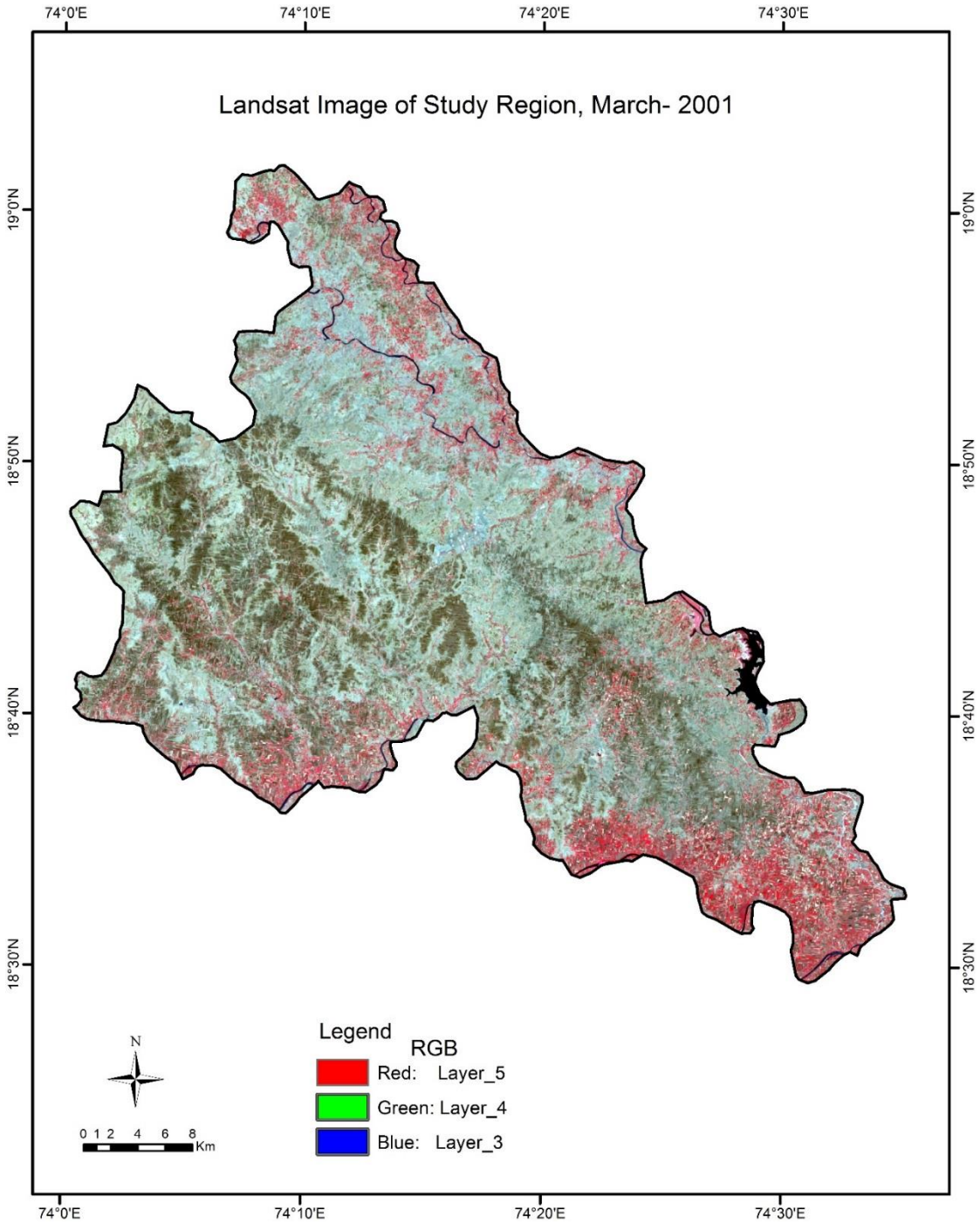


Figure No. - 3.1 Satellite Image March 2001

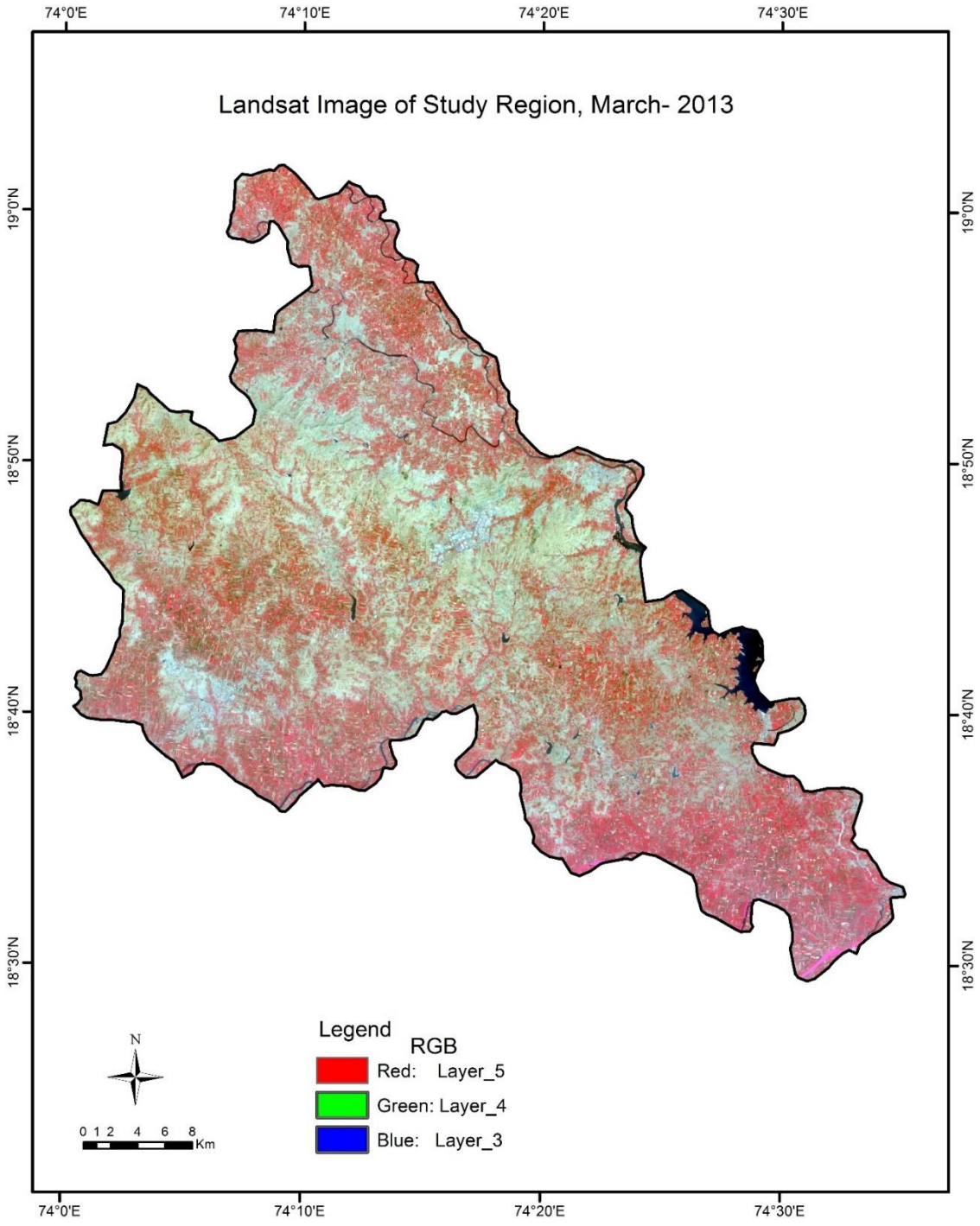


Figure No. - 3.2Satellite Image March 2013

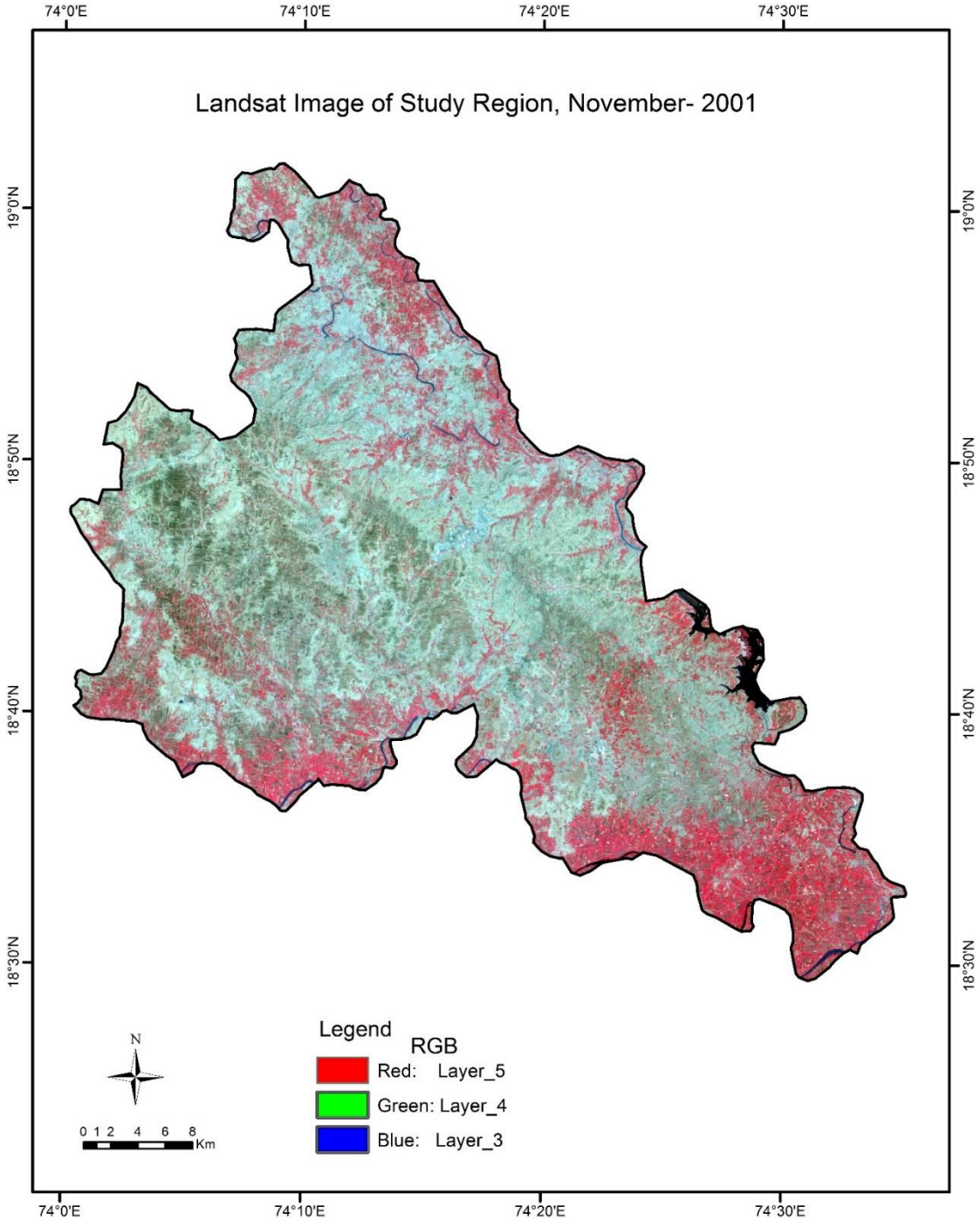


Figure No. - 3.3 Satellite Image Nov. 2001

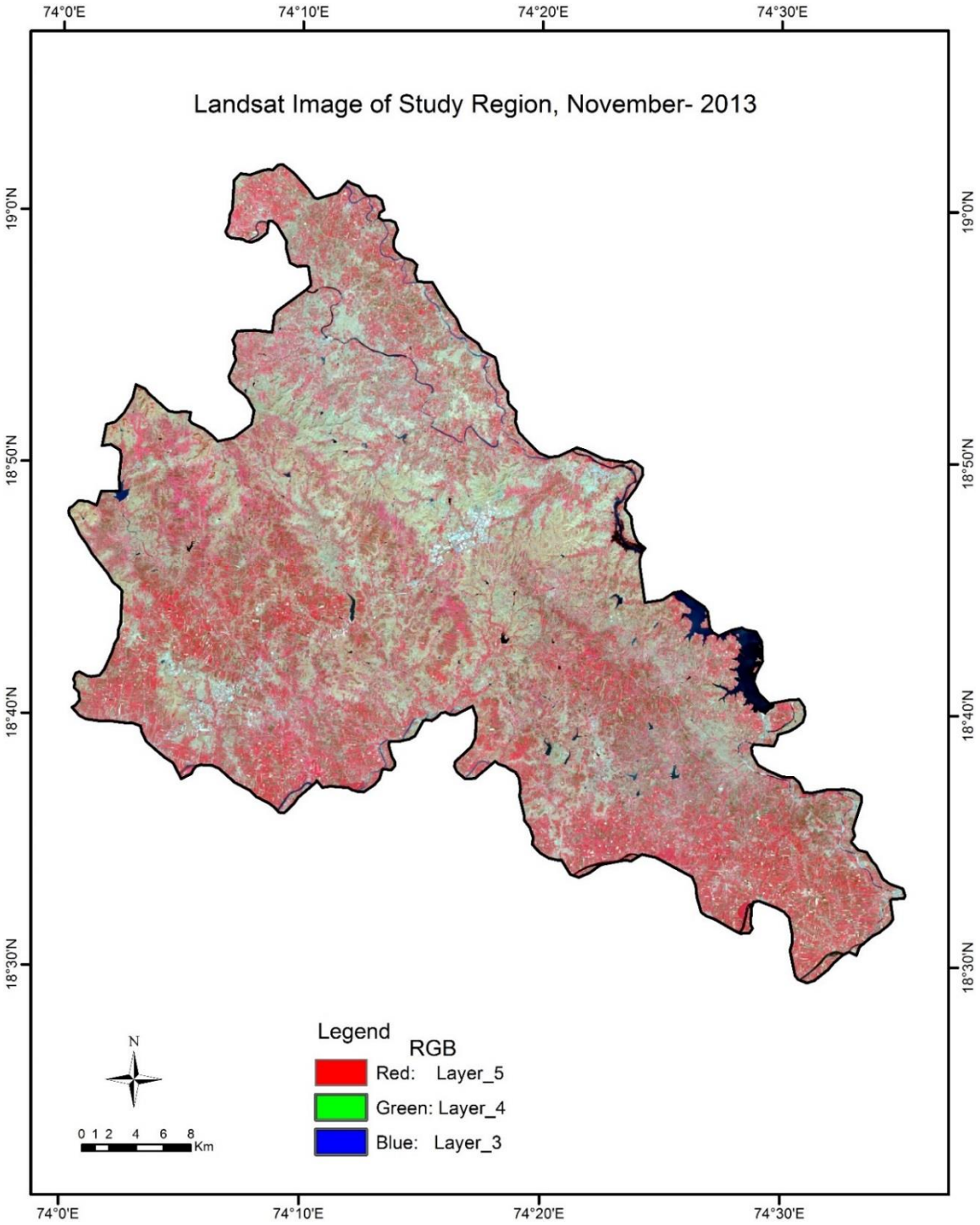


Figure No. - 3.4 Satellite Image Nov. 2013

3.4 Results and Discussion:

In this study, land use and land cover maps are used for change detection analysis. The Shirur Tahsil was classified using GIS technique in to six classes of Land use and Land cover. The composition and distribution of land use and land cover classes are such as Water body, Vegetation, Cropland, Barren land, Fallow land, and Settlement. The land use and land cover map shows the spatial and temporal variation in the area. Vegetation is environmentally significant in land use and land cover of the study area. Vegetation cover is the most important element for protecting the environment because its role of ecological balance. Vegetation are rarely found in the central and eastern parts of the study area. Barren land is the land of limited ability to support life and over which less than one-third of the area has vegetation or other cover. The finding reveals that there was a drastic and rapid increase in the built up area and decrease in agriculture area.

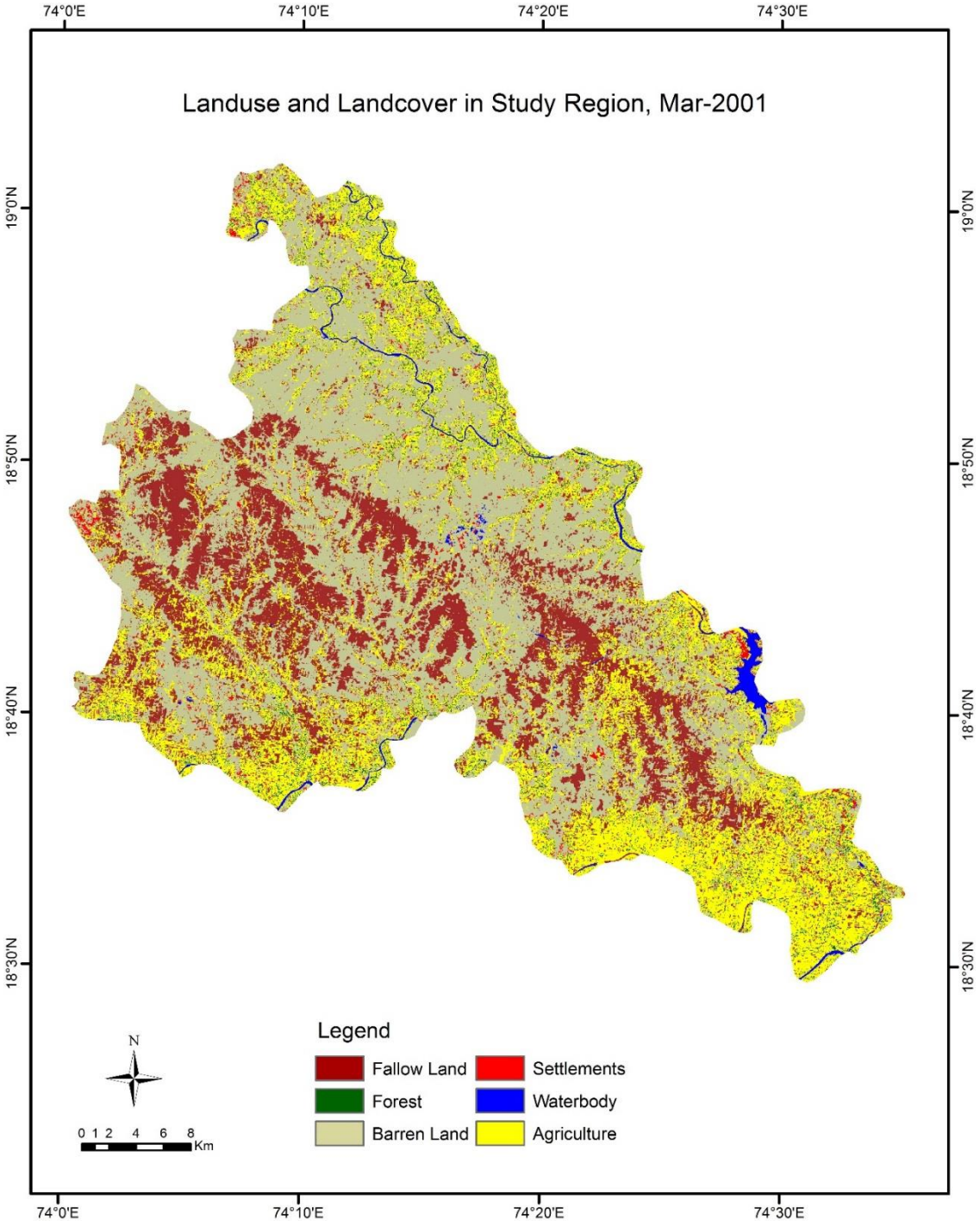


Figure No.- 3.6 Land use & land Cover March 2001

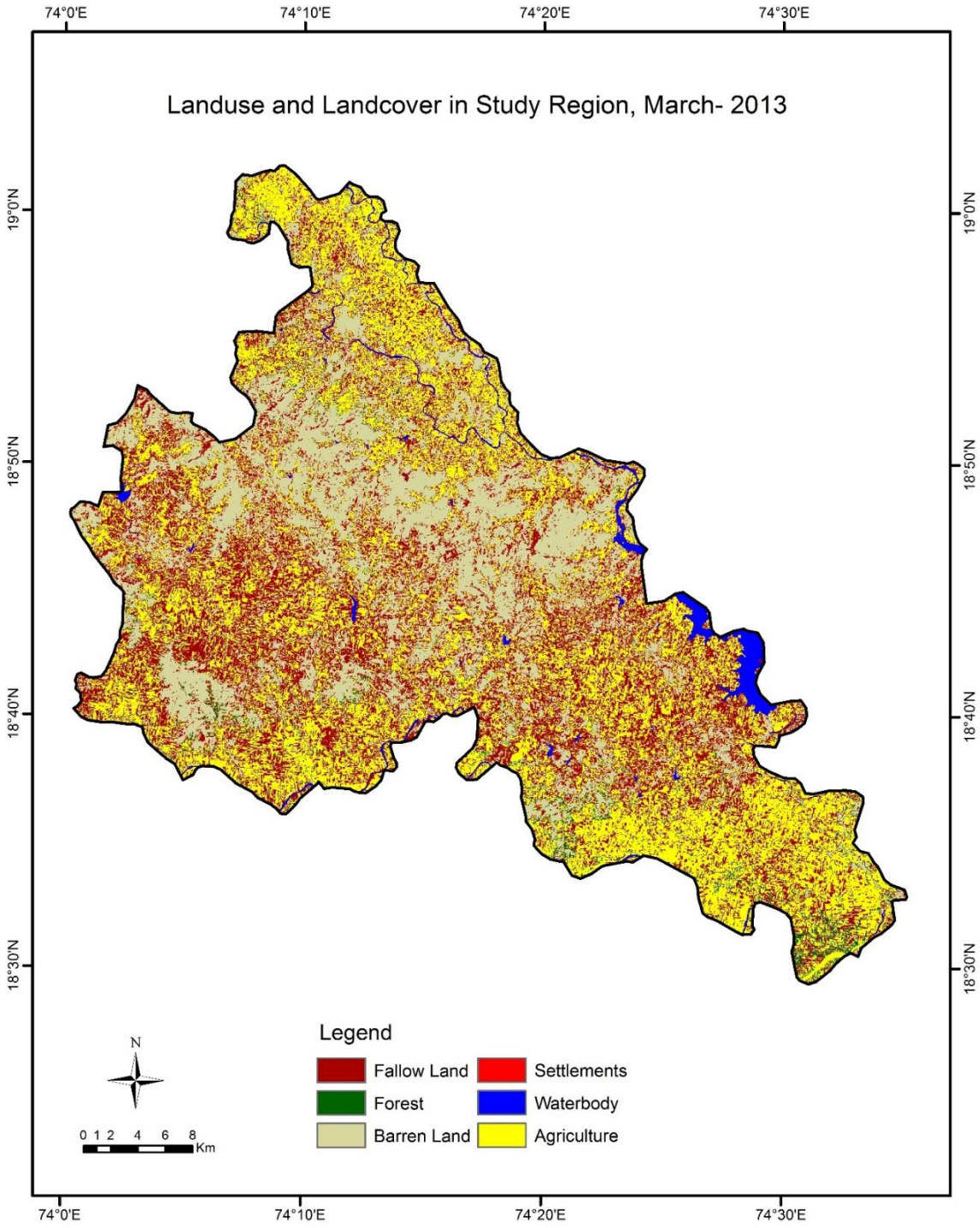


Figure No. - 3.7 Land use & land Cover March 2013

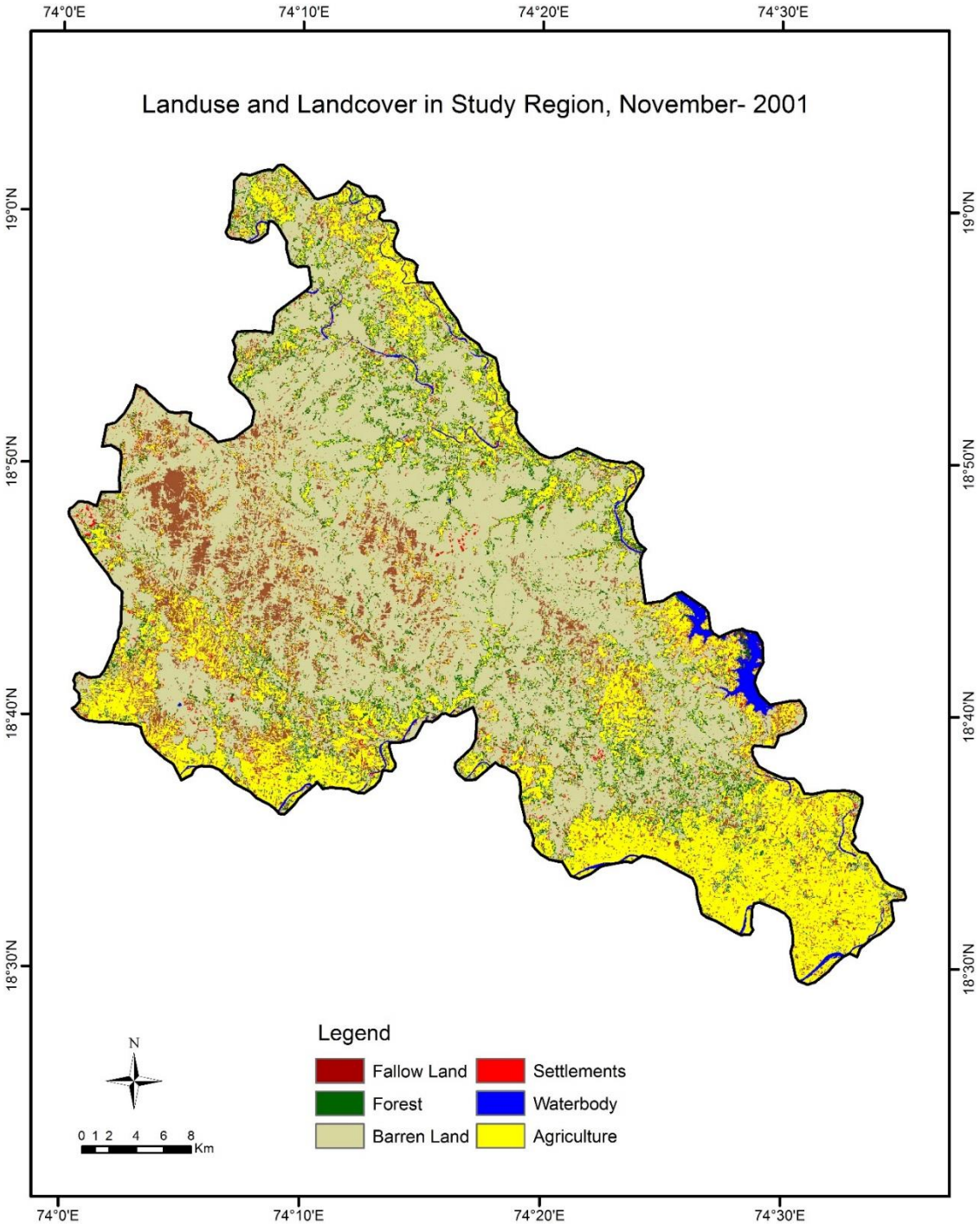


Figure No. - 3.8 Land use & land Cover Nov. 2001

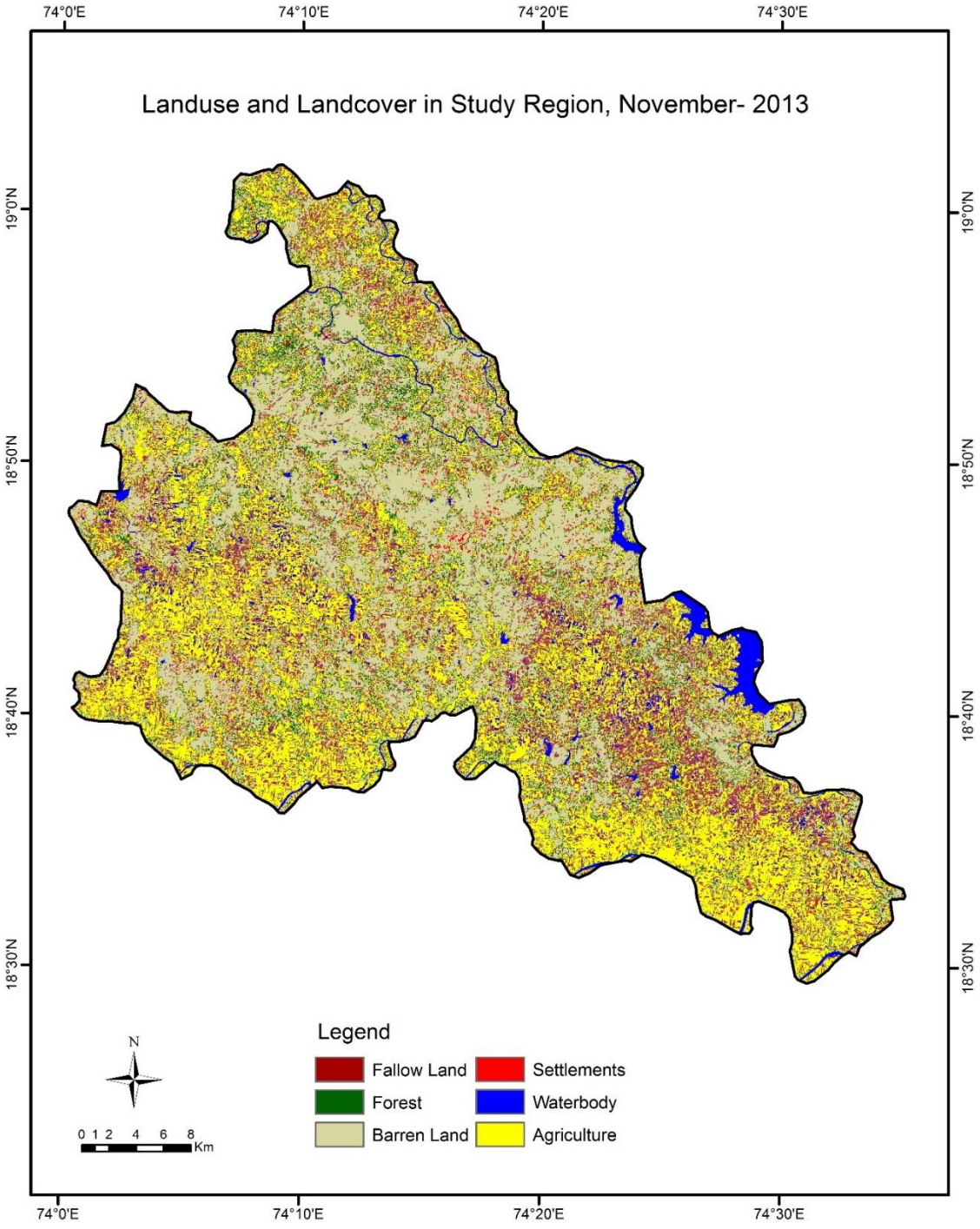


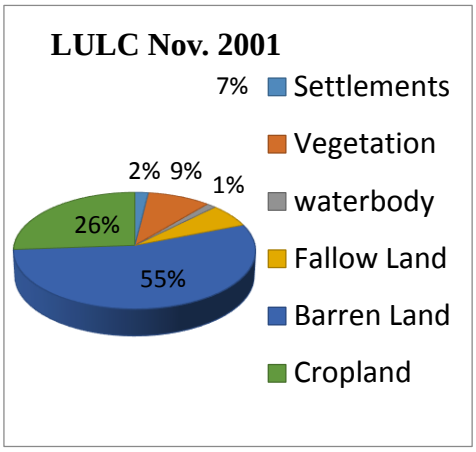
Figure No. - 3.9 Land use & land Cover Nov. 2013

Table No.- 3.2 Satellite Images Nov.2001 Results

Nov.2001			
sr.no.	**Land use**	**Area(Sqkm)**	**Area (%)**
1	Settlements	30.49	1.96
2	Vegetation	143.12	9.22
3	Waterbody	21.52	1.39
4	Fallow Land	101.02	6.51
5	Barren Land	850.28	54.78
6	Cropland	405.63	26.13
	Total	1552.06	100.00

(Computed by Researcher)

Figure No.- 3.10Satellite ImagesNov.2001 Results



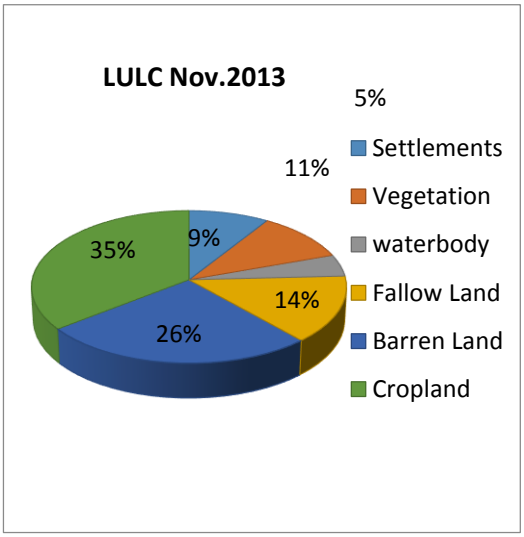
(Computed by Researcher)

Table No.- 3.3Satellite Images Nov.2013 Results

Nov.2013			
sr.no.	**Landuse**	**Area(Sqkm)**	**Area(%)**
1	Settlements	139.81	9.01
2	Vegetation	164.11	10.57
3	waterbody	71.93	4.63
4	Fallow Land	220.33	14.20
5	Barren Land	404.24	26.05
6	Cropland	551.52	35.54
	Total	1551.94	100.00

(Computed by Researcher)

Figure No.3.11Satellite Images Nov.2013 Results



(Computed by Researcher)

Tabale No.- 3.4

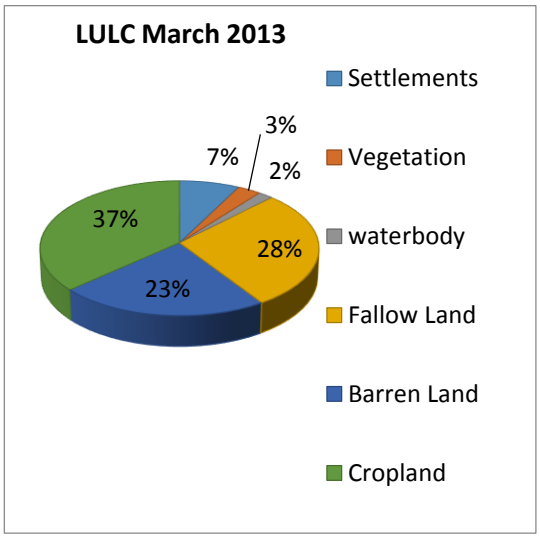
Satellite Images March 2001 Results

March. 2001			
sr. no.	**Landuse**	**Area (km^2)**	**Area(%)**
1	Settlements	33.60	2.164935
2	Vegetation	55.33	3.565054
3	Waterbody	18.51	1.192647
4	Fallow Land	331.48	21.35811
5	Barren Land	713.03	45.94236
6	Cropland	400.06	25.7769
	Total	**1552.01**	100.00

(Computed by Researcher)

Figure No.-3.12

Satellite Images March 2001 Results



(Computed by Researcher)

Table No.- 3.5

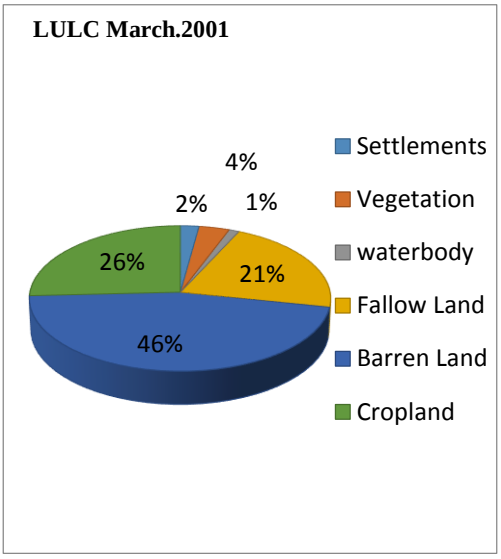
Satellite Images March 2013 Results

March.2013			
sr. no.	**Landuse**	**Area (km^2)**	**Area(%)**
1	Settlements	117.24	7.53
2	Vegetation	45.61	2.93
3	Waterbody	29.38	1.89
4	Fallow Land	441.69	28.37
5	Barren Land	352.97	22.67
6	Cropland	566.04	36.61
	Total Area	1552.92	100.00

(Computed by Researcher)

Figure No. 3.13

Satellite Images Marc 2013 Results



(Computed by Researcher)

3.5 Results and Discussion:

The Shirur tahsil has classified supervise classification technique in to Six Land use and Land cover classes. The composition and distribution of land use Land cover classes of image included Water body, Vegetation, Cropland, Fallow land, barren land and Settlement. The study areas land use and land cover map shows the spatial and temporal variation. The finding reveals that there was a drastic and rapid change increase in the built up area and decrease in Cropland area.

The analysis of spatial changes explanation of urban settlement is taking place of the of prime agriculture land in the study area.

The area under the Settlement is 9.01 sq.km in November 2001, 139.81 sq. km in November 2013 and 33.60 sq. km in March 2001 and March 2013 (117.24 sq. km.). The study area is experiencing rapid changes because of the opportunity of available Jobs, strip developments along highways, transportation, power and communication facilities, shopping centers and complexes are included in this category. Rapid growth of human population and settlement attributed the increased growth in settlement coverage. The communication lines have also increased in total length and so the density of roads in the Tahsil has increased. The Settlements in the study area have increased from March 2001 and March 2013 because increase in population, therefore agricultural low laying area are converted in built up area in the study area. Ambale, Shikrapur, Jategaon, Ranjangaon, Shirur, Taklihaji, Sanaswadi, Karegaon, Nhavara, Mandavgaon Farata and other major villages are affected with the changes. These cities are rapidly increasing in population as well as built up area in the study region.

The barren land in November 2001 to November 2013 was respectively 850.28 sq. km and 404.24 sq. km. and March 2001 to March 2013 713.03 sq. km and 352.97sq. Km respectively. Because of canal and developed irrigation facility barren land was converted into fertile land. The Fallow land in November 2001 to November 2013 was respectively 101.02 sq. km and 220.33 sq. km. and March 2001 to March 2013s 331.48 sq. km and 441.69sq. Km respectively.

The Crop land in November 2001 to November 2013 was respectively 405.63 sq. km and 551.52 sq. km. and March 2001 to March 2013y 400.06 sq.km and 566.04 sq. km. respectively. Crop land is increase because irrigation facility and agro base industry is developed. The Vegetation cover suddenly increased in the span of 2001. But, in the 2013 the forest area decreased suddenly because of average Low rainfall, therefore fallow land in 2013 suddenly decreased as compared to 2001. The Fallow

land in November 2001 to November 2013 was respectively 6.51% and 14.20% and March 2001 to March 2013 21.35% and 28.37% respectively. Fallow land suddenly increased in the March 2013 and November 2013 because March months is the summer season. And available water facility is low of the in this season.

River, stream or lake, surface water means perennial and seasonal streams, lakes, ponds, marshes, water sources and other bodies of water. The Waterbody in November 2001 to November 2013 was respectively 21.52 sq. km and 71.93 sq. km. and March 2001 to March 2013 18.51 sq.km and 29.38 sq. km. respectively. Water bodies rapidly change because canal sare provide water in small tank, ponds and God dams. The water bodies in the Ghod watershed was 1.39% and 4.63% in November 2001 and November 2013. 1.19% and 1.89% in March 2001 and March 2013 respectively.

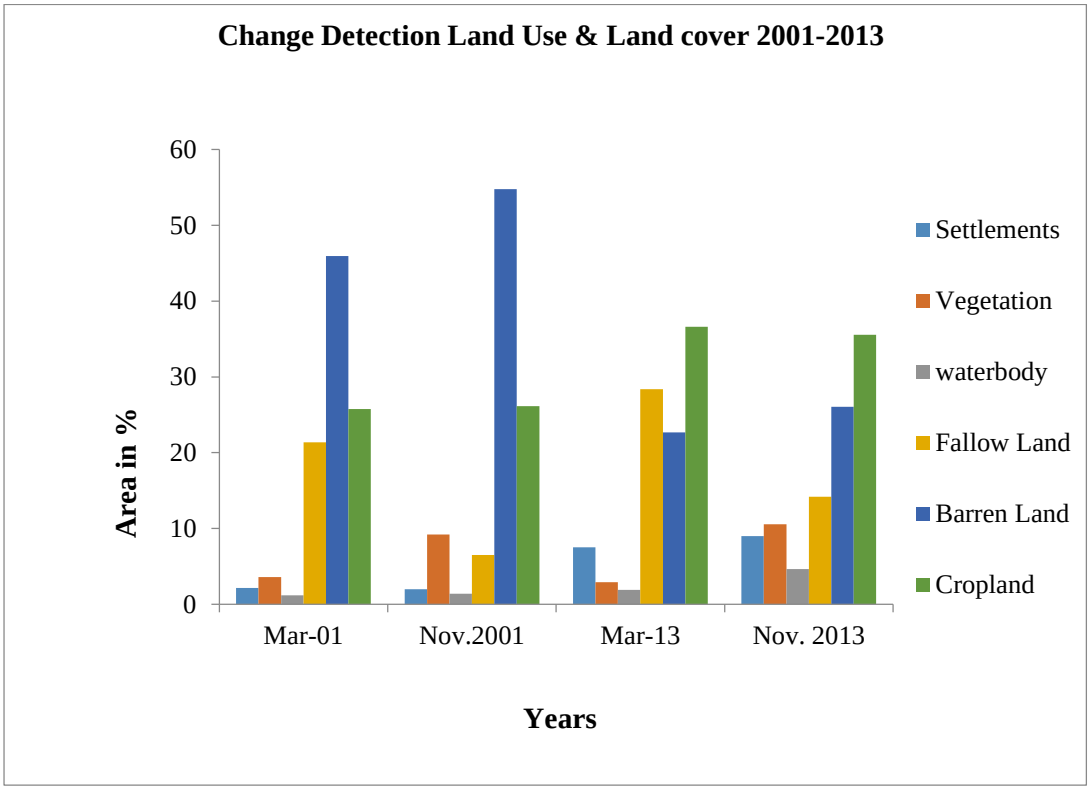
The Vegetation land in November 2001 to November 2013 was respectively 143.12 sq. km and 164.11 sq. km. and March 2001 to March 2013 55.33 sq. km and 45.61 sq. km. respectively. The changes of area in vegetation because effect on industrial and agricultural development. In the study area, Vegetation cover is good. It is above the average forest cover of India and Maharashtra. In the study area, forest cover was 9.22%, 10.57% and 3.56%, 2.93% respectively in November 2001 to November 2013. And March 2001to March 2013.

Table No.-3.6 Land use Land cover Change Detection Result Between 2001and 2013

		Area in Percentage (%)			
Sr. no.	Class Name	Mar. 2001	Nov.2001	Mar.2013	Nov.2013
1	Settlements	2.164935	1.96	7.53	9.01
2	Vegetation	3.565054	9.22	2.93	10.57
3	Water body	1.192647	1.39	1.89	4.63
4	Fallow Land	21.35811	6.51	28.37	14.2
5	Barren Land	45.94236	54.78	22.67	26.05
6	Cropland	25.7769	26.13	36.61	35.54
	Total	100	100	100	100

(Computed by Researcher)

Figure No.- 3.14 Land use Land cover Change Detection Result Between 2001and 2013



(Computed by Researcher)

Table No. 3.7Land use Land cover Change Detection Result Between 2001and 2013

Sr. no.	Class Name	Area in Percentage			
		Mar. 2001	Nov.2001	Mar.2013	Nov.2013
1	Settlements	2.164935	1.96	7.53	9.01
2	Vegetation	3.565054	9.22	2.93	10.57
3	Water body	1.192647	1.39	1.89	4.63
4	Fallow Land	21.35811	6.51	28.37	14.2
5	Barren Land	45.94236	54.78	22.67	26.05
6	Cropland	25.7769	26.13	36.61	35.54
	Total	100	100	100	100

(Computed by Researcher)

Table No.-3.8 Land use Land cover Change Detection Result Between 2001and 2013

		Change Detection in year wise	
Sr. no.	Class	March 2001to March 2013	Nov. 2001 to Nov.2013
1	Settlements	5.36	7.05
2	Vegetation	-0.63	1.35
3	waterbody	0.69	3.24
4	Fallow Land	7	7.69
5	Barren Land	-23.27	-28.73
6	Cropland	10.83	9.41

(Computed by Researcher)

Table No. 3.9 Season wise Change Detection

		Season wise Change Detection	
Sr. no.	Class	Nov2001to March 2001	Nov. 2013 to Mar. 2013
1	Settlements	-0.2	1.48
2	Vegetation	5.65	7.64
3	waterbody	0.19	2.74
4	Fallow Land	-14.84	-14.17
5	Barren Land	-99.72	3.38
6	Cropland	8.83	-1.07

(Computed by Researcher)

3.6 Summery

The Shirur Tahsil was classified into Six Land use and Land cover classes. The composition and distribution of land use Land cover classes of image include Fallow land, Settlement, Water body, Vegetation, Cropland, Barren land. The land use and land cover map shows the spatial and temporal variation in the area. The finding reveals that there were drastic and rapid increases in the built up area and Crop land. Further study will be useful to strategic planning and development.

The land use and land cover of Shirur Tahsil has change in the years 2001 and 2013 as an increase in population, heavy influx of migration from rural areas to urban areas and increases demand of settlements. Because available of job. This study suggested that the settlement area should not be allowed to increase at the expense of primary Crop land and land use policy should be strictly followed.

The Crop land increases in November 2001to November 2013 is respectively 405.63 sq. km and 551.52 sq. km. and March 2001 to March 2013 400.06 sq.km and 566.04 sq. km. respectively because of developed irrigation facility. In the study area

vegetation cover is good. It is above the average forest cover of India and Maharashtra. The water bodies in the Ghod watershed is 1.39% and 4.63% in November2001 and November 2013 is 1.19% and 1.89% in March 2001 and March 2013 respectively.

The Vegetation land in November 2001 to November 2013 was respectively 143.12 sq. km and 164.11 sq. km. and March 2001 to March 2013 55.33 sq. km and 45.61 sq. km. respectively. The changes of area in vegetation because effect on industrial and agricultural development. In the study area, Vegetation cover is good. It is above the average forest cover of India and Maharashtra. In the study area, forest cover was 9.22%, 10.57% and 3.56%, 2.93% respectively in November 2001 to November 2013. And March 2001to March 2013.

CHAPTER - IV

LAND USE AND CROPPING PATTERN 2001-02 TO 2011-12

4.1 Introduction:

The 18th century's Europe became sources of raw agricultural and mineral products among industrialized nations. About 45 percent of world's population lives on agriculture. The proportion of population involved in agriculture ranges from about three percent in United States, five percent in UK, four percent in Australia, six percent in France, twelve percent in Japan and eighteen percent in Russia to about 80 percent in Asia and Africa. Agricultural landuse means the extent of the gross cropped area under various crops during the agricultural year. Agricultural landuse pattern in any region depends on physical, climatic and socio-economic conditions. It is essential to evaluate the agricultural landuse for individual crop in order to understand the crop pattern. It is the result of the decision made by the farmers regarding the choice of crops and methods for production.

Thus, this decision-making is based on not only the physical constraints and limitations but also on farmer's perception of the total environment. Land is the solid part of earth's surface. Its value in agriculture relates with its capacity for producing agricultural commodities. Land possesses two distinguish characteristics namely, fixity and its ability to maintain physical qualities. Around twelve thousand years ago, human began to domesticate plants and animals for food. Before first agricultural revolution, people relied on hunting and gathering in order to obtain food. The crop selection and method of production are influenced by activities of humans, price fluctuations in markets, purchasing power of people, transport and other inputs besides socio-economic conditions, tradition, previous experience and knowledge contributing for decisions regarding method of crops and method of production.

The farmers' decision are generally associated with their socio-economic conditions, purchasing power and price fluctuations in markets both in local and regional. The present chapter focuses on spatial distribution, changing cropping pattern and development, of agricultural crops in the Shirur tahsil. The spatial distribution and their temporal variations have been studied for the period from2001 - 2013. The collected data was then converted into percentage to net sown area. Later on, these crops percentages were arranged into different groups and finally spatial distribution was studied for 12 crops in the study area. Moreover, personal visits to these villages have helped to get additional information about land use. Besides this, District Census Handbook, Socio-Economic Abstract of Shirur tahsil and Agriculture Department Shirur were used to collect secondary data. The spatio-temporal

variations in agricultural land use pattern have been studied for Shirur tahsil. The study of temporal variation for crops in study region was computed for 10 years (2000-2001 to 2011-12).

There are three cropping seasons in study region, namely, kharif, rabbi and summer. Kharif season begins in June or July and ends in September or October whereas rabi season starts from September or October and ends in February or March and summer season starts from March and ends in May. Jowar, Bajara, Tur, Gram, Udid, Groundnut and Soybeans are the major kharif crops grown in study region while Jowar, Wheat, Gram, Maize, Sunflower are the rabi crops. Fruits and vegetables are also produced in study region. These fruits are namely, Mango, Banana, Grapes, Chicu and Pomegranate etc. Sugarcane and Onion are grown in study region in both kharif and rabbi seasons in Shirur tahsil.

4.2 Temporal Variations in Agricultural Land use:

The factors for changes in cropping patterns differ from village to village and region to region. The cropping system is an important component of any farming system. It is the proportion of area under various crops at a point of time. The crop rotation is the process of growing different crops in succession on a piece of land in specific period of time with an objective of getting maximum profit using minimum investment without impairing the soil fertility. Therefore, it is worthwhile to study isolated causes of changes occurring through space and time.

The crop pattern in any region cannot remain static due to the variations in the rainfall amount and nature of inputs and environmental instability. Moreover, introduction of new high yielding varieties of seeds, irrigation facilities and technical knowledge are responsible for temporal changes. The cropping pattern undergoes changes in response to the changing physical and cultural environment. For an appreciation of temporal variations in study area, ten years have been taken into account and study was made with considering a real strength of individual crop. Table-4.1 displays the temporal variations in cropping pattern in the study area of Shirur tahsil from 2001-2002 to 2011-12

The various kinds of following crops are cultivated in the tahsil. The total actual cropped area is 115449.5 hectares during 2001.andtotal actual cropped area is 98781.00 hectares during 2011.

Table no.4.1 Total Crops distribution area in Hectares

Sr. No.	Crops	2001-2002		2011-2012		Percent of Variation from 2001 to 2011
		Total Area in hectares	Percent Area	Total Area in hectares	Total Area in Percent	Change area in Percent
1	Sugarcane	5539.2	4.8	8221.2	8.04	3.24
2	Fruit	2161.61	1.87	2854.4	2.79	0.92
3	Onion	9470	8.2	11775	11.51	3.31
4	Spice	252.6	0.22	283.5	0.28	0.06
5	Flower	51.5	0.04	58.6	0.06	0.02
6	Jawar	32990	28.58	25594	25.02	-3.56
7	Wheat	3686	3.19	4356	4.26	1.07
8	Total Oil Seed	95.8	0.08	106.8	0.1	0.02
9	Total Pulses	27325	23.67	18804	18.38	-5.29
10	Fodder Crop	7793.4	6.75	8305.5	8.12	1.37
11	Total Vegetable	5220.4	4.52	3512.4	3.43	-1.09
12	Bajara	20864	18.07	18422	18.01	-0.06
	Total	**115449.5**	**100**	**98781**	**100**	**0**

(Source: Agriculture Dept. Shirur Tahasil)

The area under sugarcane is 5539 hectares & 4.80Percent in Shirur tahsil in 2001and area under sugarcane is 8221.20 hectares. 8.04Percent in Shirur tahsil in 2011. (Table No. 4.2).The highest land occupied under sugarcane crop is registered at Shikrapur Circle, in 2001 (12.03Percent) and 2011 (18.91Percent)at Shikrapur, Jategaon, Vadu bk. Sanaswadi Villages. And Lowest Land occupied under sugarcane crop is registered at Nahavra circle, in 2001 (1.45 Percent) and 2011 (2.75Percent) at Gunat, Nhavara, Nirvi, Sirasgaon Kata, Dahivadi, Aalegaon paga, Kolagaon dolas, Kuruli etc. Villages, These sugarcane crops are cultivated by progressive farmers.

The fodder crops in Shirur tahsil include Kadwal, Green grass and Maize. The area under Fodder crop is 7793.40 hectares & 6.75Percent in Shirur tahsil in 2001. And the area under Fodder crop is 8305.50 hectares. 8.12 Percent in Shirur tahsil in

2011. The highest percent under this crop is in Shirur Circle 2001 (9.04Percent) in south-west part and lowest is at Pabal circle 2001 (4.60 Percent) in south-central part in the study area. Area under fodder crop has been noticed in villages. Among these, Golegaon, Takali haji Aannapur, Saradwadi, Kardalwadi, Aambale, Jambut, Chavanwadi are highest Production in Shirur circle. Lowest area under Pabal Circle 2011(5.62Percent). And highest is Shirur in 2011 (9.73 Percent). Onion crop is dominant crop is the study region and it cash crop, Onion is cultivated in Kharif season. It is drought resistant crop.

The area under Onion crop is 9470 hectares & 8.20Percent in Shirur tahsil in 2001. And area under Onion crop is 11775 hectares. 11.51Percent in Shirur tahsil in 2011. The highest land occupied under Onion crop is registered at Shirur Circle, in 2001 (13.71Percent) and 2011 (14.60 Percent) at Saradwadi, Karegaon, Golegaon Chavanwadi, Karde etc. And Lowest Land Occupied under Onion crop is registered at Shikrapur circle in 2001 (4.80Percent) etc. and 2011 (12.70Percent) at Kuruli, Pimpalsuti, Ganegaon dumala, Nirvi, Nimone, Gunat, etc. villages, These Onion crops are taken by progressive farmers.

The area under Fruits crop is 2161.61 hectares & 1.87 Percent in Shirur tahsil in 2001. And area under Fruits crop is 28.54 hectares. 2.89 Percent in Shirur tahsil in 2011.The area under vegetables crop is 5220.40 hectares & 4.52 Percent in Shirur tahsil in 2001. And area under vegetables crop is 3512.40 hectares. 3.43 Percent in Shirur tahsil in 2011.The area under pulses crop is 27325.00 hectares & 23.67Percent in Shirur tahsil in 2001. and area under pulses crop is 18804 hectares. 18.38 Percent in Shirur tahsil in 2011.The area under Spice crop is 252.60 hectares & 0.22 Percent in Shirur tahsil in 2001. The area under Spice crop is 283.50 hectares. 0.28 Percent in Shirur tahsil in 2011.The area under Bajra crop is 20864 hectares & 18.07 Percent in Shirur tahsil in 2001.and area under Bajra crop is 18422 hectares. 18.01Percent in Shirur tahsil in 2011.

The area under flower crop is 51.50 hectares and 0.04 Percent in Shirur tahsil in 2001. And area under flower crop is 58.60 hectares. 0.06 Percent in Shirur tahsil in 2011.The area under Jawar crop is 32990 hectares & 28.58 Percent in Shirur tahsil in 2001. and area under Jawar crop is 25594 hectares. 25.02 Percent in Shirur tahsil in 2011.The area under Wheat crop is 3686 hectares & 3.19Percent in Shirur tahsil in 2001.And area under Wheat crop is 4356 hectares. 4.26Percent in Shirur tahsil in 2011.

4.3 Spatial Distribution of Agricultural Land use:

The Shirur tahsil is an essentially agricultural dominant region involving 89 percent working force in agricultural practice. This study has attempted to assess the spatial distribution of agricultural crops in study area. Jowar, Wheat, Sugarcane, Fodder crops, Vegetables and other crops are mainly grown in the study region on different soil types, amount of rainfall, irrigation and farmers decision.

Then examining general land use in Shirur tahsil, it is necessary to evaluate agricultural land use. Agricultural landuse means the extent of the gross cropped area during the agricultural year under various crops. It is the result of the decision made by the farmers regarding the choice of crops and methods for production. Thus, this decision-making is based on not only the physical constraints and limitations but also on farmer's perception of the total environment. This is a result of socio-economic, physical as well as climatic conditions of the study region. The farmers' decision are generally associated with their socio-economic conditions, purchasing power and price fluctuations in markets both in local and regional.

The present chapter focuses on spatial distribution of agricultural crops in the Shirur tahsil. Agricultural land use is a geographical concept since it involves specific areas. The land use study in its spatial context is essential to understand the regional zonation of the areas of optimum land use, degraded areas etc. The utilization of land in the study area for different purposes indicates an intimate relationship between prevailing ecological conditions and man. The efficient use of land depends on the capacity of man to utilize the land and manage it in proper perspective. In the view of predominantly agrarian nature of the study region, such studies are the subject of supreme importance.

Cropping Pattern means the proportion of area under various crops at a point of time. Cropping pattern is however, a dynamic concept as it changes over space and time. The cropping pattern of a region is closely influenced by the geo-climatic, socio-cultural, economic, historical and political factors. Moreover, for small holdings the land tendency, ownership of land, size of holdings and size of fields also impose restrictions on the cropping pattern of a region in the study area.

The farmers tend to be subsistent despite innovation diffusion, depending on the terrain, topography, slope, temperature, amount and reliability of rainfall, soils and availability of water for irrigation. In the changed situation of irrigation, farming and improved as well as mechanized methods of cultivation, the ensuring section

therefore, deals with the cropping pattern and changes there for individual, general and irrigated particular crops in the tahsil. Cropping pattern is the central element of agricultural land use. In the study area, it experienced considerable transformation during the study period (2001-2002 to 2010-11).

4.4 Distribution of Principal Crops:

Distribution of irrigated land among different crops shown Kharif crops i.e. Onion, Bajara, Oilseeds, Sugarcane, Jowar as well as rabbi crops i.e. Wheat, Jowar, Pulses, Sugarcane etc. are important crops grown with the help of ground water. It is observed that rice is the leading crop as is grown in irrigated land. The next important crop is Sugarcane, Onion, Vegetable, Fruit crops etc. grown by the irrigated land.

It is quite interesting to note that almost all the farmers are using high yielding varieties seeds of pulses. Along with farm yard manure the chemical fertilizer like D.A.P., Urea, Super Phosphate and Potash are used. Pesticides and insecticides are also applied to protect the crops from pests and diseases. But, the quantity of applying chemical fertilizers is less than recommended doses. Traditional methods are followed for sowing, weeding and harvesting crops. A few farmers used threshers.

Table No.4.2 Distribution of major crops:

Sr. No	Crops Group	Particular
1	Onion	Kharif Onion crop
2	Bajara	Kharif Bajara crop
3	Wheat	Rabbi Wheat crop
4	Pulses	Tur, mug, math, gram etc.
5	Spice	Chilli, Termaric, jira,
6	Oilseeds	Groundnuts, kardai, jawas, sunflower etc.
7	Jawar	Rabbi Jawar
8	Sugarcane	Kharif/Rabbi Cash crop
9	Fruit Crops	Guava, Chikku, grapes, pomegranate, papaya, sweet lime, coconut, orange, mangoes, etc.
10	Vegetable Crops	Onion, cabbage, chilly, cauliflower, brinjal, tomato, methi, leafy vegetable, ridge guard, garlic, coriander seeds etc.
11	Flower Crops	Rose, Camomile, Jasmine, Marigold, Mogra etc.
12	Fodder Crops	Grass and maize etc.

(Source: computed by researcher)

Above table no 4.2 includes, all major crops divided into total 12 major crops categories have been included in the study area. Onion, Bajara, Wheat, Pulses, Spice, Oilseed, Jawar, Sugarcane, Fruit, Vegetable, Flower, Fodder. The table shows the sum of crop groups include in the various Kharif and rabbi crops.

Circle wise area of major crops:

Detailed village wise cropping data in the study area (Total-108villages), during 2001-2002 to 2011-12.

4.4.1 Sugarcane

Sugarcane is a perennial crop. This crop requires clay to loamy soil containing high organic matter. It can tolerate moderate acidity and alkalinity. Soil rich in 'Phosphorus' and 'Calcium' are suitable for better juice quality (Das, 2000). The temperature between 20^{o} and 26^{o} centigrade is essential for its growth. Sugarcane i.e. Sacharum Officinarum L. is the most irrigated cash crop cultivated in Ghod and Bhima river command area of tahasil. Although it is an annual crop (unlike seasonal crops like wheat, vegetables etc.), it requires high amount of water throughout the year, irrigation from sources like the river, well, tube well, lift, canal, tank or reservoirs also. In the study area number of farmers and land are engaged in cultivation of sugarcane. It has the high density of crop during the rabbi season. 'Suru', 'Adsali', pre-seasonal and ratoon are the types of sugarcane grown in Shirur tahsil. Where the crop matures within a year from its plantation.

The area under sugarcane is 5539 hectares & 4.80Percent in Shirur tahsil in 2001. And area under sugarcane is 8221.20 hectares. 8.04Percent in Shirur tahsil in 2011. and Map no. 4.9).The highest land occupied under Sugarcane crop is registered at Shikrapur Circle, in 2001 (12.03 Percent) and 2011 (18.91Percent) at Shikrapur, Jategaon, Vadu bk. Sanaswadi Villages And Lowest Land Occupied under sugarcane crop is registered at Nahavra circle in 2001 (1.45 Percent) and 2011 (2.75Percent) at Gunat, Nhavara, Nirvi, Sirasgaon Kata, Dahivadi, Aalegaon paga, Kolagaon dolas, Kuruli, etc. villages, These sugarcane crops are taken by progressive farmers.

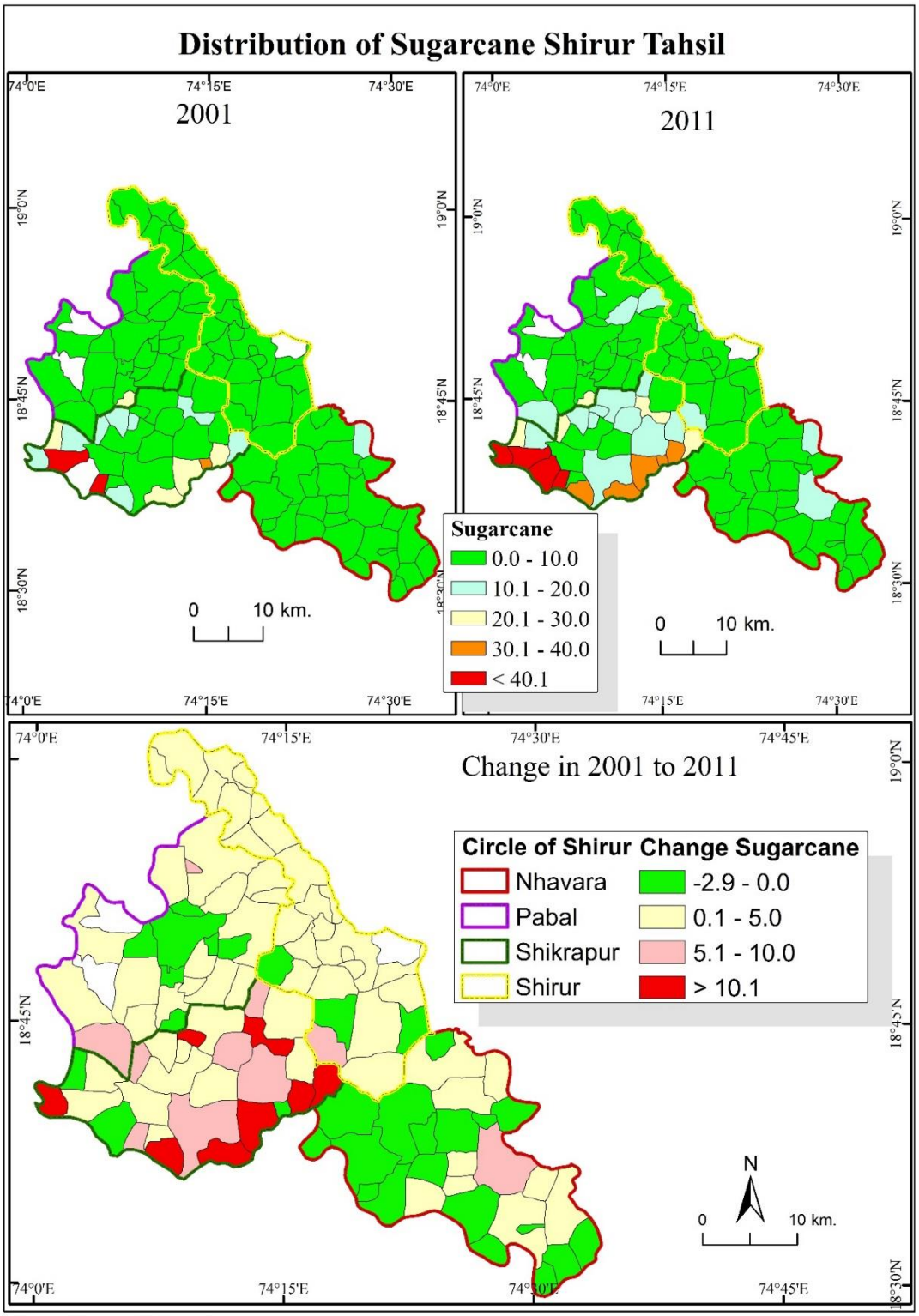
Table No.- 4.3 **Circle wise Distribution of Sugarcane**

Sr. No.	Name of Circle	Sugarcane		
		Year (Area in Percent)		Volume of change Percent Percent
		2001	2011	2001-2011
1	Shirur	2.46	3.65	1.19
2	Nhavara	1.45	2.75	1.30
3	Shikrapur	12.03	18.91	6.88
4	Pabal	1.83	2.99	1.16
	Total	17.76	28.30	10.53

(Source: computed by researcher)

The map 4.1 shows the distribution of area under Sugarcane crops. In Shirur tehsil, the area under Sugarcane is mainly found in Nhavara and Shikarapur Circle, South western Part of the tehsil because there are many Sugarcane factories are located in Nahavra and Mukhai village in Nahavra circle and Shikarapur Circle. Moreover, the Irrigable water a availability of Ghod and Bhima river, the area under Sugarcane increased during 2011 because of canals Irrigation Providing a water.

The present change form 2001 to2011 has increased mainly in Shikarapur circle in which there is a positive for that more than 10 Percent is area included in Mandavgan, Nagargaon, Ranjangaon Sandas, Vadgaon, and a Negative Change factor is that less than -2.9 Percent is indicated in Aannapur Aamdabad, Shindodi, Golegaon Kuruli, Gunat, Kolagaon dolas Nirvi, Sirasgaon kata, Aandalgaon Villeges.



Source: Computed by Researcher

Figure No.- 4.1 **Distribution of sugarcane**

4.4.2 Fodder Crops:

Fodder crops are grown in the study area in both (Kharif and rabbi) seasons and are used as food crop for the animals like cattlees, goats, sheeps, horses, chickens and pigs etc. Fodder cultivation takes place on all types of soil. Various types of seeds are grown in the study area like summer Jowar, grass, lasoon ghass, ginni and other. The area under fodder cultivation in the tahsil. The fodder crops in Shirur tahsil includes Kadwal, Green grass and Maize. The area under Fodder crop is 7793.40 hectares & 6.75 Percent in Shirur tahsil in 2001. And area under Fodder crop is 8305.50 hectares. 8.12 Percent in Shirur tahsil in 2011.

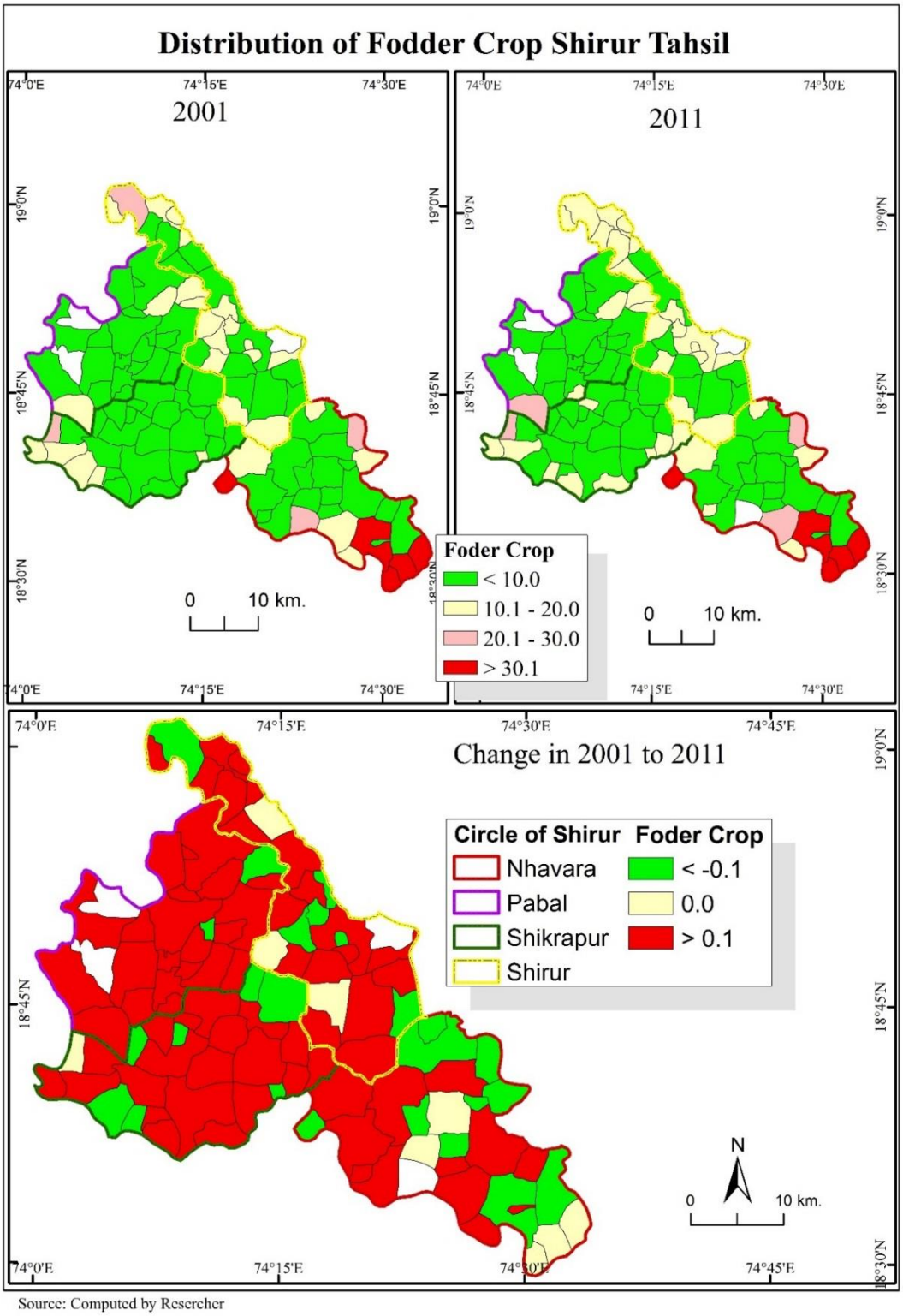
The highest percent under Fodder crop is in 2001 (9.04 Percent) in south-west part and lowest is at Pabal circle 2001 (4.60 Percent) in south-central part in study area. Area under fodder crop has been noticed in villages. like Golegaon, Takali haji, Aannapur, Saradwadi, Kardalwadi, Aambale, Jambut, chavanwadi are highest in Production of fodder crops. In Shirur circle. Pabal Circle 2011(5.62Percent). And Shirur 2011 (9.73 Percent) registered the highest in the production of fodder crop. These villages concentrated no dairy dominating area in this tahsil.

Table No. 4.4 **Circle wise distribution of Fodder crops**

Fodder Crop				
Sr. No.	Name of Circle	Year (Area in Percent)		Volume of change (Percent)
		2001	2011	2001-2011
1	Shirur	9.04	9.73	0.69
2	Nhavara	8.83	9.14	0.31
3	Shikrapur	5.98	7.30	1.32
4	Pabal	4.60	5.62	1.01
	Total	28.46	31.79	3.34

(Source: computed by researcher)

The Map (4.4 Shows) the distribution of area under fodder crop. In Shirur tehsil, area under fodder crop is mainly found in Chichani, Shindodi, Babalsar bk., Gnegaon dumala, Tandali, Nagargaon is Nhavara circle. The area under fodder crop increased during 2011 because of Milk plant. Mainly people work in agriculture cultivation, dairy farming grazing. The area under Fodder crop is not only more change but normal change in Foder crop distribution. The present change from 2001 to 2011 has decreased mainly in Pimpale Jagatap, Karandi, Jategaon. In the Shikarapur Circle, there is normal change in Bhabarde, Aambale, Dahivadi, Karjavane, Ranjangaon, Kasari villages.



Source: Computed by Researcher

Figure No.- 4.2 **Distribution of Fodder crops**

4.4.3 Distribution of Fruit:

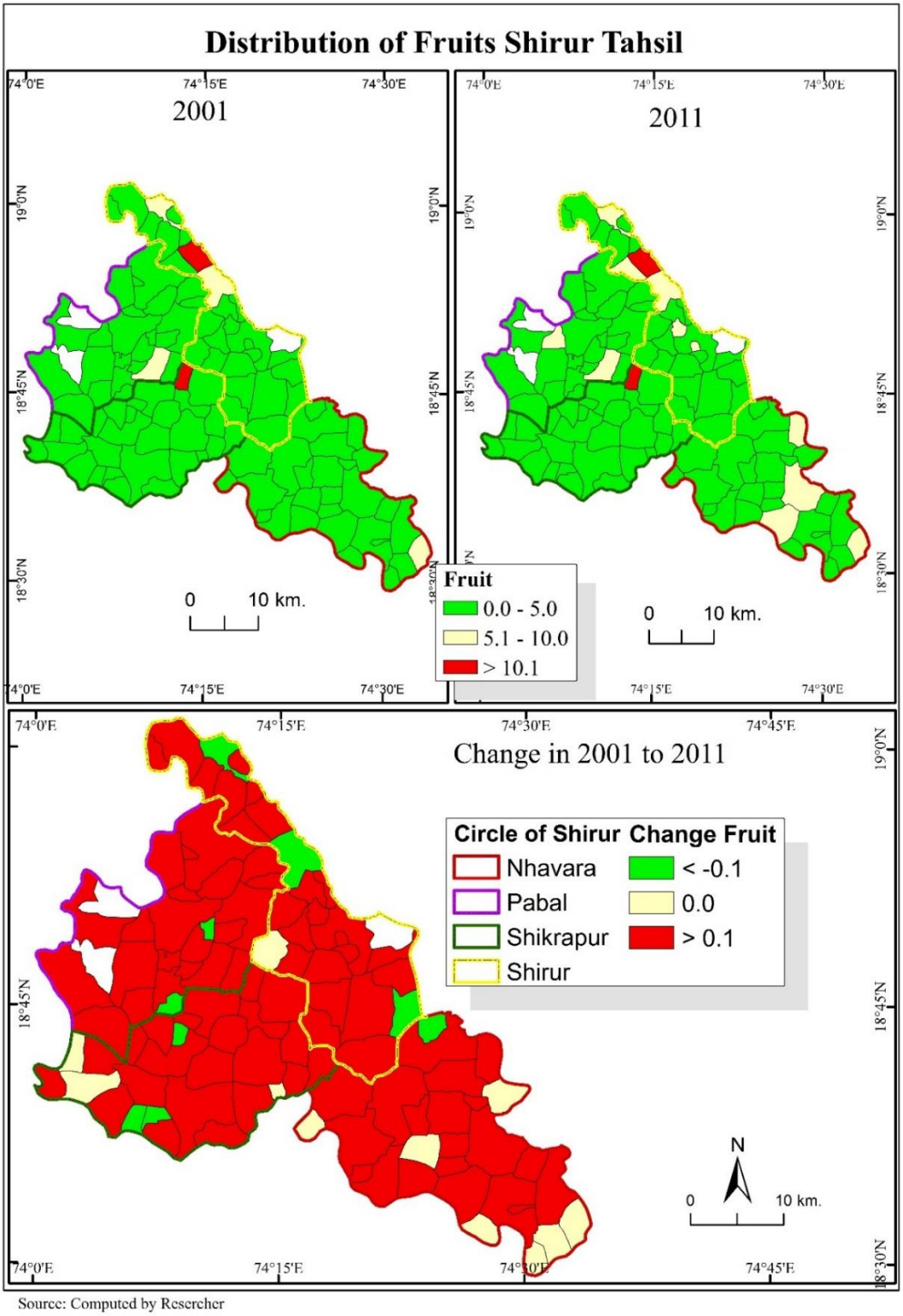
The fruits include Banana, Grapes, Chiku, guava, Orange and Mango are cultivated as a fruit crops in study area. The area under Fruits crop was 2161.61 hectares and 1.87 Percent in Shirur tahsil in 2001. Which rose to 28.54 hectares. 2.89 Percent in Shirur tahsil in 2011. The highest land occupied under fruit crop is registered at Shirur Circle, in 2001 (2.93Percent) and 2011 (3.97Percent) at Tardobachiwadi Golegaon, Saradwadi, Aamdabad, Aannpur, Jambut ,Nimgaon Bogi, Chandov. And the Lowest Land Occupied under fruit crop is registered at Pabal circle in 2001 (1.50 Percent) and 2011 (2.10Percent) at Pabal, Karandi, Wagale, Kavate, Singadwadi, Warude, Villages, These fruit crops are taken by progressive farmers. (Shows map 4.3)

Table No. 4.5 **Circle wise Distribution of Fruit crop**

Fruit crop				
Sr. No.	Name of Circle	Year (Area in Percent)		Volume of change %(Percent)
		2001	2011	2001-2011
1	Shirur	2.93	3.97	1.04
2	Nhavara	1.91	2.84	0.93
3	Shikrapur	1.54	2.09	0.55
4	Pabal	1.50	2.10	0.60
	Total	7.89	11.01	3.12

(Data Source- Computed by researcher)

The map (4.5) shows the distribution of area under Fruit crop. In Shirur tehsil area under Fruit crop is mainly found Malthan, Saradwadi, is Pabal circle. The area under Fruit crop increased during 2011 because of developed irrigation facilities in this area, such as watershed Management plan is available, constriction of dam, Nala bonding. The Present change from 2001 to 2011 has increase manly in Nahavra, Pabal circle, Nimone, Kendur, Karegaon, Saradwad, Malthan, Tardobachiwadi, Karde. And villages Golegaon, Shirur city registered decreased 0.1Percent area in Fruit crop.



Source: Computed by Researcher

Figure No.- 4.3 **Distribution of Fruit crop**

4.4.4 Distribution of Oilseed:

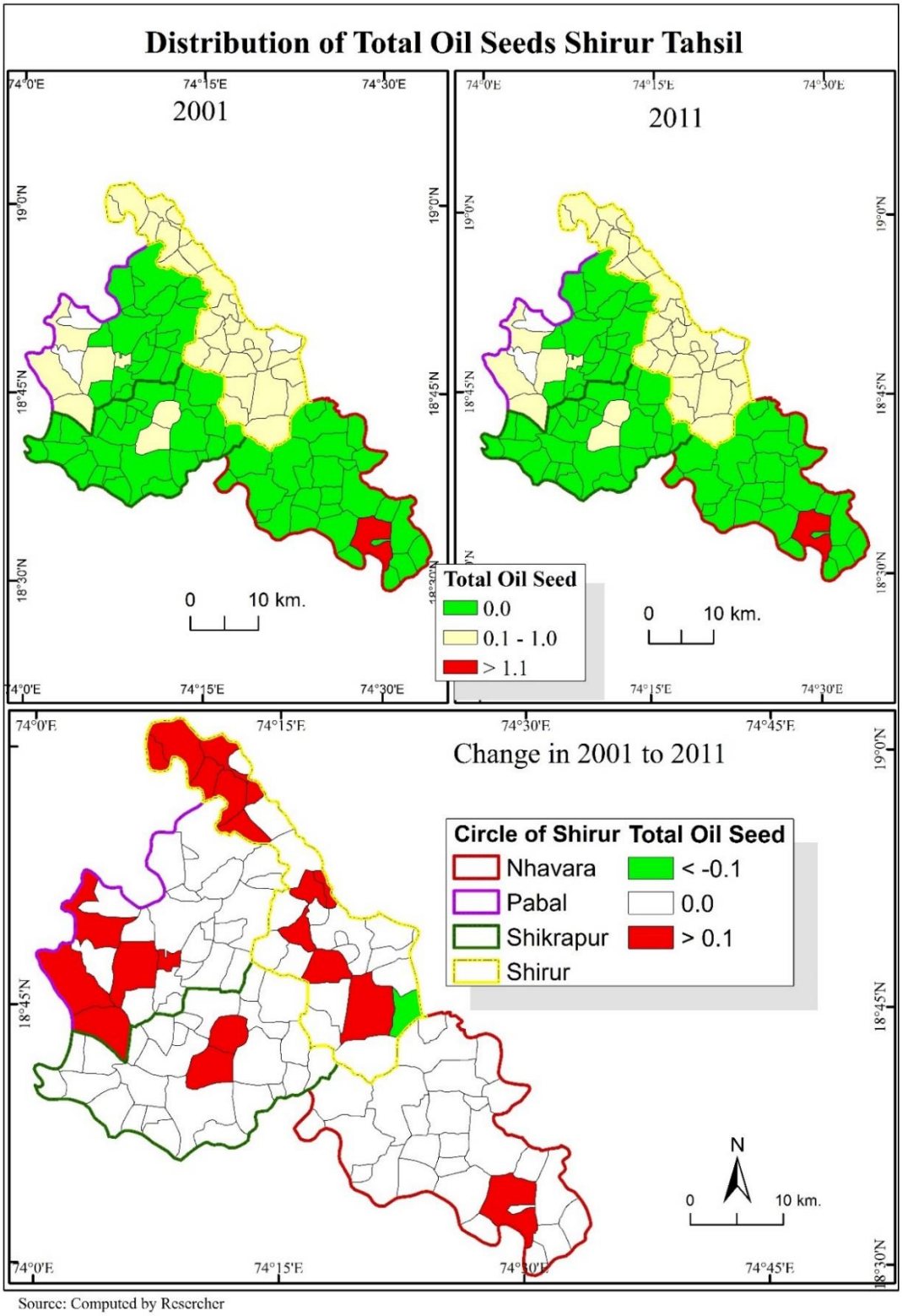
Shirur circle registered the highest area under Oilseed production. The area under oilseed crop was 95.80 hectares & 0.08 Percent in Shirur tahsil in 2001.which rose to 106.80 hectares. 0.10 Percent in 2011. The highest land occupied under oilseed crop is registered in Shirur Circle, in 2001 (0.22Percent) and 2011 (0.26 Percent) at Warude, Wagale, Singadwadi, Khire nagad, Mukai. And the lowest land occupied under oilseed crop is registered at Pabal circle in 2001 (0.08Percent) Khirenagad, Pabal, Kendur Karandi, Hivare etc. and 2011 (0.01 Percent) at shikrapur, Jategaon, Vadu bk. Sanaswadi Villages. These Oilseed crops are cultivated by progressive farmers.

Table No. 4.6 **Circle wise distribution of Total Oil Seed**

Total Oil Seed				
Sr. No.	Name of Circle	Year (Area in Percent)		Volume of change (Percent)
		2001	2011	2001-2011
1	Shirur	0.22	0.26	0.03
2	Nhavara	0.06	0.07	0.01
3	Shikrapur	0.01	0.01	0.00
4	Pabal	0.08	0.09	0.01
	Total	0.38	0.43	0.05

(Computed by researcher)

The (Map 4.4) shows the distribution of area under Oilseed crop. In Shirur tahsil area under oilseed crop is mainly found in Mndavgan, Sadalgaon, in the Nhavara circle. Oilseed was the dominant crop is the 2001.The area under oilseed crop in Nhavara circle remained some during 2011. The present change from 2001 to 2011 has increase mainly in Pimparkhed Katapurkh. Jambut, by 0.1Percent. But Pabal, Thetewadi, Khairenagad, Kendur, Shirur city registered decreased by decline -0.1Percent area in oilseed crop.



Source: Computed by Researcher

Figure No.- 4.4 **Distribution of Total Oil Seed**

4.4.5 Distribution of Total Pulses:

The pulses deserve the spatial attention on the food cultivations in the study region. It is generally mix crop cultivation. Pulses are Kharif as well as rabbi crop and the chief pulses grown in the study area e.g. Gram, Tur and Mug while math, Chavali, Vatana, Udid and Val are also grown on a small scale. The area under pulses crop is 27325.00 hectares & 23.67Percent in Shirur tahsil in 2001. Which increaded to 18804 hectares. 18.38Percent in Shirur tahsil in 2011.

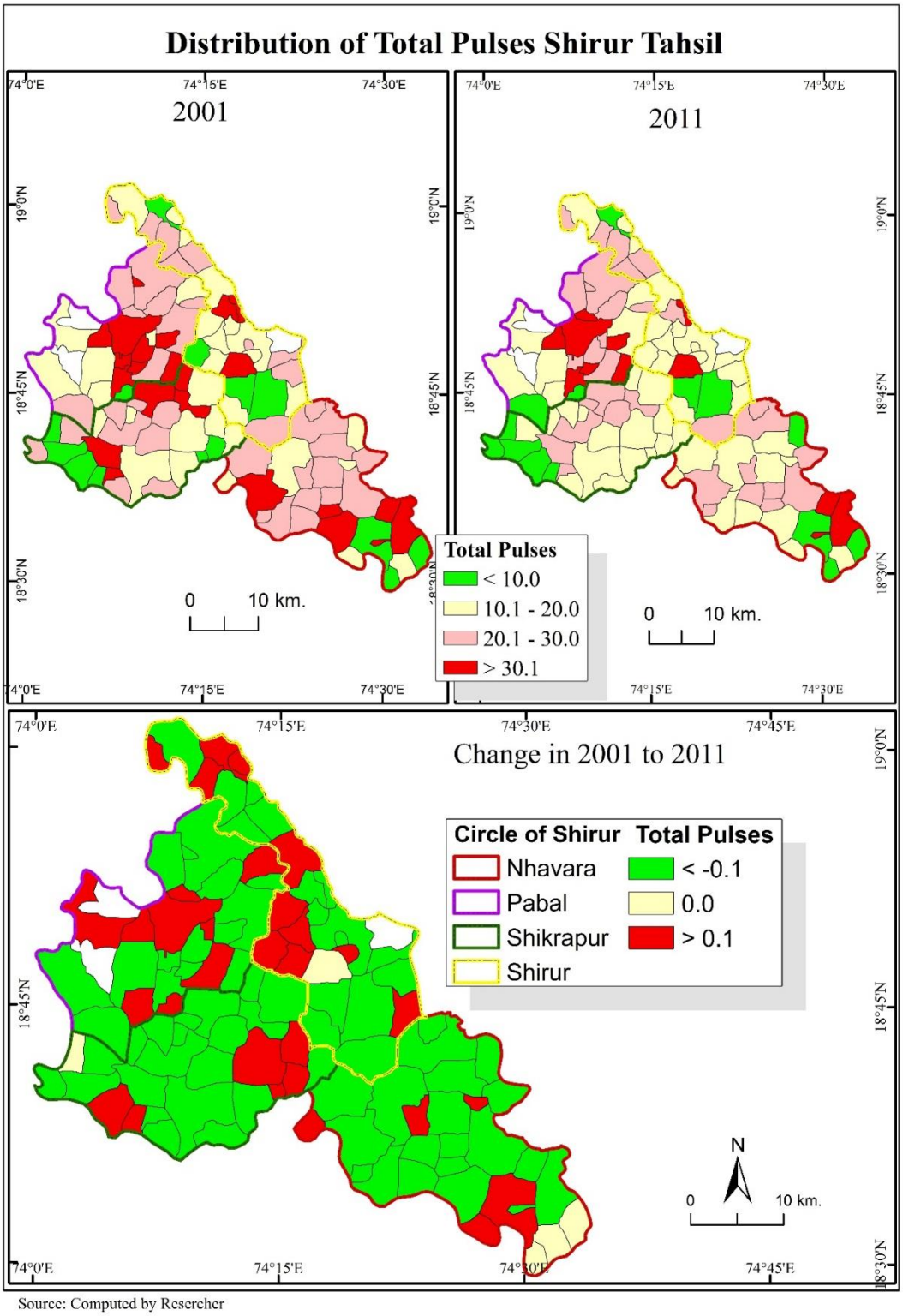
The highest land occupied under Pulses crop was registered in Pabal Circle, in 2001 (27.05Percent) and 2011 (24.21 Percent) at Warude, Wagale, Singadwadi, Khire nagad, Mukai, And Lowest Land Occupied under Pulses crop was registered in Shirur circle in 2001 (18.77 Percent) Saradwadi, Golegaon, Doksangavi, Karde, Aambale etc.and 2011 (16.43 Percent) at Shikrapur, Jategaon, Vadu bk. Sanaswadi Villages. These Pulses crops are cultivated by progressive farmers.

Table No. 4.7 **Circle wise distribution of Total Pulses**

Total Pulses				
Sr. No.	Name of Circle	Year (Area in Percent)		Volume of change (Percent)
		2001	2011	2001-2011
1	Shirur	18.77	16.74	-2.03
2	Nhavara	26.35	22.35	-3.99
3	Shikrapur	21.23	16.43	-4.80
4	Pabal	27.05	24.21	-2.84
	Total	93.40	79.73	-13.67

(Computed by researcher)

The Map (4.5) shows the distribution of area under pulses crop, In Shirur tahsil the area under pulses crop was mainly found at Karde, Khannur masai, Malthan, Munjalwadi, Pimpale jagatap, Kuruli, Andalgaon. Total pulses was the dominant crop in 2001.the cultivation of total pulses devlop because of drip irrigation develop in this area, such as watershed Management plant is available, constriction dam, Nala bonding. The villages like Pabal, Thitewadi, Khiarnagad, Kendur, Shirur, Nhavra, Nirvi, Nimone, koregaon registred decreased by -0.1 percent in pulses crop.



Source: Computed by Researcher

Figure No.-4.5 **Distribution of Total Pulses**

4.4.6 Distribution of Vegetable:

Vegetable growers are encouraged to cultivate vegetables in shade net houses. These shade net houses are erected in groups to save the initial cost of erection and cultivation. This is an opportunity for small farmers for adopting high value crops and to utilize the available land and water resources efficiently for quality production. Agreement for marketing with retail markets and related discussions are at progressive stage.

Intensive cultivation of vegetables may be done either by growing a sequence of crops or through relay cropping, i.e. another one crop sown under a standing crop. The vegetable cultivated in the study area were short duration, i.e. 90 days to 120 days or 3 to 4 months, that's why the intensive cropping is more popular. A variety of vegetable like potato, sweet potato, bitter and bottle guard, cucumber, tomato, okra (lady fingers), cabbage, chilly, brinjal, cauliflower, vetch, radish, pea, lufa etc. are grown on small as well as large patches of land in the study area. Vegetables are cultivated on a smaller scale as compared to rice, cereal crops and cash crops. These vegetables are irrigated using lift, canal, and well, tube well, reservoirs and river water, with the marginal support from groundwater.

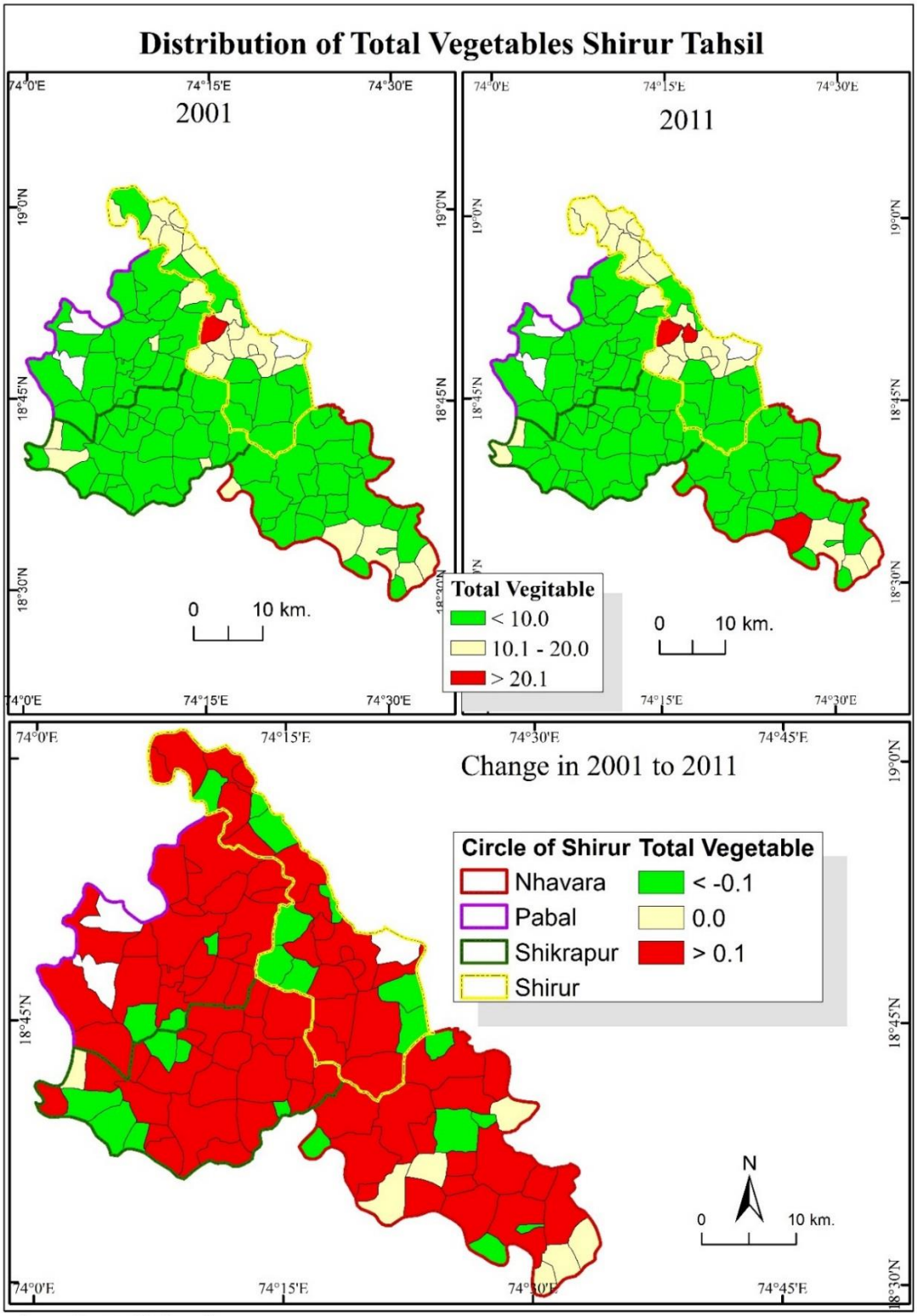
The area under vegetables crop is 5220.40 hectares and 4.52 Percent in Shirur tahsil in 2001. Which come down to 3512.40 hectares. 3.43Percent in 2011. The highest land occupied under Vegetables crop is registered in Shirur Circle, in 2001 (9.95 Percent) and 2011 (11.13 Percent) at saradwadi, Karegaon, Golegaon Chavanwadi, Karde, etc. And lowest land occupied under Vegetables crop is registered in Nhavara circle in 2001 (2.44 Percent) Ganegaon dumala, Mandavgan, Sirasgaon Kata, Sadalgaon, Shindodi etc. and 2011 (2.90 Percent) at Vadgaon Rasai, Nagargaon, Ranjangaon Sandas, etc. villages. These Vegetables crops are cultivated by progressive farmers.

Table No. 4.8 **Circle wise Distribution of Total Vegetable**

Total Vegetable				
Sr. No.	Name of Circle	Year (Area in Percent)		Volume of change% (Percent)
		2001	2011	2001-2011
1	Shirur	9.95	11.13	1.18
2	Nhavara	2.44	2.90	0.46
3	Shikrapur	3.53	4.32	0.79
4	Pabal	3.61	4.56	0.96
	Total	19.52	22.91	3.39

(Computed by researcher)

The Map 4.6 (Shows) the distribution of area under Vegetables crop. In Shirur tahsil the area under vegetable crop is mainly found Karde, Khannur Masai, Malthan, Munjalwadi, Pimpale Jagatap, Kuruli, Andalgaon, and Nahavra Circle and Shirur circle. The cultivation of vegetable crop developed because of irrigation development in this area. The watershed management plant is available, constriction dam, Nala bonding.



Source: Computed by Researcher

Figure No.- 4.6 **Distribution of Total Vegetable**

4.4.7 Bajara:

Bajara is cultivated in Kharif season. It is drought resistant crop. This crop is grown on less amount of rainfall ranging between 25 and 45 cm. Bajara is confined to arid tract in study region on coarse shallow, black and lighter soil. For the growth of Bajara, less amount of rainfall is required during its growing period. Bajara (pearl millet) is an important food grain crop grown in kharif season. This crop is grown on all types of soil. The Bajara crop being short duration i.e. maximum of 120 days or 4 months has been successfully adopted by the farmers in the study region. The distribution pattern of Bajara crop cultivation in study region in influenced by soil types, relief and rainfall amount.

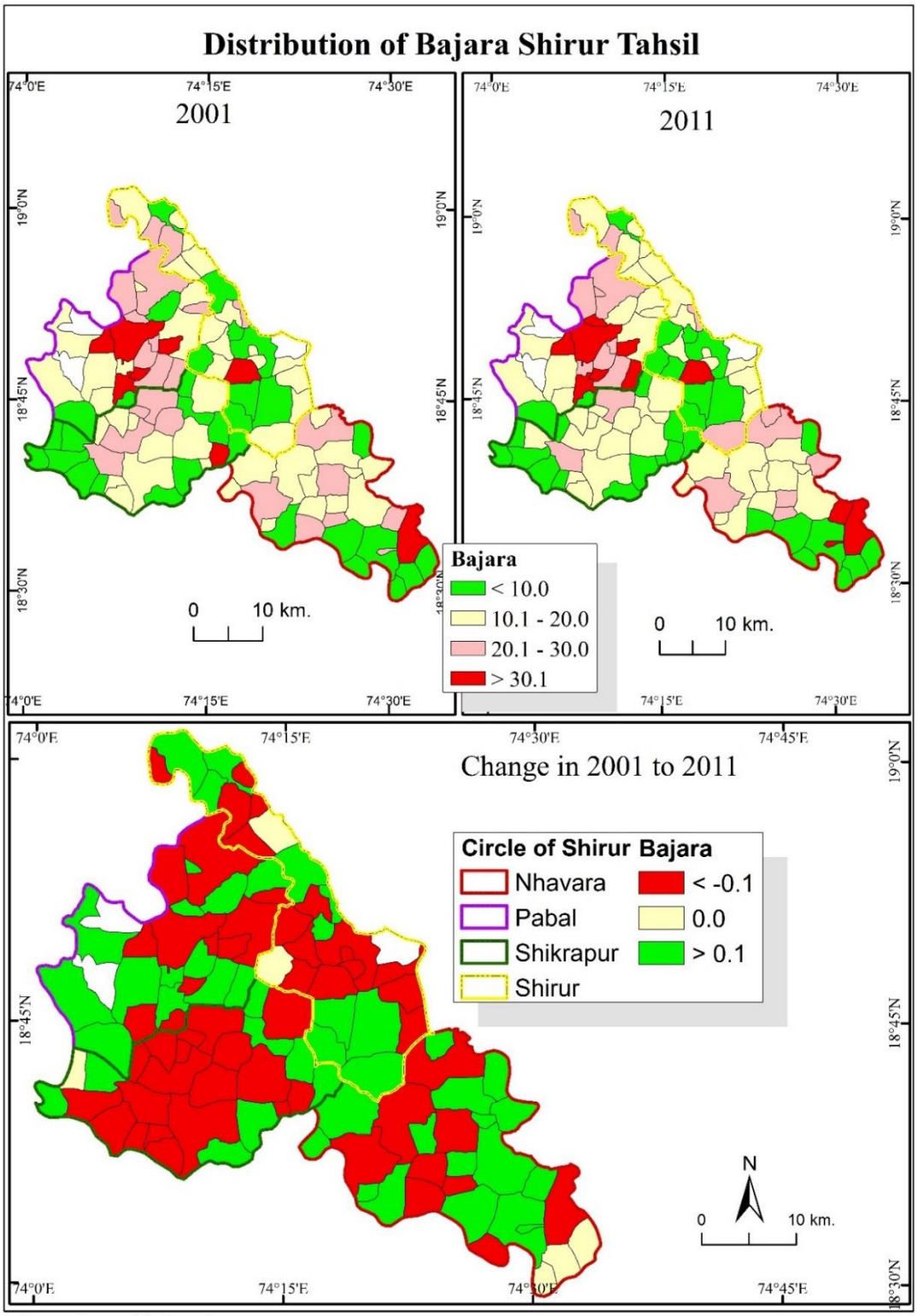
The area under Bajara crop in 2001 was 20864 hectares and 18.07 Percent in Shirur tahsil. Which reduced to 18422 hectares. 18.01Percent in 2011. The highest land occupied under Bajra crop in registered at Pabal Circle, in 2001 (21.92Percent) and 2011 (22.36 Percent) at Warude, wagale, Singadwadi, Khire nagad, Mukai, etc. And lowest land occupied under Bajra crop is registered at Shirur circle in 2001 (13.79 Percent) Saradwadi, Karegaon, Golegaon, Chavanwadi, Karde etc. and in 2011 (12.70Percent) at Shikarapur Circle Shikrapur, Jategaon, vadu bk. Sanaswadi, etc. Villages, These Bajara crops are cultivated by progressive farmers.

Table No. 4.9 **Circle wise Distribution of Bajara**

Bajara				
Sr. No.	Name of Circle	Year (Area in Percent)		Volume of change (Percent)
		2001	2011	2001-2011
1	Shirur	13.79	13.54	-0.25
2	Nahavra	19.55	19.83	0.28
3	Shikrapur	15.64	12.70	-2.94
4	Pabal	21.92	22.36	0.44
	Total	70.90	68.44	-2.46

(Computed by researcher)

The Map (4.7) shows the distribution of area under Bajara crop, In Shirur tahsil the area under Bajara crop was mainly found in Pimpalsuti, Inamgaon, in the Nhavara circle in 2001. Pabal Circle is the Kannur mesai, shastabad, kakhawadi, Mahalungi, takali Bhima, is the 2001 is the mostly area under Bajara crop. There was not much change during 2011.



Source: Computed by Researcher

Figure 4.7 **Distribution of Bajara**

4.4.8 Distribution of Onion:

Onion crop is dominant crop in the study region and it cash crop. Onion is cultivated in kharif season. It is drought resistant crop. In 2001 about 9470 hectares and 8.20 Percent of the study area was under Onion crop. Which rose to 11775 hectares. In the Shirur tahsil in 2001 13.71 percent and in 20011 14.60 percent area.

The highest land occupied under Onion crop is registered at Shirur Circle, in 2001 (13.71Percent) and 2011 (14.60 Percent) at Saradwadi, Karegaon, Golegaon Chavanwadi, Karde etc. And lowest land occupied under Onion crop was registered at Shikrapur circle in 2001 (4.80 Percent) etc. and 2011 (12.70Percent) at Kuruli, Pimpalsuti, Ganegaon dumala, Nirvi, Nimone, Gunat, etc. villages.

Table No. 4.10 **Circle wise Distribution of Onion**

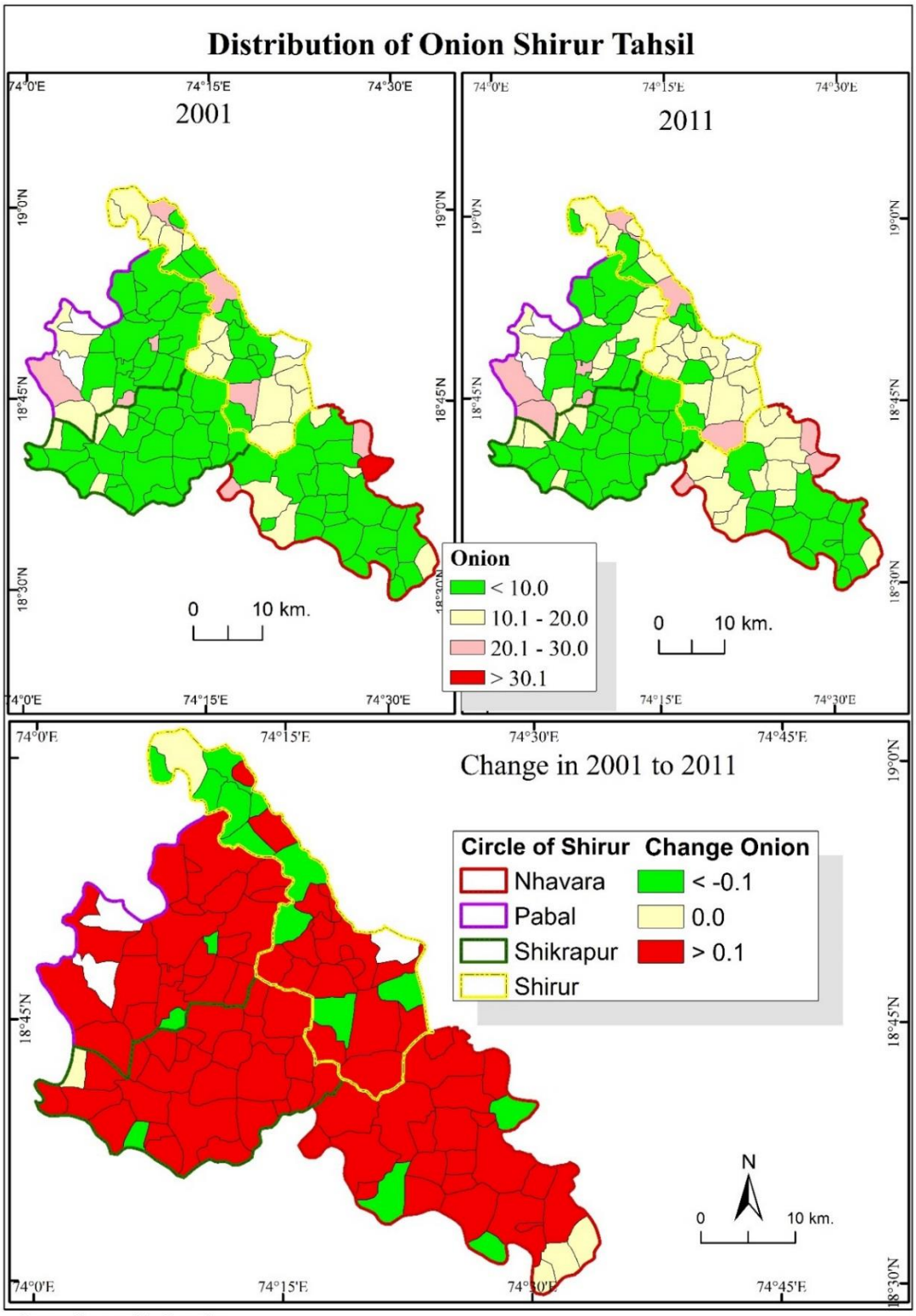
Onion				
Sr. No.	Name of Circle	Year (Area in Percent)		Volume of change (Percent)
		2001	2011	2001-2011
1	Shirur	13.71	14.60	0.89
2	Nhavara	7.80	11.10	3.30
3	Shikrapur	4.80	6.87	2.07
4	Pabal	8.30	12.25	3.95
	Total	34.61	44.83	10.22

(Computed by researcher)

The Map (4.8) shows the distribution of area under Onion crop. In 2001 Pimpalsuti, Inamgoan, in Nahvra circle and Kannur Mesai, Shastabad, Mahlungi, takali Bhima, Amdabad, Takalihaji, Jambut etc. produced highest Onion crop.

There was not much changes in 2011 in production of Onion but villages like Sanswadi, Vadu Budruk, Shirur, Karegoan, Ranjangoan, Pimpale khalasa produced less onion than their previous record.

Whereas Bhabarde, Doksangavi, ambale, karde, shikarapur, Mukai, Jategaon, Kannur masai Uralgaon, sirasgaon, Chichani, Gunat ,Karegaon, Vittalwadi kavate, Echakwadi etc. villages are showed growth in production of onion crop.



Source: Computed by Researcher

Figure No.- 4.8 **Distribution of Onion**

4.4.9 Distribution of Spices:

(Name of spices – Chilli, Jeera, Termuric etc.)

The area under Spice crop is 252.60 hectares and 0.22Percent of Shirur tahsil produced spices in 2001. Which increased to 283.50 hectares. 0.28 Percent in 2011.

In villages like Warude, Kendur, Waghale, Singadwadi, Khire nagad, Mukai, etc. as high 0.31 percent in 2001 and 0.41 percent in 2011 was occupied under Spices cultivation.

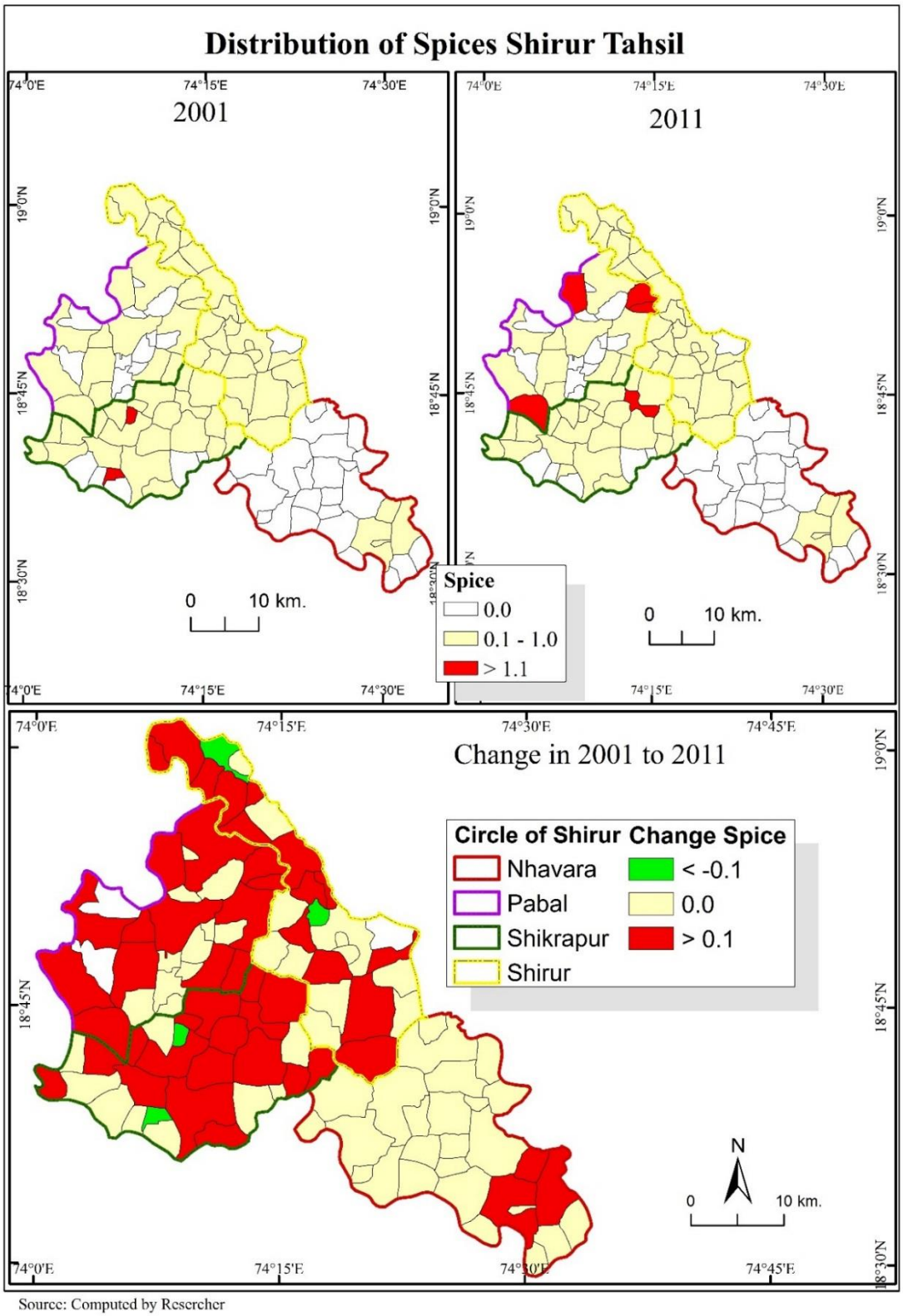
Whereas Kuruli, Pimpalsuti, Ganegaon dumala, Nirvi, Nimone, Gunat, etc. were as low as 0.03 percent in 2001 and 0.07 percent in 2011 in production of Spices.

Table No.4.11 **Circle wise distribution of Spices**

Spices				
Sr. No.	Name of Circle	Year (Area in Percent)		Volume of change %(Percent)
		2001	2011	2001-2011
1	Shirur	0.28	0.26	-0.01
2	Nhavara	0.03	0.07	0.03
3	Shikrapur	0.23	0.26	0.03
4	Pabal	0.31	0.41	0.11
	Total	0.84	1.01	0.16

(Computed by researcher)

The (Map 4.9 Shows) the distribution of area under Spice crop. In 2011, Pimpale Khalasa, Hivre produced large number of spices in Shirur tahsil. Savindane, Ichakewadi, Nimgoan dude etc. also show positive cultivation of Spices crop. Villages Annapur, Sardawadi showed less production of Spices in 2011.



Source: Computed by Researcher

Figure No.-4.9 **Distribution of Spices**

4.4.10 Flower Crops:

Flower crops are an important crops grown in the both (kharif and rabbi) seasons. During recent years, the area under flower cultivation is increasing day by day. A variety of flower crops like Rose, Camomile, Jasmine, Marigold, Mogra, Chrysanthemum, Gallardia and Gladiolus etc. are grown on small as well as large patches of land in the study area. Recently, greenhouse cultivation is also started in the study area.

Under flower crop, 51.50 hectares and 0.04 Percent cultivated flower in 2001. Rising by 58.60 hectares. 0.06 Percent

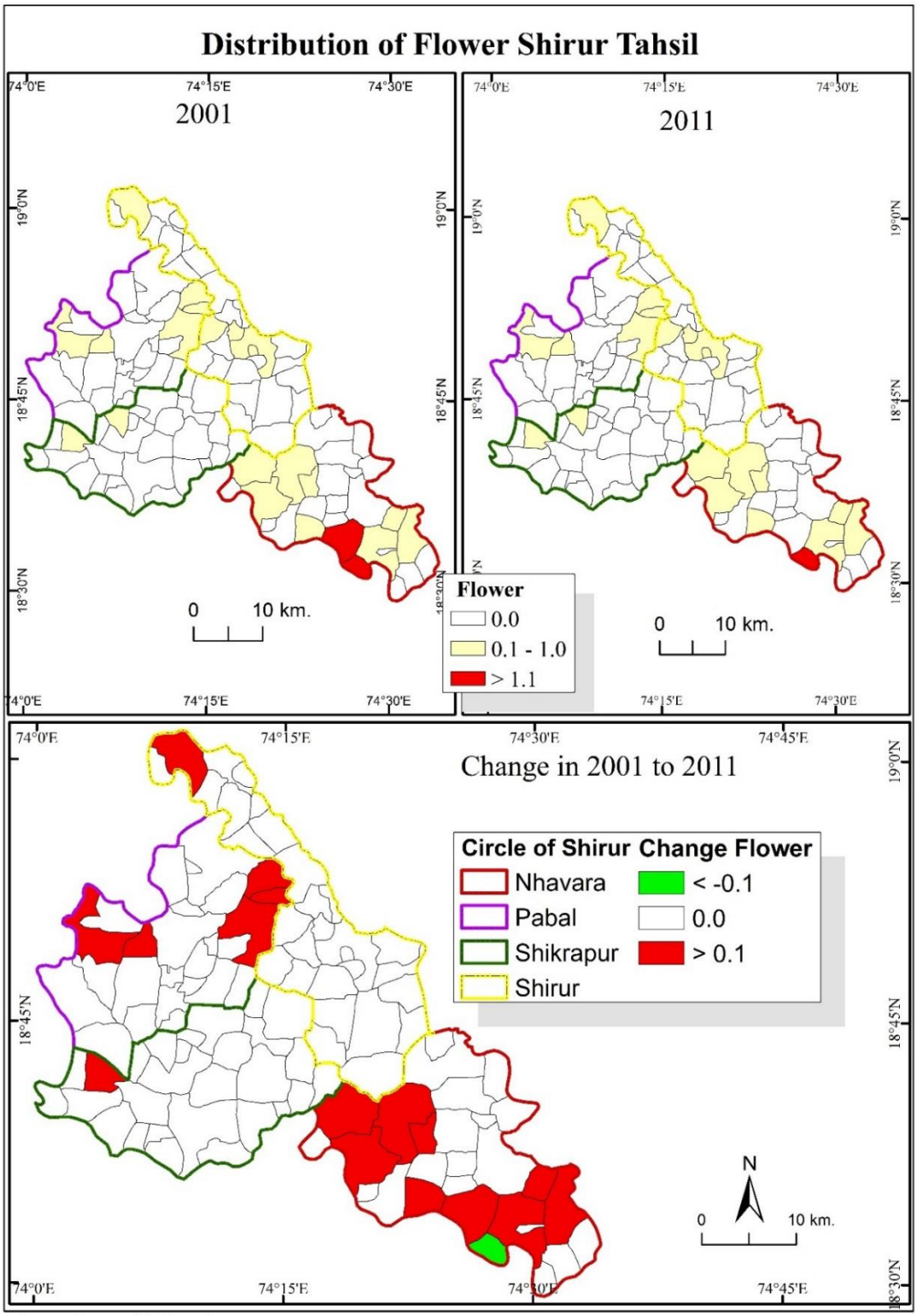
Table No. 4.12 **Circle wise distribution of Flowers**

Flower				
Sr. No.	Name of Circle	Year (Area in Percent)		Volume of change %(Percent)
		2001	2011	2001-2011
1	Shirur	0.05	0.05	0.00
2	Nahavra	0.13	0.17	0.03
3	Shikrapur	0.01	0.01	0.00
4	Pabal	0.02	0.02	0.01
	Total	0.20	0.25	0.04

(Computed by researcher)

In Nhavara Circle, villages like Kuruli, Pimpalsuti, Ganegaon dumala, Nirvi, Nimone, Gunat, etc. produces around 0.13 percent in 2001 and 0.17 percent in 2011respectively.

In Shikrapur Circle Shikrapur, Jategaon, vadu bk. Sanaswadi, etc. produced highest number of flowers crop.



Source: Computed by Researcher

Figure No.- 4.10 **Distribution of Flowers**

Flower crop was mainly in Sadalgaon village, and Mandavgan, villages is mainly in shirur tahsil 2001, it was reduced in 2011 due to growth in cash crop.

The production decreased by 0.05 percent in Shirur, Shikrapur and Nhavara circle in villages like Amdabad, Nimgaon, Bhogi, Annapur, Mukai, Buranjwadi, Sadalgaon etc. Mandagan farata, Vadgaon, Kurali, Nagargaon, Ranjangaon sandas, khathapur, munjalwadi, Pabal, and Thetewadi Villages showed positive growth of 0.1 percent in flower cultivation.

4.4.11 Distribution of Jawar:

As high as (31.02 percent) in 2001 and 25.15 in 2011 was occupied under Jawar crop cultivation in villages Shikrapur, Jategaon, Vadu bk. Sanaswadi, etc. in Shikrapur circle. Shirur circle registered lowest production of Jawar 0.01 percent in 2001 and 0.01 percent in 2011 in villages Saradwadi, Karegaon, Golegaon Chavanwadi, Karde etc.

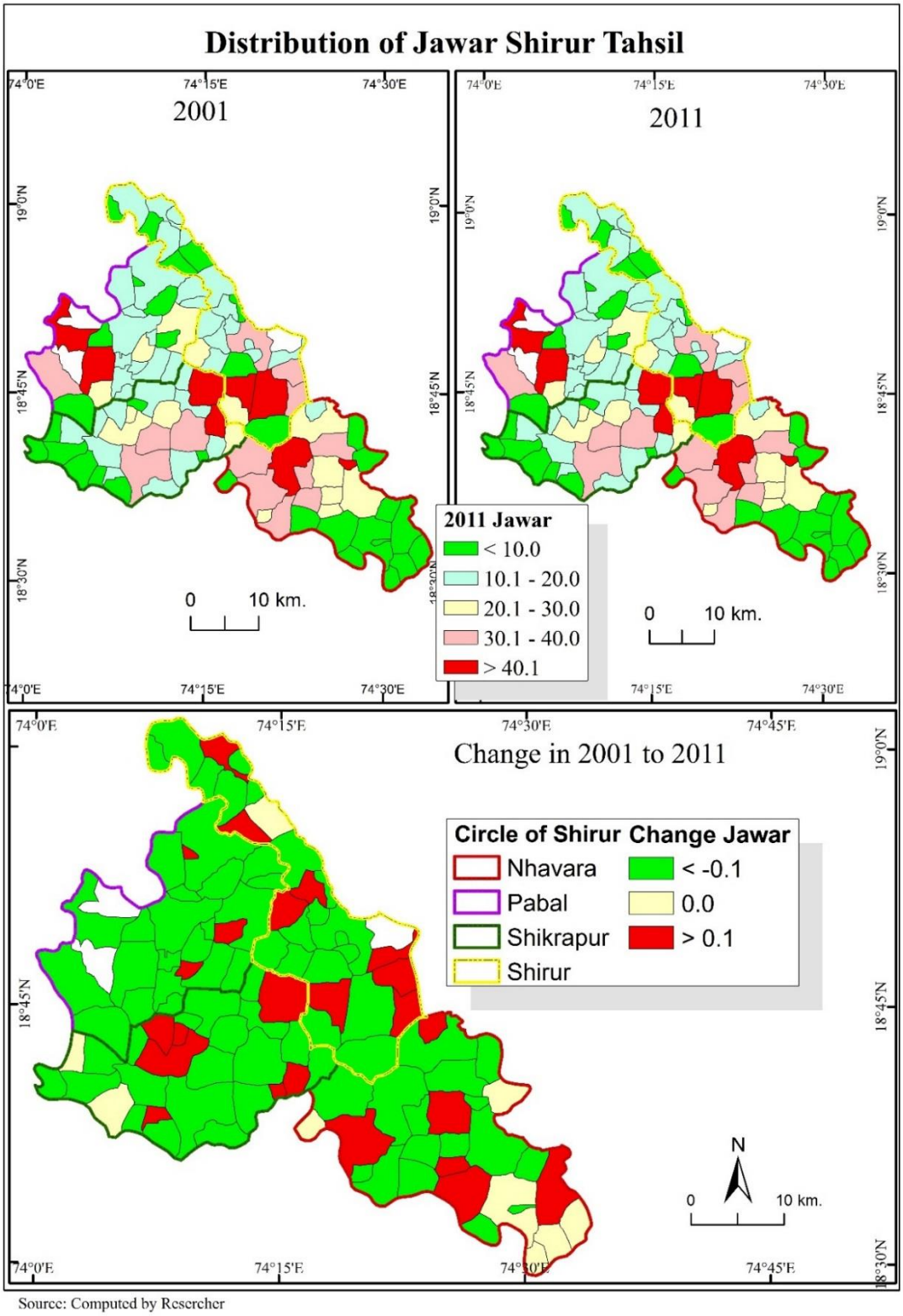
Table No. 4.13 **Circle wise distribution of Jawar**

Jawar				
Sr. No.	Name of Circle	Year (Area in Percent)		Volume of change% (Percent)
		2001	2011	2001-2011
1	Shirur	24.20	21.86	-2.34
2	Nhavara	28.62	25.26	-3.36
3	Shikrapur	31.02	25.15	-5.87
4	Pabal	28.93	22.92	-6.01
	Total	112.77	95.20	-17.57

(Computed by researcher)

The Map (4.11 Shows) the distribution of area under Jawar crop. In 2001, Karde, Khannur masai, Malthan, Munjalwadi, Pimpale Jagatap, Kuruli, Andalgaon produced large number of Jawar with no change in 2011.

Some villages like Pabal, Thetewadi, Khairenagad, Kendur, Shirur, Nhavara, Nirvi, Nimone, Karegaon villages showed less production by -0.1Percent in production of Jawar.



Source: Computed by Researcher

Figure No.- 4.11 **Distribution of Jawar**

4.4.13 Distribution of Wheat:

The wheat is cereal crop of rabbi season in Shirur tehsil. Wheat a short duration succession crop for the rabbi season became popular in the all command areas of the tahasil after onion, helps cultivate wheat, as the initial water requirement for growing the crop is meet through soil moisture available over a period of a month after the last spell of rains. In initial period, wheat requires 10 to 15^0c temperature. Wheat is generally sown in November and is harvested in March.

Spatial distribution of wheat in the tahsil is mostly located on the river canal and another source of available in irrigation facilities. The main sources of irrigation for wheat are lift, well and tube well irrigation. The wheat crop being short duration i.e. maximum of 120 days or 4 months has been successfully adopted by the farmers as a major rabbi crop. There has been a steady increase in the number of farmers for cultivating the food grain crop, probably due to better returns than other crops. The area under wheat cultivation in the tahsil was about 3686 hectares 3.19Percent in 2001.

The area under Wheat crop production was 3686 hectares and 3.19 Percent in Shirur tahsil in 2001. Getting a rise by 4356 hectares. 4.26 Percent in Shirur tahsil in 2011. The highest land occupied under Wheat crop is registered at Shirur Circle, in 2001 (4.60 Percent) Saradwadi, Karegaon, Golegaon Chavanwadi, Karde, Villages and 2011 (5.93 Percent) Shikrapur, Circle at Shikrapur, Jategaon, vadu bk. Sanaswadi, etc. And Lowest Land Occupied under Wheat crop is registered at Pabal circle in 2001 (1.86 Percent) and 2011 (2.46 Percent) at Warude, Kendur, Waghale, Singadwadi, Khire nagad, Mukai, etc. Villages, These Wheat crops are taken by progressive farmers.

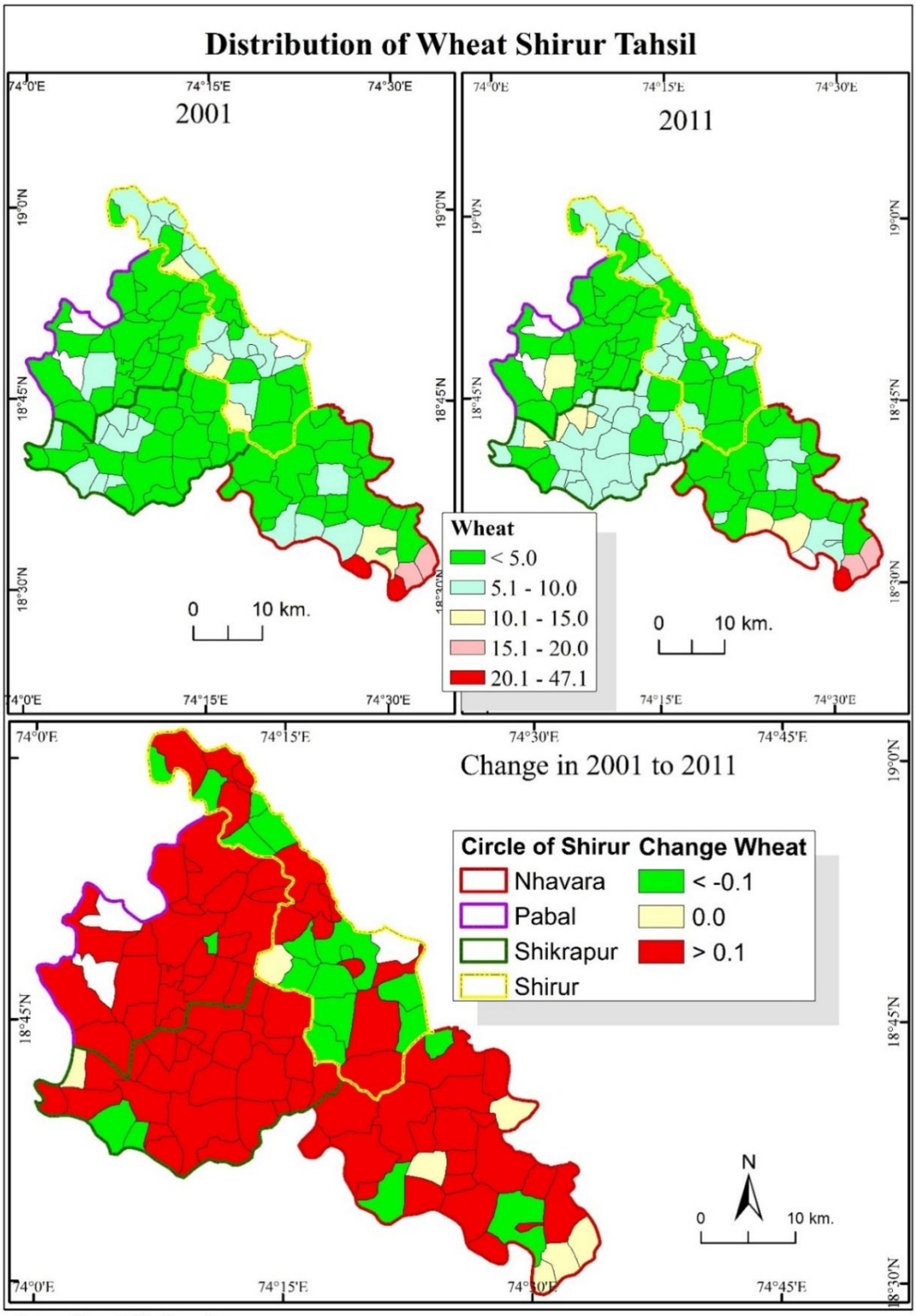
Table No. 4.14 **Circle wise distribution of Wheat**

Wheat				
Sr. No.	Name of Circle	Year (Area in Percent)		Volume of change (Percent)
		2001	2011	2001-2011
1	Shirur	4.60	4.20	-0.40
2	Nahavra	2.82	3.51	0.69
3	Shikrapur	3.98	5.93	1.96
4	Pabal	1.86	2.46	0.60
	Total	13.26	16.11	2.85

(Computed by researcher)

In Shirur circle, Sardawadi, Karegaon, Golegaon Chavanwadi, Karde, Villages produced 4.60 percent of wheat crop in 2001. In 2011 Warude, Kendur, Waghale, Singadwadi, Khire nagad, Mukai, etc. Villages covered lowest number of land covered under wheat cultivation. Babalsar Bk. Ganeggaon khalsa, Sadalgaon, Kuruli, Andalgaon, mainly produced Wheat crop in Shirur tahsil in 2001.

From 2001 to 2011 Mandavgan farata, Ganegaon, Vadgaon Rasai vilalges showed positive growth in wheat production whereas Golegaon, Karde, Bhambarde, Amblevillage villages registered negative production by -0.1 percent due to production of sugarcane.



Source: Computed by Researcher

Figure No.- 4.12 **Distribution of Wheat**

4.4 Summary:

The major crops cultivated in kharif season [June to October, November] are Bajara Onion, Total Pulses, Total Oilseed, Fodder crop, Sugarcane, Fruit (Cash crops) etc. In rabbi season [October to March] crops such as (Cereals) wheat, Jowar, etc. and Mix Crops are (Kharif, Rabbi and Summer Seasons) e.g. Sugarcane, All Fruits, Vegetables, Flowers and Fodder Crops etc. grown in the study area. In summer groundnut and fodder crops are grown in summer season in the area where irrigation and water is available. Sugarcane is cultivated as Adsali, pre-seasonal and Suru.

It is observed that the agricultural land use is decreasing during the study period. This is mainly because of the agricultural land is being converted into residential and other uses for the growth and development of the specific area of the study region. It is observed from the study area that there is a greater variation in the changes regarding to land use and cropping pattern, during the study period i.e. 2001 to 2011.

In the study area farmers have adopted partially modern technology i.e. drip irrigation facility, HYV seeds material, sugarcane, fruits, vegetables, food grain and other crops, increasing uses of composting biomass, machineries, improved plantation technology and micro irrigation systems, available for nearby village inputs (seeds, fertilizers, insecticides, cattle feeds and veterinary services), agricultural labor bullock power, crop loans, electricity, irrigation, dairy centers and processing units, nearby sugar factory, good network of transports and markets, good communication facilities, agricultural advisory centers etc. are available in the study area.

CHAPTER – V

AGRICULTURE REGION

5.1 Introduction:

The National Sample Survey Organization has divided India into 25 main agricultural regions with 66 sub-regions by grouping within each state, union territory, districts or parts of districts having similar population density, crop pattern and altitude above sea level, transport and communication facilities. A systematic appraisal of soil and climatic resources is a pre-requisite for formulating effective land use plan. Mapping of various agro- ecological regions will help in identifying suitable cropping patterns for a particular region. In order to determine agricultural regions, rainfall, temperature, altitude, soil types and crops are taken into consideration. Many scientists have classified regions for the purpose of agricultural planning into variety of ways. Dr. Chen Han Seng has divided India into sixteen regions on the basis of topographical situation, agricultural water supply, crop system, land tenure system and general economic development. K. William Easter has divided country into three main divisions, 10 subdivisions and 52 regions.

This chapter has attempted to find out crop regions of Shirur Tahsil by applying Crop ranking, crop combination and crop diversification techniques. Cropping pattern is influenced by relief, soil, climate, use of fertilizers, pesticides, irrigation facilities, distance from market, attitude of farmers, transport and price fluctuation etc. In order to study, relative strength of aerial extent of crop, crop ranking, crop combination and crop diversification methods which applied in order to understand spatial variations in agricultural regions in study region.

Ranking of crop reveals the relative strength of 12 crop percent at village level were taken into consideration for computing crop ranking. These 12 crops are, namely, Jowar, Wheat, Bajara, Sugarcane, Fodder crops, Oilseeds, Pulses, Fruits and Vegetables, Spice and Onion (Table-5.1). The cultivation of these crops is the result of soil types and irrigation besides farmer's decision in the study area. The ranking obtained for all these crops show the relative significance of individual crop in cropping pattern.

5.2 Crop Ranking:

The relative strength of crop percentage at tahsil level is understood by ranking of crops. In order to compute crop ranking, 12 dominant crops have considered in present study. These crops are, namely, Jowar, wheat, Bajara, sugarcane, fodder crops, fruits, vegetables, Spices, flower, Oilseed, pulses, Onion, (Table- 5.1).

Table No.-5.1: Crop Rank Frequency in 2001

Source: Computed by Researcher

sr. no.	Crop Name	Crop Ranks and Number of Villages 2001											
		1	2	3	4	5	6	7	8	9	10	11	12
1	Sugarcane	6	4	7	9	7	7	11	20	26	10	1	
2	Fodder Crop	7	10	8	16	35	18	11	3				
3	Onion	3	10	9	34	16	21	9	5	1			
4	Wheat	2	2	3	5	10	14	34	27	10	1		
5	Bajara	6	31	29	19	6	9	3	5				
6	Pulses	38	39	16	5	5	4	1					
7	Jowar	45	7	23	7	6	4	6	5	2		2	1
8	Fruit			2	1	7	7	16	22	47	5	1	
9	Vegetables	1	5	11	12	16	24	15	20	4			
10	Spice									12	81	14	1
11	Flower							1	1	5	4	67	30
12	Oil Seeds							1		1	7	23	76
	Total	108	108	108	108	108	108	108	108	108	108	108	108

Table-5.2: Crop Rank Frequency in 2011

sr. no.	Crop Name	Crop Ranks and Number of Villages2011											
		1	2	3	4	5	6	7	8	9	10	11	12
1	Sugarcane	31	7	5	8	5	7	4	14	18	8	1	
2	Fodder Crop	5	17	7	21	27	15	9	6	1			
3	Onion	4	15	17	27	17	16	11	1				
4	Wheat		6	7	3	12	14	33	26	7			
5	Bajara		30	26	18	10	12	5	7				
6	Pulses	34	23	15	8	8	4	4	4	7			1
7	Jowar	30	5	18	12	10	6	10	8	6		2	1
8	Fruit	1		1	1	6	10	18	18	48	4	1	
9	Vegetable	3	5	11	10	13	24	13	23	4	2		
10	Spice									11	82	14	1
11	Flower							1	1	4	5	67	30
12	Oil Seed			1						2	7	23	75
	Total Villages	108	108	108	108	108	108	108	108	108	108	108	108

Source: Computed by Researcher

5.2.1 First Crop Ranking:

Table no. - 5.3 and shows the first ranking crops in Shirur tahsil. Eight crops have been identified as first ranking crops. These Eight crops are, namely, Jowar, Wheat, Fruit, Onion, Pulses, Sugarcane, Vegetable and Fodder crop .Displays the distribution of first ranking crops in the Shirur tahsil. And Pulses is major crop and it stands as the first rank crop and is found to have largest coverage in 32villages occupying 52.94% area in the study region.

Table No.- 5.3 **Crops, Villages and Areas in First Ranking**

Sr. No.	Crops	Crops, Villages and Areas in First Ranking		
		No. of Villages	Area in Hectors	Area in Percentage
1	Bajara			
2	Flower			
3	Fodder Crop	7	760.5	2.12
4	Fruit	1	136.4	0.38
5	Jawar	32	18944.7	52.94
6	Onion	5	1110	3.10
7	Spice			0
8	Sugarcane	14	3513	9.81
9	Oil Seed			0
10	Pulses	42	10702	29.90
11	Vegetable	5	498.5	1.393
12	Wheat	2	118	0.32
	Total	108	35783.1	100

Data Source: Computed by Researcher

Jowar appears in south part in the study region on deep soil along Shikrapur, Pabal, and Nahavra Circle. The favorable environment in the region is responsible for growing sugarcane on fertile black soil. Sugarcane is another crop showing first rank in study region. Its cultivation is found in east central part in 14 villages on 9.81% of total area this crop is grown in 3513 hectares. Pulses is identified as the second major crop standing in the area under study. Pulses is grown in 42 villages (29.90 percent to total villages) and is confined to the north, north-west and middle part in the study region.

This crop is cultivated on 10702 hectares in less rainfall region on coarse shallow soil. Wheat has been identified as first ranking crop in two village's lies at the central part in the study region. The wheat cultivation in Mandavgaon, Vadgav ranks

first due to fertile soil and availability of irrigation by along Bhima River. This crop is cultivated on 118 hectares (0.32 percent of total area0 in less rainfall region on coarse shallow soil. The Onion cultivation in Amble, Karde, Nimone, Tardobachiwadi, Golegaon, is major dominant in the Pabal and Nahavra circle. Ghod River and canal irrigation is the Chaskaman.

This crop is cultivated on 1110 hectares (3.10 percent of total area in less rainfall region on coarse shallow soil. The Fodder crop cultivation in Amble, Karde, Nimone, Tardobachiwadi, Golegaon, is major dominant in the Pabal and Nahavra circle. Ghod River and canal irrigation is the Chascaman. This crop is cultivated on 760 hectares (2.12 percent of total area in less rainfall region on coarse shallow soil.

The fruit cultivation in Mandavgaon, Vadgaon ranks first due to fertile soil and availability of irrigation by along Bhima River. This crop is cultivated on 136.4 hectares (0.38 percent of total area0 in less rainfall region on coarse shallow soil. Fruit has been identified as first ranking crop in two villages lies at central part in the study region.

5.2.2 Second Crop Ranking:

Table No.5.4 Show the second ranking crops in the Shirur tahsil. Bajara is major crop and it stands as Second rank and is found to have largest coverage in 32villages occupying 37.68% area in the study region.

Table No.- 5.4 **Crops, Villages and Areas in Second Ranking**

Sr. No.	Crops	Crops, Villages and Areas in Second Ranking		
		No. of Villages	Area in Hectors	Area in Percentage
1	Bajara	32	8587	37.68
2	Flower			0
3	Fodder Crop	16	1508.5	6.62
4	Fruit			0
5	Jowar	7	1088.7	4.77
6	Onion	13	3302	14.49
7	Spice			0
8	Sugarcane	3	412	1.80
9	Total Oil Seed			0
10	Total Pulses	30	7451	32.69
11	Total Veg	4	356.3	1.56
12	Wheat	3	81	0.35
	Total	108	22786.5	100

(Source: Computed by Researcher)

The Bajara appears in south part in the study region on deep soil along Shikrapur, Pabal, and Nahavra Circle. The favorable environment in the region is responsible for growing sugarcane on fertile black soil. Sugarcane is another crops showing second rank in study region. Its cultivation is found in east central part in 3 villages on 1.80% of total area this crop is grown in 412 hectares. Fodder is identified as the second major crop standing in the area under region. Fodder crop is grown in 16 villages (6.60 percent to total villages) and is confined to the north, north-west and middle part in the study region.

This crop is cultivated on 11508.5 hectares in less rainfall region on coarse shallow soil. Jowar has been identified as Second ranking crop in seven villages' lies at central part in the study region. The Jowar cultivation in Kuruli, Nirvi, Kolgaon dolas Sirasgaon, Amble, Karde, Karjavane, Kendur, Pabal is ranks second due to fertile soil. This crop is cultivated on 1088 hectares (4.77 percent of total area in less rainfall region on coarse shallow soil. Wheat has been identified as Second ranking crop in three villages lies at central part in the study region such as Mandavgan, Ganegaon dumala, Babulsar bk.. The Onion cultivation in Amble, Karde, Nimone, Tardobachiwadi, Golegaon, is major dominant is the Pabal and Nahavra circle. Ranks second due to fertile soil and availability of irrigation by along Ghod River and canal irrigation is the Chascaman. This crop is cultivated on 3302 hectares (14.49 percent of total area in less rainfall region on coarse shallow soil.

The Fodder crop cultivation in Amble, Karde, Nimone, Tardobachiwadi, Golegaon, is dominantly is the Pabal and Nhavara circle. Fodder crop second due to fertile soil and availability of irrigation by along Ghod river and canal irrigation. This crop is cultivated on 1508.5 hectares (6.62 percent of total area in less rainfall region on coarse shallow soil. The vegetable cultivation in Mandavgaon, Vadgaon, Saradwadi, Sanaswadi Shindodi, Gunat, Karde, Amble Uralgaon Dahivadi, Shikrapur, Koregaon Bhima ranks second due to fertile soil and availability of irrigation by along Bhima River. This crop is cultivated on 356.3hectares (1.56 percent of total area0 in less rainfall region on coarse shallow soil.

5.2.3 Third Crop Ranking:

Table no. - 5.5 and show the Third ranking crops in the Shirur tahsil. Nine crops have been identified as third ranking crops. These nine crops are, namely, Jowar, Wheat, Bajara, Fruit, Onion, Pulses, Sugarcane, Vegetable, and Fodder crop. Displays the distribution of third ranking crops in the Shirur tahsil. And Bajara is major crop and it stands as third rank and is found to have largest coverage in twenty sixth villages occupying 39.55% area in the study region.

Table No. 5.5 **Crops, Villages and Areas in Third Ranking**

Sr. No.	Crops	Crops, Villages and Areas in Third Ranking		
		No. of Villages	Area in Hectors	Area in Percentage
1	Bajara	26	6214	39.55
2	Flower			0
3	Fodder Crop	6	387.8	2.46
4	Fruit	1	73.85	0.47
5	Jowar	19	3441	21.90
6	Onion	15	995	6.33
7	Spice			0
8	Sugarcane	9	1133	7.21
9	Oil Seed			0
10	Pulses	18	2325	14.79
11	Vegetable	13	1117	7.10
12	Wheat	1	25	0.15
	Total	108	15711.65	100

(Source: Computed by Researcher)

The Bajara appears in south part in the study region on deep soil along Shikrapur, Pabal, and Nahavra Circle. The favorable environment in the region is responsible for growing sugarcane on fertile black soil. Sugarcane is another crops showing third rank in study region. Its cultivation is found in east central part in 9 villages on 7.21% of total area. This crop is grown in 113 hectares. Fodder crop is grown in 6 villages (2.46 percent to total villages) and is confined to the north, north-west and middle part in the study region. This crop is cultivated on 387.8 hectares in less rainfall region on coarse shallow soil. Jowar has been identified as third ranking crop in 19 villages lies at central part in the study region.

The Jowar cultivation in Kuruli, Nirvi, Kolgaon dolas Sirasgaon, Ambale, Karde, Karjavane, Kendur, and Pabal is ranks second due to fertile soil. This crop is

cultivated on 3441 hectares (21.90 percent of total area in less rainfall region on coarse shallow soil.

Wheat has been identified as third ranking crop in only one village lies at central part in the study region such as Babulasar Bk. This crop is cultivated on 25 hectares (0.15 percent of total area in less rainfall region on coarse shallow soil. Onion has been identified as Third ranking crop in15 villages lies at central part in the study region. The Onion cultivation in Amble, Karde, Nimone, Tardobachiwadi, Golegaon, is major dominant is the Pabal and Nhavara circle. Ghod River and canal irrigation is the Chascaman. This crop is cultivated on 995 hectares (6.32 percent of total area in less rainfall region on coarse shallow soil. Onion has been identified as Third ranking crop in15 villages lies at central part in the study region.

The Fodder crop cultivation in Amble, Karde, Nimone, Tardobachiwadi Golegaon, is major dominant is the Pabal and Nahavra circle. It ranks third due to fertile soil and availability of irrigation by along Ghod River and canal irrigation. This crop is cultivated on 387.8hectares (2.46 percent of total area in less rainfall region on coarse shallow soil. Third ranking crop in13 villages lies at central part in the study region. The vegetable cultivation in Mandavgan, Vadgaon, Saradwadi, Sanaswadi Shindodi, Gunat, Karde, Amble, Uralgaon dahivadi, Shikarapur, Koregaon Bhima ranks third due to fertile soil and availability of irrigation by along Bhima River. This crop is cultivated on 1117 hectares (7.10 percent of total area0 in less rainfall region on coarse shallow soil.

5.2.4 Four Crop Ranking:

Table no. - 5.6 and show the fourth ranking crop in the Shirur tahsil. Nine crops have been identified as fourth ranking crop. These Nine crops are, namely, Jowar, Wheat, Bajara, Fruit, Onion, Pulses, Sugarcane, Vegetable, and Fodder crop. A displays the distribution of four ranking crops in the Shirur tahsil. And Onion is major crop and it stands as fourth rank crop and is found to have largest coverage in 28 villages occupying 32.60% area in the study region. The Onion cultivation in Amble, Karde, Nimone, Tardobachiwadi Golegoan, is major dominant is the Pabal and Nahavra& central part in the study region. It forth ranks fourth due to fertile soil and availability of irrigation by along Ghod River and canal irrigation is the Chascaman circle.

Table No.- 5.6 **Four crop ranking**

Four crop ranking				
Sr. No.	Crops	No. of Villages	Area in Hectors	Area in Percentage
1	Bajara	16	2187	20.31
2	Flower			
3	Fodder Crop	23	2009.4	18.66
4	Fruit	1	154.7	1.43
5	Jawar	12	339.8	3.15
6	Onion	28	3509	32.60
7	Spice			
8	Sugarcane	7	1255	11.65
9	Total Oil Seed			
10	Total Pulses	9	510	4.73
11	Total Veg.	10	513.7	4.77
12	Wheat	2	285	2.64
	Total	108	10763.6	100

(Source: Computed by Researcher)

The Bajara appears in south part in the study region on deep soil along Shikarapur, Ppabal, and Nahavra Circle. The favorable environment in the region is responsible for growing sugarcane on fertile black soil. Sugarcane is another crops of the fourth rank in study region. Its cultivation is found in east central part in 7 villages on 11.65% of total area. This crop is grown in 1255 hectares. Fodder crop is grown in 23 villages (18.66 percent to total villages) and is confined to the north, north-west and middle part in the study region. The Fodder crop cultivation in Amble, Karde, Nimone, Tardobachiwadi, Golegoan, in a dominant of the Pabal and Nahavra circle.

This crop is cultivated on 2009 hectares in less rainfall region on coarse shallow soil. Jawar has been identified as fourth ranking crop in 12 villages lies at central part in the study region. The Jowar cultivation in Kuruli, Nirvi, Kolgaon dolas, Sirasgaon, Amble, Karde, Karjavane, Kendur, Pabal is ranks four due to fertile soil. This crop is cultivated on 339 hectares (3.15 percent of total area in less rainfall region on coarse shallow soil. Wheat has been identified as third ranking crop in 2 villages lies at central part in the study region such as Babulsar bk. Mandavgan. This crop is cultivated on 285 hectares (2.64 percent of total area in less rainfall region on coarse shallow soil. Pulses has been identified as four ranking crop in ninth villages lies at central part in the study region. It ranks fourth due to fertile soil and availability

of irrigation by along Ghod River and canal irrigation. This crop is cultivated on 510 hectares 4.73 percent of total area in less rainfall region on coarse shallow soil.

Vegetable has been identified as four ranking crop in 10 villages lies at central part in the study region. The vegetable cultivation in Mandavgaon, Vadgaon, Saradwadi, Sanaswadi, Shindodi, Gunat, Karde, Amble Uralgaon, Dahivadi, Shikrapur, Koregaon bhima ranks third due to fertile soil and availability of irrigation by along Bhima River. This crop is cultivated on 513.7 hectares (4.77 percent of total area, in less rainfall region on coarse shallow soil.

5.2.5 Fifth Crop Ranking:

Table no. - 5.7 and show the four ranking crops in the Shirur tahsil. Nine crops have been identified as five ranking crops. These Nine crops are, namely, Jowar, Wheat, Bajara, Fruit, Onion, Pulses, Sugarcane, Vegetable, and Fodder crop. Onion is major crop and it stands as fifth rank and is found to have largest coverage in 17 villages occupying 17.89% area in the study region. The Onion cultivation in Amble, Karde, Nimone, Tardobachiwadi, Golegoan, is major dominant is the Pabal and Nahavra and central part in the study region. It ranks fifth due to fertile soil and availability of irrigation by along Ghod River and canal irrigation is the Chascaman circle.

Table No.- 5.7 **Five Crop Ranking**

Sr. No.	Crops	Five Crop Ranking		
		No. of Villages	Area in Hectors	Area in Percentage
1	Bajara	10	658	8.94
2	Flower			0
3	Fodder Crop	27	1923.402	26.13
4	Fruit	6	329.82	4.48
5	Jawar	10	523	7.10
6	Onion	17	1317	17.896
7	Spice			0
8	Sugarcane	5	452	6.14
9	Total Oil Seed			0
10	Total Pulses	8	352	4.78
11	Total Veg	13	862.69	11.72
12	Wheat	12	941	12.78
	Total	108	7358.912	100

Source: Computed by Researcher

The Bajara appears in south part in the study region on deep soil along Shikrapur, Pabal, and Nahavra Circle. The favorable environment in the region is responsible for growing sugarcane on fertile black soil. Sugarcane is another crops showing four rank in study region. Its cultivation is found in east central part in 7 villages on 11.65% of total area. This crop is grown in 1317 hectares. Fodder crop is grown in 27 villages (26.13 percent to total villages) and is confined to the north, north-west and middle part in the study region.

The Fodder crop cultivation in Saradwadi, Chavanwadi, Babulasar Khurd, Koregaon, Sonesangavi, Pimparkhed, Nhavara, Kohakdewadi, Dumalwadi, Aalegaon Paga, Raksewadi, Nimone, Motewadi, Gunt, Shindhodi, Kolgaon dolas, ,Aandalgaon, Darekarwadi, Kasari, Ranjangaon Ganpati, Pabal, Kendur, Khierewadi, Hivare, Singadwadi, Khannur Mesai, Kavate. This crop is cultivated on 1923 hectares in less rainfall region on coarse shallow soil. Jowar has been identified as fifth ranking crop in 10 villages lies at central part in the study region.

The Jawar cultivation in Tardobachi wadi, Kardalwadi, Dhoksangavi, Golegav, vadner, Dongargan, Fakate, Koregaon Bhima, Burangwadi, Karandi is ranks fifth due to fertile soil. This crop is cultivated on 523 hectares (7.10 percent of total area in less rainfall region on coarse shallow soil.

Wheat has been identified as fifth ranking crop in 12 villages at central part in the study region such Annapur, Nirvi, Chinchani, Ranjangaon Sandas, Inamgaon, Faratwadi, shikarapur, Rautwadi, Jategaon Khurd, Kondapuri, Khandale, Ganegaon Khalsa. This crop is cultivated on 941 hectares (12.78 percent of total area in less rainfall region on coarse shallow soil. pulses has been identified as five ranking crop in eighth villages lies at central part in the study region. Crop is cultivated on 352 hectares (4.78 percent of total area in less rainfall region on coarse shallow soil. vegetable has been identified as four ranking crop in 13 villages lies at central part in the study region.

The vegetable cultivation in Mandavgan, Vadgaon, Saradwadi, Sanaswadi Shindodi, Gunat, Karde, Amble Uralgaon, dahivadi, Shikarapur, Koregaon bhima ranks fifth due to fertile soil and availability of irrigation by along Bhima River. This crop is cultivated on 862.69 hectares (11.72 percent of total area, in less rainfall region on coarse shallow soil. Fruit has been identified as fifth ranking crop in 6Villages lies at central part in the study region. This crop is cultivated on 329hectares &4.48 percent of total area.

5.2.6 Sixth Crop Ranking:

Table no. 5.8 and shows the sixth ranking crops in the Shirur tahsil. Nine crops have been identified as six ranking crops. These nine crops are, namely, Jowar, Wheat, Bajara, Fruit, Onion, Pulses, Sugarcane, Vegetable, and Fodder crop. A displays the distribution of sixth ranking crops in the Shirur tahsil. Onion is major cash crop and it stands as sixth rank and is found to have largest coverage in 16 villages occupying 1054 hectors and 18.59% area in the study region. The Onion cultivation in Sardwadi, Tardobachi wadi, Bhabarde, Karegaon, Vadner, Dongargan, Fakate, Aamdabad, Vadgaon Rasai, Shikarapur, Talegaon Damdere, Takli Bhima, Shivtkarar, Dadivadi, Karnjavane, Ranjangaon Ganpati villages in study region.

Table No.- 5.8 **Sixth Crop Ranking**

Sr. No.	Crops	Sixth Crop Ranking		
		No. of Villages	Area in Hectors	Area in Percentage
1	Bajara	13	519.2	9.16
2	Flower			0
3	Fodder Crop	15	915.5	16.15
4	Fruit	9	427.15	7.53
5	Jowar	7	329.7	5.81
6	Onion	16	1054	18.59
7	Spice			0
8	Sugarcane	10	457	8.06
9	Total Oil Seed			0
10	Total Pulses	1	57	1.00
11	Total Veg	22	1292.2	22.79
12	Wheat	15	616	10.86
	Total	108	5667.75	100

(Source: Computed by Researcher)

The favorable environment in the region is responsible for growing sugarcane on fertile black soil. Sugarcane is another crops showing sixth rank in study region. Its cultivation is found in east central part in 10 villages on 11.65% of total area this crop is grown in 1317 hectares. Fodder crop is grown in 15 villages (16.15 percent to total villages) and is confined to the north, north-west and middle part in the study region.

The Fodder crop cultivation in Saradwadi, Chavanwadi, Babulsar Khurd, Karegaon, Sonesangavi, Pimparkhed, Nhavara, Khohakdewadi, Dumalwadi, Aalegaon Paga, Raksewadi, Nimone, Motewadi, Gunt, shindhodi, Kolgaon dolas, ,Aandalgaon, Darekarwadi, Kasari,Ranjangaon Ganpati, Pabal, Kendur, Khierewadi, Hivare, Singadwadi, Khannur Mesai, ,Kavathe. This crop is cultivated on 915.5 hectares in less rainfall region on coarse shallow soil. Jowar has been identified as sixth ranking crop in seventh villages lies at central part in the study region. The

Jawar cultivation in Tardobachi wadi, Kardalwadi, Dhoksangavi, Golegav, vadner, Dongargan, Fakate, Koregaon Bhima, Burangwadi, Karandi is ranks sixth due to fertile soil. This crop is cultivated on 329.7 hectares (5.81 percent of total area in less rainfall region on coarse shallow soil.

Wheat has been identified as four ranking crop in 15 villages lies at central part in the study region such Annapur, Nirvi, Chinchani, Ranjangaon Sandas, Inamgaon, Faratwadi, shikarapur, Rautwadi, Jategaon Khurd, Kondapuri, Khandale, Ganegaon Khalsa, This crop is cultivated on 616 hectares (10.86 percent of total area in less rainfall region on coarse shallow soil. pulses has been identified as five ranking crop in eighth villages lies at central part in the study region. This crop is cultivated on 57 hectares (1.0 percent of total area in less rainfall region on coarse shallow soil. vegetable has been identified as six ranking crop in 22 villages lies at central part in the study region.

The vegetable cultivation in Mandavgan, vadgaon, Saradwadi, Sanaswadi Shindodi, Gunat, Karde, Amble Uralgaon, Dahivadi, Shikrapur Koregaon Bhima ranks third due to fertile soil and availability of irrigation by along Bhima River. This crop is cultivated on 1292.2 hectares (22.79 percent of total area, in less rainfall region on coarse shallow soil.

Fruit has been identified as sixth ranking crop in ninth village's lies at central part in the study region. This crop is cultivated on 427 hectares &7.53% of total area.

5.2.7 Seventh Crop Ranking:

Table no - 5.9 and shows the seventh ranking crops in the Shirur tahsil. Nine crops have been identified as nine ranking crops. These nine crops are, namely, Jowar, Wheat, Bajara, Fruit, Onion, Flower, Sugarcane, Vegetable, and Fodder crop. A displays the distribution of seven ranking crops in the Shirur tahsil. Sugarcane is cash crop and it stands as seventh rank and is found to have largest coverage in four villages occupying 304 hectors &7.22% area in the study region. The sugarcane cultivation in Shirur rural, Amble, Saradwadi, Dongargan, Malwadi, Nimgaon Bhogi Fakate, Pimparkhed, Khathapur, Aarngaon, Kasari, Ranjangaon Ganpati, Varude, Chincholi village in study region. Ghod River and canal irrigation is the Chascaman circle.

Table No.- 5.9 **Seventh Crop Ranking**

Sr. No.	Crops	Seventh Crop Ranking		
		No. of Villages	Area in Hectors	Area in Percentage
1	Bajara	5	170	4.03
2	Flower	1	3	0.07
3	Fodder Crop	9	553	13.14
4	Fruit	18	612.51	14.55
5	Jowar	10	261	6.20
6	Onion	11	364	8.64
7	Spice			0
8	Sugarcane	4	304	7.22
9	Total Oil Seed	0	0	0
10	Total Pulses	0	0	0
11	Total Veg	13	542	12.87
12	Wheat	37	1399	33.24
	Total	108	4208.51	100

(Source: Computed by Researcher)

The favorable environment in the region is responsible for growing sugarcane on fertile black soil. Onion is another crops showing seventh rank in study region. Its cultivation is found in east central part in 11 villages on 8.64% of total area this crop is grown in 364 hectares. Fodder crop is grown in 9 villages (13.14 percent to total villages) and is confined to the north, north-west and middle part in the study region.

The Fodder crop cultivation in Tardobachiwadi, Shikrapur, Rautwadi, Jategaon Budruk, Jategaon Khurd, pimpale jagtap. This crop is cultivated on 553hectares in less rainfall region on coarse shallow soil. Jawar has been identified as six ranking crop in tenth villages lies at central part in the study region.

The Jowar cultivation in Anapur, Aarngaon, Chinchani, Pimpalsuti, vajewadi, Dingrajwadi, Dhanore, Nimgaon Dude, Munjalwadi, Ichakewadiis ranks sevnth due to fertile soil. This crop is cultivated on 261hectares (6.20 percent of total area in less rainfall region on coarse shallow soil. Wheat has been identified as seventh ranking crop in 37 villages at central part in the study region such Shirur rural, Saradwadi,

Kardalwadi, Dhoksangavi, Golegav, Karegaon, Jambut, Saradwadi, Dongargan, Sabalewadi,alwadi, Sonesangavi, Nimgaon Bhogi, Fakate, Pimparkhed, Khathapur, Nhavara, Khohakdewadi, Nimone, Aandalgaon , Koregaon Bhima, Takli Bhima, Nimgaon Mhalungi, Shivtkarar, Kasari, Parodi, Dadivadi, Karnjavane, Ranjangaon Ganpati, Pabal, Karandi, Mukhai, Ravadewadi. This crop is cultivated on1399 hectares 33.24 percent of total area in less rainfall region on coarse shallow soil.

Pulses has been identified as Sevanth ranking crop in 1 villages lies at central part in the study region. Tardobachiwadi, Chandoh, Inamgaon and Mandavgan Farata. This crop is cultivated on 57 hectares 0.07 percent of total area in less rainfall region on coarse shallow soil. Vegetable has been identified as seven ranking crop in 13 villages lies at central part in the study region. The vegetable cultivation in Aalegaon Paga, Motewadi, Kolgaon dolas, Kuruli, Shikarapur, Jategaon Budruk, Jategaon Khurd, Pimpale jagtap Darekarwadi, Dhamari, Hivare, Pimpale Khalsa, Khannur Mesai ranks seventh due to fertile soil and availability of irrigation by along Bhima River.

This crop is cultivated on 542 hectares 12.87 percent of total area, in less rainfall region on coarse shallow soil. Fruit has been identified as seventh ranking crop in 18 villages lies at central part in the study region. Chavanwadi, Babulsar Khurd, Karde, Aambale, Takali Haji, Uralgaon, Dumalwadi, Ranjangaon Sandas, Raksewadi, Sirasgaon Kata, Thandali, Ganegaon Dumala, Babulsar Budruk., Khierewadi,,Singadwadi, Midagulwadi, Shastabad and Lakhewadi. This crop is cultivated on 612.51 hectares and 14.55 percent of total area.

5.2.8 Eighth Crop Ranking:

Table no - 5.10 and shows the eight ranking crops in the Shirur tahsil. Nine crops have been identified as eighth ranking crops. These nine crops are, namely, Jowar wheat, Bajara, Fruit, Onion, flower, Sugarcane, Vegetable, and Fodder crop. Vegetable is crop and it stands as eight rank and is found to have largest coverage in 23villages occupying 653.3 hectors and 24.68 percent area in the study region. The sugarcane cultivation in Shirur rural, Ambale, Saradwadi, Dongargan, Malwadi, Nimgaon Bhogi Fakate, Pimparkhed, Khathapur, Aarngaon, Kasari, Ranjangaon Ganpati, Varude and Chincholi villages in study region.

Table No.-5.10 **Eight crop Ranking**

Sr. No.	Crops	Eight crop Ranking		
		No. of Villages	Area in Hectors	Area in Percentage
1	Bajara	6	161	6.08
2	Flower	1	6	0.22
3	Fodder Crop	5	169	6.38
4	Fruit	18	364.63	13.77
5	Jowar	6	61	2.30
6	Onion	1	69	2.60
7	Spice			0
8	Sugarcane	21	523	19.75
9	Total Oil Seed			0
10	Total Pulses			0
11	Total Veg	23	653.3	24.68
12	Wheat	27	640	24.17
	Total	108	2646.93	100

(Source: Computed by Researcher)

The favorable environment in the region is responsible for growing sugarcane on fertile black soil. Sugarcane is another crops showing eighth rank in study region. Its cultivation is found in east central part of Shirur rural, such as Amble, Saradwadi, Dongargan, Malwadi, Nimgaon Bhogi Fakate, Pimparkhed, Khathapur, Aarngaon, Kasari, Ranjangaon Ganpati, Varude, chincholi in 21 villages on 19.75% of total area and this crop is grown in 523 hectares. Wheat crop is grown in 27 villages (24.17 percent to total villages) and is confined to the north, north-west and middle part such as Chavanwadi, Babulsar Khurd, Bhabarde, Karde, Vadner, Mhase, Uralgaon, Aalegaon Paga, shindhodi, Sirasgaon Kata, Kuruli, Darekarwadi, Vitthalwadi, Khierenagar, Khierewadi, Hivare, Singadwadi, Khannur Mesai, Midagulwadi, Shastabad, Lakhewadi, Nimgaon Dude, Kavate, Munjalwadi, Ichakewadi and savidane.

In the study region this crop is cultivated on 640 hectares in less rainfall region on coarse shallow soil. Fruit has been identified as eighth ranking crop in 18 villages

lies at central part in the study region. The fruit cultivation Sardwadi, Kardalwadi, Dhoksangavi, Karegaon, Sabalewadi, Sonesangavi, Khohakdewadi, Chinchani, Kolgaon dolas, Pimpalsuti, Mandavgan Farata, Faratwadi, Nagargaon, Pabal, Kendur, Dhamari, Malthan, Ravadewadi ranks eighth due to fertile soil. This crop is cultivated on 364.63 hectares (13.77 percent of total area in less rainfall region on coarse shallow soil. Bajara has been identified as eight ranking crop in six villages lies at central part in the study region such Shirur rural, Annapur, Chandoh, Motewadi, vajewadi, Dingrajwadi, Karandi, Pimpale Khalsa. This crop is cultivated on161 hectares (6.08 percent) of total area in less rainfall region on coarse shallow soil. Jowar has been identified as eighth ranking crop in 6 villages lies at central part in the study region. Jambut, Aamdabad, sadalgaon, Thandali, Ganegaon Dumala, Vadu Budruk, Aapti and Shivtkarar etc.

This crop is cultivated on 61 hectares (6.08 percent of total area in less rainfall region on coarse shallow soil. fodder has been identified as eighth ranking crop in five villages lies at central part in the study region. The fodder cultivation Tardobachiwadi, Shikrapur, Rautwadi, Jategaon Budruk, Jategaon Khurd, pimpale jagtap ranks eighth due to fertile soil and availability of irrigation by along Bhima River. This crop is cultivated on 169 hectares (6.38 percent of total area, in less rainfall region on coarse shallow soil. onion has been identified as eighth ranking crop in one village's lies at central part in the study region. Ganegaon Khalsa. This crop is cultivated on 69 hectares and 2.30 percent of total area. Flower has been identified as eight ranking crop in 1 village's lies at central part in the study region. Vadgaon Rasai, This crop is cultivated on 6 hectares and 0.22 percent of total area.

5.2.9 Nine Crop Ranking:

Table no - 5.11 and shows the ninth ranking crops in the Shirur tahsil. Nine crops have been identified as nine ranking crops. These nine crops are, namely, Jowar, Wheat, Fruit, Oilseed, flower, Sugarcane, and Fodder crop. Spice, Pulses. Fruit is crop and it stands as nine rank and is found to have largest coverage in 49 villages occupying 769.59 hectors and 54.46 % area in the study region. The fruit cultivation in Shirur rural, Shirur rural, Tardobachiwadi, Golegaon, Bhabarde, Jambut, Saradwadi, vadner, Dongargan, Mhase, Nimgaon Bhogi, Fakate, Pimparkhed, Khathapur, Aarngaon, Gunt, Kuruli, Sadalgaon, Shikarapur, Rautwadi, Jategaon Budruk, Jategaon Khurd, Pimpale jagtap, Vajewadi, Aapti, Koregaon Bhima,

Dingrajwadi, Dhanore, Talegaon Damdere, Vitthalwadi, Takli Bhima, Mhalungi, Kasari, Kondapuri, Parodi, Dadivadi, Karnjavane, Khandale, Ganegaon Khalsa, Burangwadi, Karandi, Mukhai, Hivare, Pimpale Khalsa, Nimgaon Dude, Kavate, Munjalwadi and Ichakewadi in study region. Ghod River and canal irrigation is the Chascaman circle.

Table No.- 5.11 **Ninth Crop Ranking**

Sr. No.	Crops	Ninth Crop Ranking		
		No. of Villages	Area in Hectors	Area in Percentage
1	Bajara			0
2	Flower	4	19.4	1.32
3	Fodder Crop	1	29	1.97
4	Fruit	49	769.59	52.46
5	Jowar	5	50.3	3.42
6	Onion			0
7	Spice	11	70.4	4.79
8	Sugarcane	22	138.2	9.42
9	Total Oil Seed	2	18	1.22
10	Total Pulses	4	116	7.90
11	Total Veg	0	0	0
12	Wheat	10	256	17.45
	Total	108	1466.89	100

(Source: Computed by Researcher)

The favorable environment in the region is responsible for growing sugarcane on fertile black soil. Sugarcane is another crop showing nine rank in study region. Its cultivation is found in east central part Shirur rural, such as Saradwadi, Kardalwadi, Dhoksangavi, Chavanwadi, Babulsar Khurd, Karegaon, Karde, Sonesangavi, Nirvi, Dumalwadi, Raksewadi, Ganegaon Dumala, Aandalgaon, Dhamari, Singadwadi, Midagulwadi, Shastabad, Lakhewadi in 22 villages on 9.42% of total area and this crop is grown in 138.2 hectares. spice crop is grown in11 villages (4.79 percent to total villages) and is confined to the north, north-west and middle part such as Chandoh, Inamgaon, Babulsar Budruk., sanaswadi, Darekarwadi, Vadu Budruk,

Pabal, Khierenagar, hannur Mesai, savidane, Ravadewadi. In the study region this crop is cultivated on 70.4 hectares in less rainfall region on coarse shallow soil. Wheat has been identified as eight ranking crop in 10 villages lies at central part in the study region.

The wheat cultivation Amble, Kolgaon dolas, Kendur, Varude, Vagale, Chincholi, Malthan. Ranks nine due to fertile soil. This crop is cultivated on 256 hectares (117.45%) of total area in less rainfall region on coarse shallow soil. Jawar has been identified as nine ranking crop in five village's lies at central part in the study region such Shirur rural. Takali Haji, Sabalewadi, Malwadi, shindhodi, Vadgaon Rasai, Nagargaon. This crop is cultivated on 50.3 hectares (3.42 percent) of total area in less rainfall region on coarse shallow soil. Pulses has been identified as nine ranking crop in four villages lies at central part in the study region. Annapur, Aamdabad, Chinchani, Ranjangaon Sandas, Motewadi, Thandali and Faratwadi. This crop is cultivated on 116 hectares 7.90 percent of total area in less rainfall region on coarse shallow soil. flower has been identified as nine ranking crop in four villages lies at central part in the study region.

The flower cultivation Nahavra, Khohakdewadi, Uralgaon, Aalegaon Paga. Ranks eight due to fertile soil and availability of irrigation by along Bhima River. This crop is cultivated on 19.4 hectares (1.32 percent) of total area, in less rainfall region on coarse shallow soil. Fodder crop has been identified as eighth ranking crop in one village's lies at central part in the study region. Pimpri Dumala. This crop is cultivated on 29 hectares and 1.97 percent of total area. Oilseed has been identified as nine ranking crop in two village's Mandavgan Farata and Khierewadi. This crop is cultivated on 18 hectares and 1.22 percent of total area.

5.2.10 Ten Crop Ranking:

Table no - 5.12 and shows the tenth ranking crops in the Shirur tahsil. Four crops have been identified as tenth ranking crops. These four crops are, namely, Fruit, Oilseed, Flower, Sugarcane, and Spice, displays the distribution of tenth ranking crops in the Shirur tahsil. Fruit is crop and it stands as ten rank and is found to have coverage in four villages occupying 20.75 hectors and 5.59 percent area in the study region. The fruit cultivation in Shirur rural, Shirur rural, sanaswadi, Darekarwadi, Vadu Budruk, savidane in study region.

The favorable environment in the region is responsible for growing sugarcane on fertile black soil. Sugarcane is another crops showing tenth rank in study region. Its cultivation is found in east central part Shirur rural, such as Nahavra, Khohakdewadi, Uralgaon, Aalegaon Paga, abal, Khierewadi, Khannur Mesai, Ravadewadi in 10 villages on 6.07 percent of total area.

This crop is grown in 22 hectares. spice crop is grown in 82 villages and 74.27 percent is confined to the north, north-west and middle part such as Shirur rural, Sardwadi, Tardobachi wadi, Annapur, Dhoksangavi, Golegav, Babulsar Khurd, Bhabarde, Aambale, Takali Haji, Jambut, Saradwadi, Dongargan, Sabalewadi, Mhase, Malwadi, Sonesangavi, Nimgaon Bhogi, Fakate, Khathapur, Aamdabad, Aarngaon, Nirvi, Chinchani, Dumalwadi, Ranjangaon Sandas, Raksewadi, Nimone, Motewadi, Gunt, shindhodi, Sirasgaon Kata, Kolgaon dolas, Kuruli, Pimpalsuti, Thandali, Ganegaon Dumala, Mandavgan Farata, Faratwadi, Aandalgaon , shikarapur, Rautwadi, Jategaon Budruk, Jategaon Khurd, pimpale jagtap, vajewadi, Aapti, Koregaon Bhima, Dingrajwadi, Dhanore, Talegaon Damdere Vitthalwadi, Takli Bhima, Nimgaon Mhalungi, Shivtkarar Mha., Kasari, Kondapuri, Parodi, Dadivadi, Karnjavane, Ranjangaon Ganpati, Pimpri Dumala, Khandale, Ganegaon Khalsa Burangwadi, Kendur, Karandi, Mukhai, Hivare, Pimpale Khalsa, Varude, Vagale, Singadwadi, Midagulwadi, chincholi and Shastabad, the study region. This crop is cultivated on 269 hectares in less rainfall region on coarse shallow soil. Flower has been identified as ten ranking crop in five village's lies at central part in the study region such Shirur rural. Pimparkhed, Inamgaon, Babulsar Budruk., Nagargaon and Khiere nagar. This crop is cultivated on11.6 hectares 3.20% of total area in less rainfall region on coarse shallow soil.

Table No.- 5.12 **Tenth Crop Ranking**

Sr. No.	Crops	Tenth Crop Ranking		
		No. of Villages	Area in Hectors	Area in Percentage
1	Bajara			0
2	Flower	5	11.6	3.20
3	Fodder Crop			0
4	Fruit	4	20.25	5.59
5	Jowar			0
6	Onion			0
7	Spice	82	269	74.27
8	Sugarcane	10	22	6.07
9	Total Oil Seed	7	39.3	10.85
10	Total Pulses			0
11	Total Veg			0
12	Wheat			0
	Total	108	362.15	100

(Source: Computed by Researcher)

5.11 Eleventh Crop Ranking:

Table no - 5.13 shows the eleventh ranking crops in the Shirur tahsil. Five crops have been identified as eleventh ranking crops. These tenth crops are, namely, Fruit, Oilseed, Flower, Jowar and Spice, Fruit is crop and it stands as tenth rank and is found to have coverage in one villages occupying 2.4 hectors and 10.63 percent area in Chandov of the study region.

Flower is another crops showing this crop is grown in 15.5 hectares. spice crop is grown in 67 villages and 10.63 percent is confined to the north, north-west and middle part such as Shirur rural, Shirur rural, Annapur, Kardalwadi, Aamdabad, Aarngaon, Nirvi, Chinchani, Dumalwadi, Ranjangaon Sandas, Raksewadi, Nimone, Motewadi, Gunt, Shindhodi, Sirasgaon Kata, Kolgaon dolas, Kuruli, Pimpalsuti, Thandali, Ganegaon Dumala, Mandavgan Farata, Faratwadi, Aandalgaon, Shikarapur, Rautwadi, Jategaon Budruk, Jategaon Khurd, Pimpale jagtap, Sanaswadi,

Darekarwadi, Vajewadi, Vadu Budruk, Aapti, Koregaon Bhima, Dingrajwadi, Dhanore, Talegaon Damdere, Kavate, Munjalwadi, Ichakewadi, Savidane and Ravadewadi. etc. villages.

Jowar stands as eleventh rank and is found to have coverage in two villages occupying one hectors and 0.68 percent area show the Inamgaon and Babulsar Budruk in study region. Oilseed is crop and it stands as eleven rank and is found to have coverage in 23 villages occupying 113.2 hectors and 77.64 percent area.

Table No-.5.13 **Eleventh Crop Ranking**

Sr. No.	Crops	Eleventh Crop ranking		
		No. of Villages	Area in Hectors	Area in Percentage
1	Bajara			0
2	Flower	67	15.5	10.63
3	Fodder Crop			0
4	Fruit	1	2.4	1.64
5	Jawar	2	1	0.68
6	Onion			0
7	Spice	14	13.7	9.39
8	Sugarcane			0
9	Total Oil Seed	23	113.2	77.64
10	Total Pulses			0
11	Total Veg			0
12	Wheat			0
	Total	107	145.8	100

(Source: Computed by Researcher)

5.2.12 Twelfth Crop Ranking:

Table no - 5.14 and show the 12 ranking crops in the Shirur tahsil. Three crops have been identified as 12 ranking crops. These three crops are, namely, Oilseed, flower and. Spice displays the distribution of 12 ranking crops in the Shirur tahsil. oilseed is crop and it stands as twelfth rank and is found to have coverage in 76 villages occupying 4.5 hectors and 8.03 percent area in Shirur rural, Annapur,

Pimparkhed, Aamdabad, Nhavara, Khohakdewadi, Uralgaon, Aarngaon, Nirvi, Chinchani, Dumalwadi, Aalegaon Paga, Ranjangaon Sandas, Raksewadi, Nimone, Motewadi, Gunt, Sirasgaon Kata, Kolgaon dolas, Kuruli, Inamgaon, Pimpalsuti, Vadgaon Rasai, sadalgaon, Thandali, Ganegaon Dumala, Babulsar Budruk., Faratwadi, Nagargaon, Aandalgaon, shikarapur, Rautwadi, Jategaon Budruk, Jategaon Khurd, Pimpale jagtap, Sanaswadi, Darekarwadi, vajewadi, Vadu Budruk, Aapti, Koregaon Bhima, Dingrajwadi, Dhanore, Talegaon Damdere, Vitthalwadi, Takli Bhima, Nimgaon Mhalungi, Shivtkarar Mha., Parodi, Dadivadi, Karnjavane, Ranjangaon Ganpati, Pimpri Dumala, Khandale, Ganegaon Khalsa, Burangwadi, Khierenagar, Mukhai, Hivare, Pimpale Khalsa, Varude, Vagale, Singadwadi, Khannur Mesai, Midagulwadi, chincholi, Shastabad, Malthan, Lakhewadi, Nimgaon Dude, Kavate, Munjalwadi, Ichakewadi, savidane and Ravadewadi of the study region.

Table No. 5.14 **Twelfth Crop Ranking**

Sr. No.	Crops	Twelfth Crop Ranking		
		No. of Villages	Area in Hectors	Area in Percentage
1	Bajara			0
2	Flower	30	51	91.07
3	Fodder Crop			0
4	Fruit			0
5	Jowar			0
6	Onion			0
7	Spice	1	0.5	0.89
8	Sugarcane			0
9	Total Oil Seed	76	4.5	8.03
10	Total Pulses			0
11	Total Veg			0
12	Wheat			0
	Total	107	56	100

(Source: Computed by Researcher)

The spice is crop and it stands as twelfth rank and is found to have coverage in only one villages occupying 0.5 hectors and 0.89 percent area in Shirur rural, Kardalwadi of the study region. Flower is crop and it stands as twelfth rank and is found to have coverage in 30 villages occupying 51 hectors and 91.07 percent area in Shirur rural, Sardwadi, Tardobachiwadi, Dhoksangavi, Golegav, Chavanwadi, Babulsar Khurd, Bhabarde, Karegaon, Karde, Aambale, Takali Haji, Jambut, Saradwadi, vadner, Dongargan, Sabalewadi, Mhase, Malwadi, Sonesangavi, Nimgaon Bhogi, Chandoh, Fakate, Khathapur, Kasari, Kondapuri, Pabal, Kendur, Karandi, Dhamari and Khierewadi of the study area.

5.3 Crop Combination:

Recently the crop combination analysis in geographical studies has gained momentum and its importance is increasing day by day. The study of crops on regional scale must take into consideration the combinational analysis and the relative position of crops. Such analysis would ultimately minimize the change of oversimplified generalization. Combination studies are fruitful in many ways; firstly, they provide an adequate understanding of individual crop geography. Secondly, the combination is in itself integrative realities that demand definition and distribution analysis, and lastly crop combination regions are essential for the construction of still more complex structure of vivid agricultural region.

A number of statistical techniques have been introduced by geographers, agriculturists and economists to demarcate crop combination regions. The introduction of these crop combination methods by Weaver (1954), Thomas (1963), Coppack (1964), Johnson (1958), Rafiullah (1956), Bhatia (1960), Athawale (1966), Ayyar (1909) and Doi (1959). In the present study Weaver's technique (1954) used for finding crop combination

Crop combination Method (Weaver's 1954) Formula-

Variance = $\frac{\Sigma d^2}{n}$ **Standard Deviation =** $\sqrt{\frac{\Sigma d^2}{n}}$

Where, d = the difference between actual crop % in a given unit and the % in the theoretical distribution.

n = the numbers of crops in a given combination

Table No. 5.15 Crop Combination in Shirur Tahsil of year 2001- 2002

Combination Type	Crops Combination	No. of Villages	Area Hectares	Total Area (%)
Two Crop Combination	TP/B/W/FC/J	*6*	3988	3.93
Three Crop Combination	B/TP/J/O/F/FC/TV/S	27	33681	33.15
Four Crop Combination	J/TP/B/O/FC	15	19697	19.39
Five Crop Combination	J/TV/TP/FC/O/B/S	12	7811.4	7.69
Six Crop Combination	J/B/TP/TV/FC/O/S	19	9820.1	9.67
Seven Crop Combination	J/TP/TV/B/O/FC/W	7	4383.7	4.31
Eight Crop Combination	J/TP/W/FC/O/TV/S/B	6	2819.35	2.77
Eleven Crop Combination	S/FC/B/J/W/TP/TV/O/F/SP/FL	1	637.5	0.63
Twelve Crop Combination	J/O/B/TP/FC/TV/F/W/S/TOS/SP/FL	15	18762.06	18.46
Total		**108**	**101600.11**	**100**

(Source: Computed by researcher)

TV- Total Vegetable Crops, TP- Total Pulses, B-Bajara, FL-Flower Crops, TOS- Total

Oil Seed, W-Wheat, FC -Fodder Crop, S- Sugarcane, F-Fruit Crop, J-Jowar, SP- Spices,

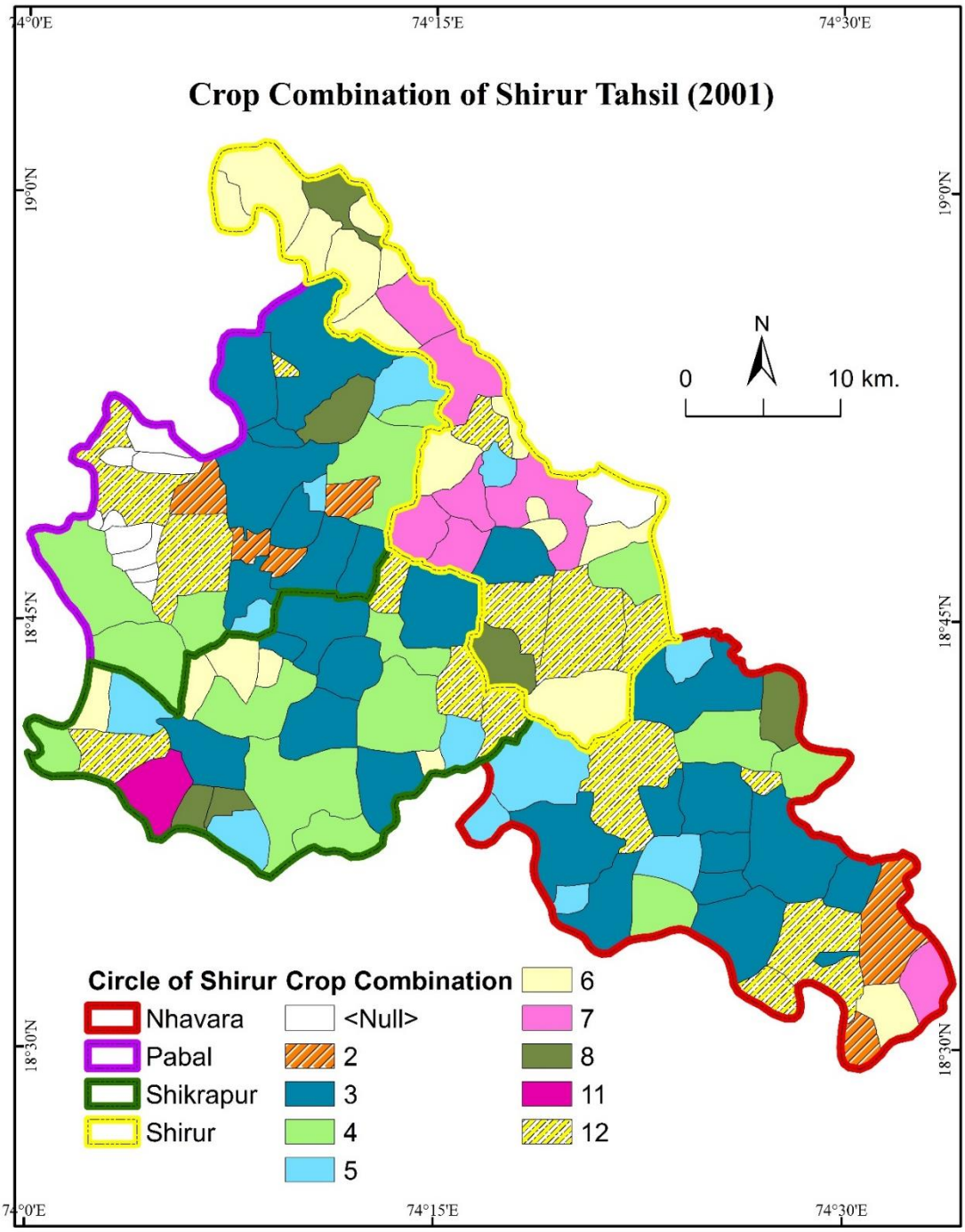
O – Onion.

Table No. 5.16 Crop Combination in Shirur Tahsil of year 2011-12

Combination Type	Crops Combination	No. of Villages	Area (Hect)	Total Area (%)
Two Crop Combination	TP/B/W/FC	6	6505	6.73
Three Crop Combination	W/TP/FC/B/O	7	5052	5.22
Four Crop Combination	TP/B/J/TV/S/FC/O	18	18223.51	18.84
Five Crop Combination	J/TV/TP/FC/O/B/S/W/F	13	11707.9	12.11
Six Crop Combination	J/B/TP/TV/FC/O/S/FL/W/F	22	13174.6	13.62
Seven Crop Combination	J/TP/TV/B/O/FC/W/S/F	19	19557.85	20.22
Eight Crop Combination	J/TP/W/FC/O/TV/S/B/F	7	4721.85	4.88
Nine Crop Combination	S/FC/B/J/W/TP/TV/O/F/SP/FL	2	1312.19	1.36
Twelve Crop Combination	J/O/B/TP/FC/TV/F/W/S/TOS/SP/FL	14	16460.8	17.02
Total		108	96715.7	100

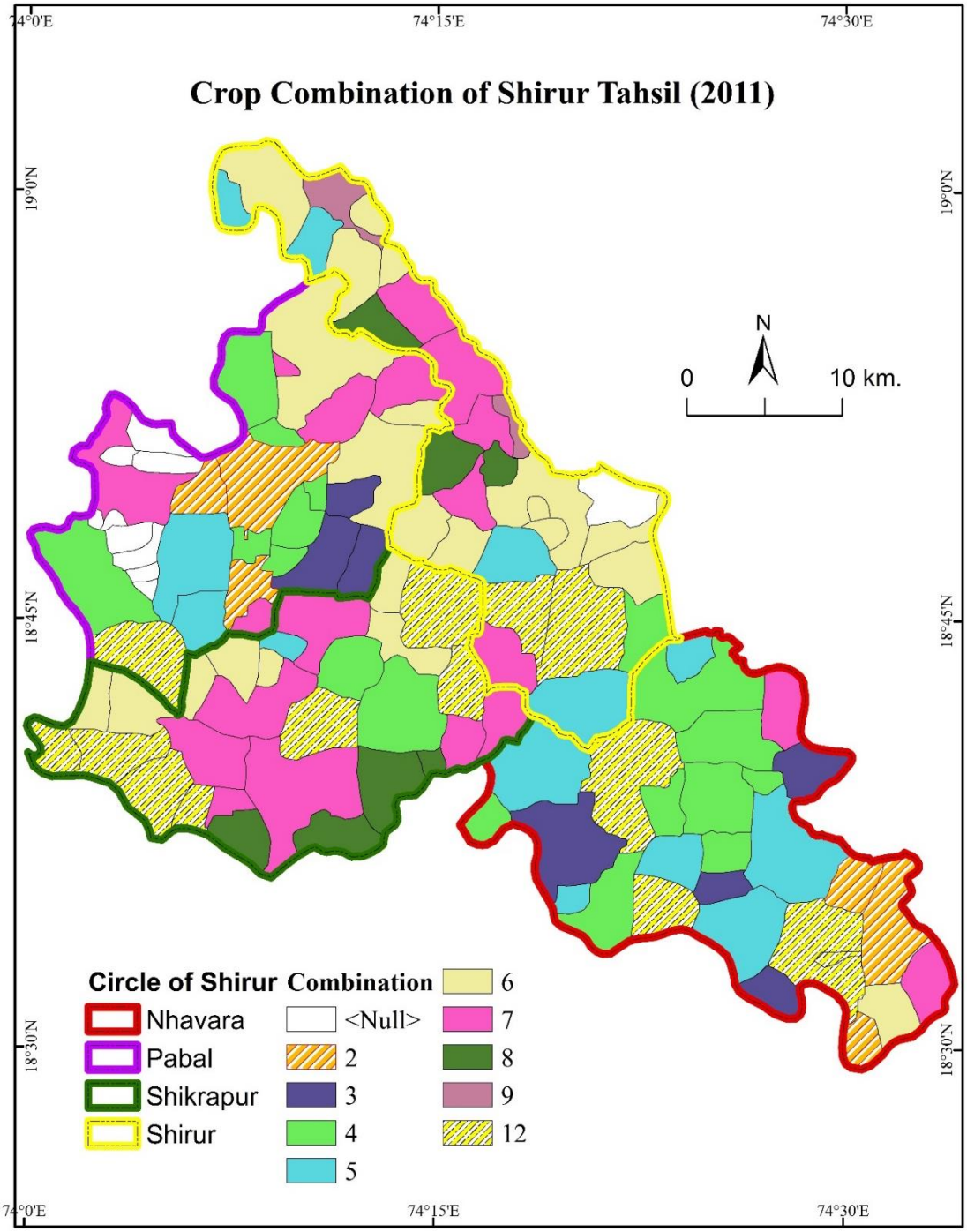
(Source: Computed by researcher)

(TV- Total Vegetable Crops, TP- Total Pulses, B-Bajara, FL-Flower Crops, TOS- Total Oil Seed, W-Wheat, FC -Fodder Crop, S- Sugarcane, F-Fruit Crop, J-Jowar, SP- Spices,
O – Onion.)



Source: Computed by Reserchер

Figure No.-5.1 Crop combination 2001



Source: Computed by Reserecher

Figure No.- 5.2 Crop combination 2011

5.4 Crop Combination:

All Twelfth types of crop combinations have been identified during2001-2 to 2011-12 for Shirur Tahsil. The villages and area under each crop combination are shown in table.

5.4.1 Two crop combination:

Two crop combination was constantly decreasing from year 2001-2002 to 2011-12. It was six villages of year 2001-1002, 2011-12. This combination was only identified in Pabal circle and Nhavara circle during 2001-2002. Except Shirur Circle and Shikrapur Circle two crop combination is not found at any place in 2001-2, 2011-12. The major crops are Wheat, Total pulses Bajara, Fodder crop and Jowar crops in this combination. In 2001-2 two crop combination is found in area hectors 3988, and area in 3.93 percent. In 2011-12 2 two crop combination is hectors 6505, and area in 6.73 percent. Such as Babulasar Bk., Pimpalsuti, Inamgoan, Kahnnur Mesai, Malthan and Chincholi Morachi.etc villages.

Fig.5.3 (2001) Two crop combination

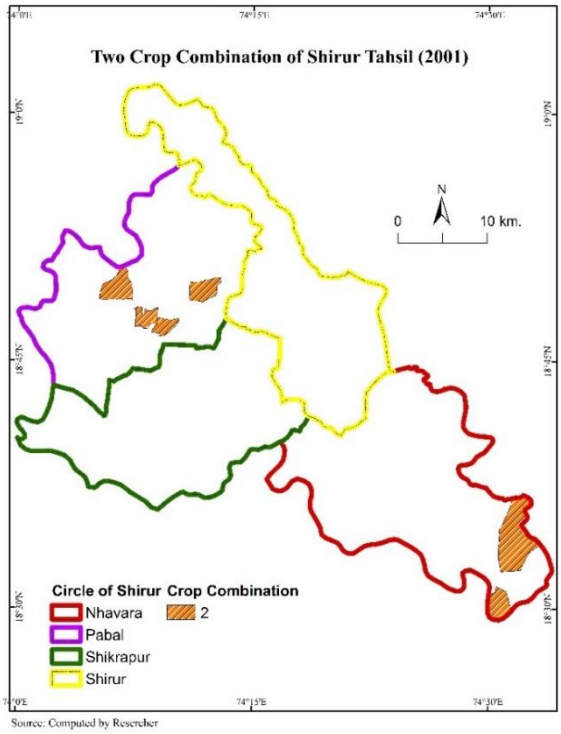
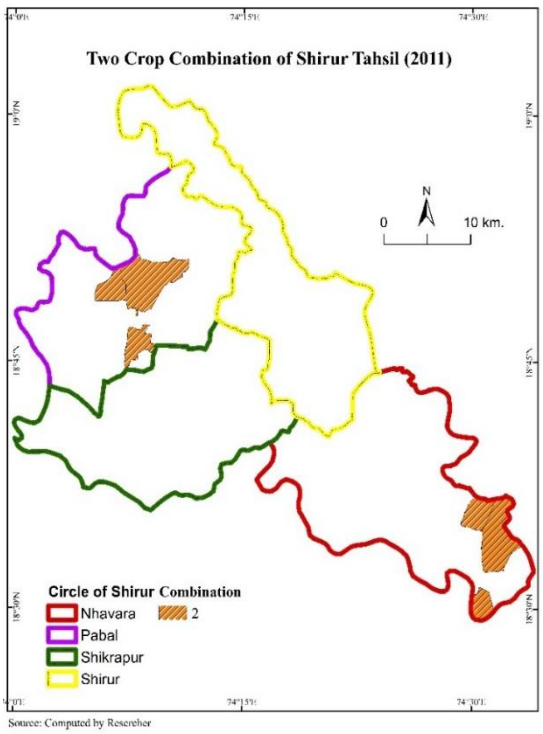


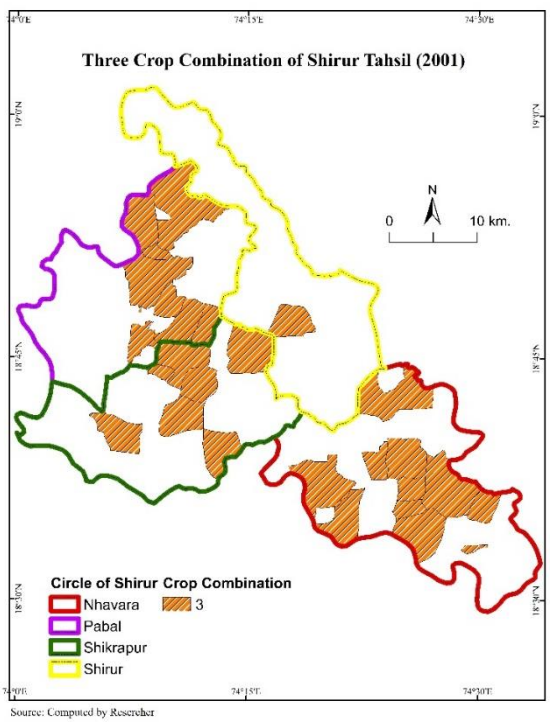
Fig. 5.4 (2011) Two crop combination

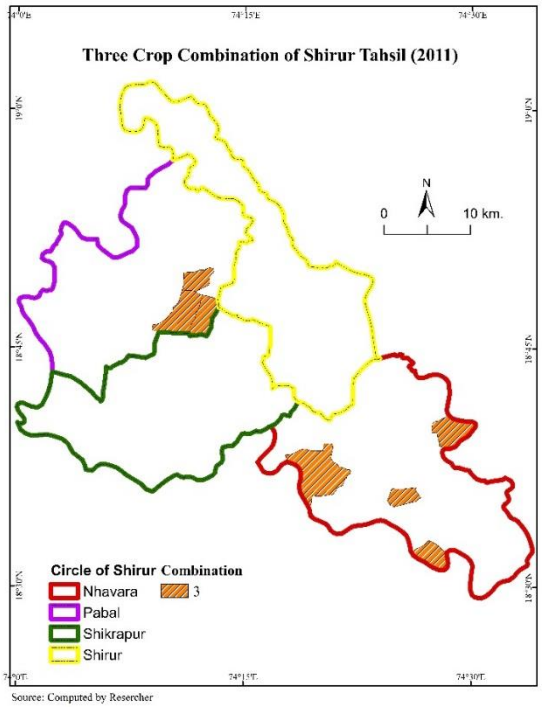


5.4.2 Three crop combination:

Three crop combinations was found 2001-2 in which 27 villages on were from Pabal circle, Shikrapur Circle, Shirur circle. The dominant crops in this combination are Bajara, total Pulses, Jowar, Onion, Fodder crop, Total vegetable, and Sugarcane. Found in various villages. The area of this combination reduced in 2000-01 (33.15 percent). And 2011-12in which seven villages area in5052 hectors, and 5.22Present. Is found in Pabal and Nahavra Circle. Such as Pimpari dumala, Wagale, Chichani, Aalegaon Paga and Mandvgan farata, etc. village.

Fig. 5.5**(2001) Three crop combination** Figure 5.6 **(2011) Three crop combination**

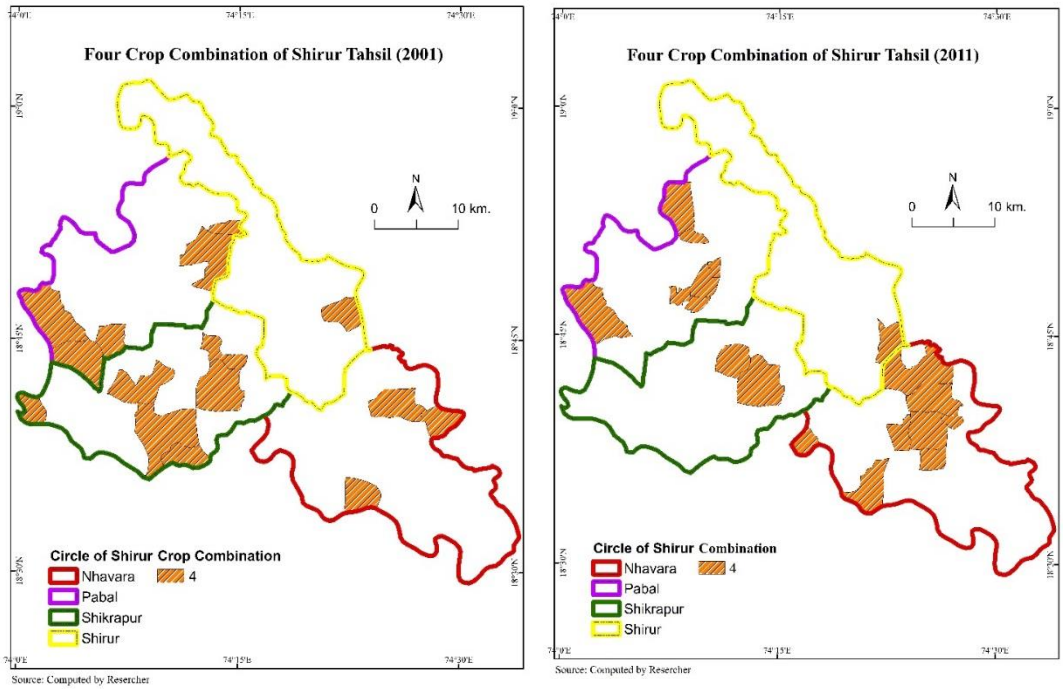




5.4.3 Four crop combination:

Four crop combinations was found 2001-2 in which 15 villages dominantly were from Shikrapur Circle, Pabal circle, Nahavra circle, and Shirur circle. The dominant crops in this combination are Bajara, Total Pulses, Jowar, Onion, Fodder crop, and Total pulses. Found in various villages. The area of this combination is reduced in 2000-01 (19.39 percent).And 2011-12in which 18 village's area in 18223 hectors and 18.84 at Present it. Is found in Pabal, Shikarapur, Shirur, and Nahavra Circle. Such as Shindodi, Nimone, Gunat, Nirvi, Nagargaon is the Nhavara Circle. And Kondapuri, Kendur, Sone Sangavi is the Pabal Circle. And Karjavane, nimgaon Malungi is the Shikrapur Circle, Shirur Circle is found Golegaon Village.

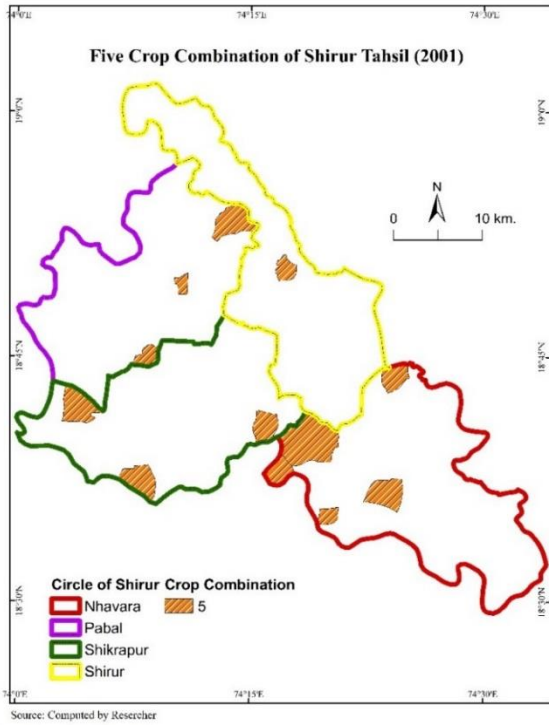
(2001) Four crop combination Figure 5.7 Fig.5.8**(2011) Four crop combination**

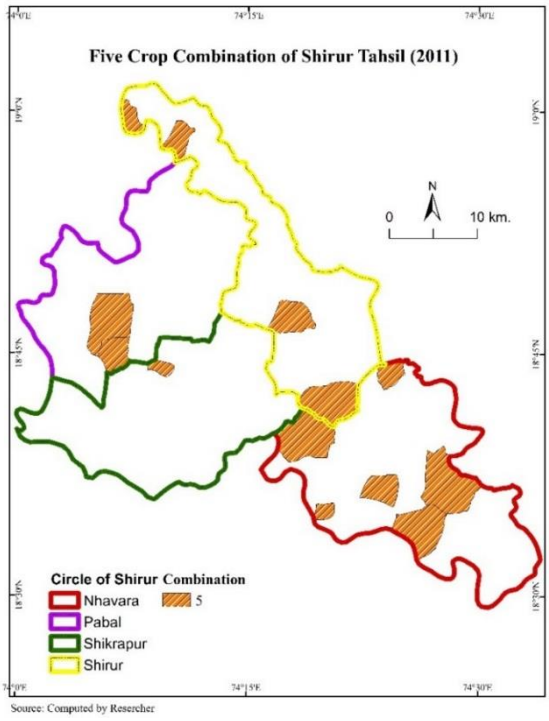


5.4.4 Five crop combination:

Five crop combinations was found 2001-2 in which 12 villages dominantly were from Nahavra circle, Pabal Circle, Shikrapur Circle. The dominant crops in this combination are Bajara, Total pulses, Total Vegetable, Sugarcane, Wheat, Jowar, Onion, Fodder crop, and flowers found in various villages. The area of this combination reduced in 2000-01 (7.69 percent). And 2011-12in which 13 villages area in 11707.90 hectors and 12.11 at Present it. Is found in Pabal, Shikarapur, Shirur, and Nahavra Circle. Such as Shindodi, Sirasgaon kata, Vdgaon Rasai, Nirvi, Nagargaon is the Nahavra Circle. And Kondapuri, Kendur, Sone Sangavi, is the Pabal Circle. And Karjavane, Nimgaon malungi is the Shikrapur Circle, Shirur Circle is found Golegaon. Village.

(2001) Five crop combination Fig. 5.9 **(2011)Five crop combination** Fig.5.10

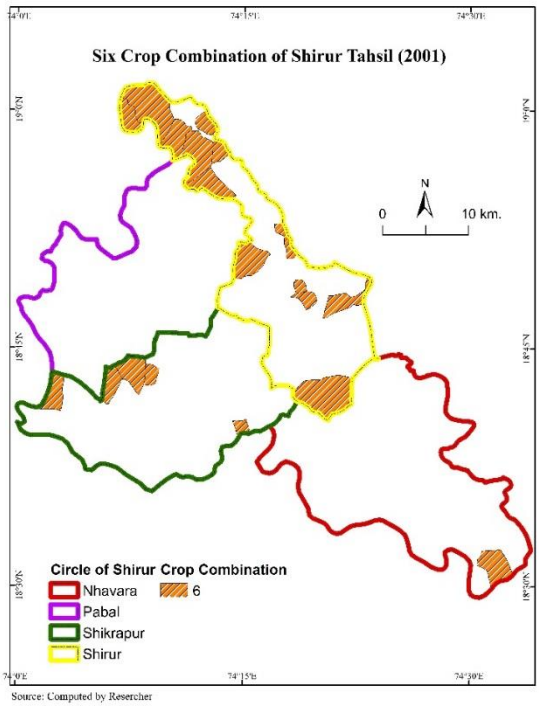


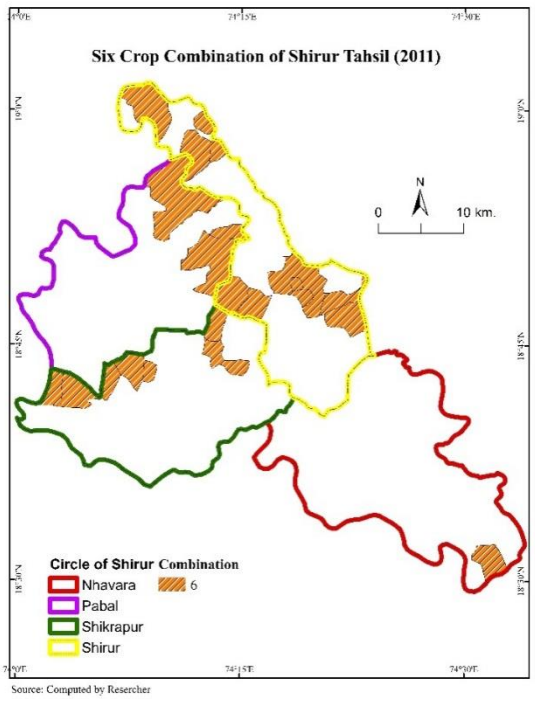


5.4.5 Six Crop Combinations:

Six crop combinations was found 2001-2 in which 19 villages dominantly were from Shirur Circle Such as Pimparkhed, Chandoh, Fakate, Nimgaon Dude, Aamdabad etc. Pabal Circle in a not due to six crop combination and rarely found in Nahavra circle, Shikrapur Circle. The crops in this combination are Bajara, Total Pulses, Total Vegetable, Sugarcane, Jowar, Onion, Fodder crop, and flowers found in various villages. The area of this combination is reduced in 2000-01 (9.67 percent).And 2011-12in which 22 villages area in 13174.60 hectors and 1362 present. Is found in Shirur circle is increasing a six crop combination compare to 2001-2. And Pabal, Shikarapur, Shirur, and Nahavra Circle. Such as Burunjwadi, Pimpale Khalsa, and Ganegaon Dumala etc.

(2001) Six crop combination Fig. 5.11 **(2011) Six crop combination** Fig.5.12

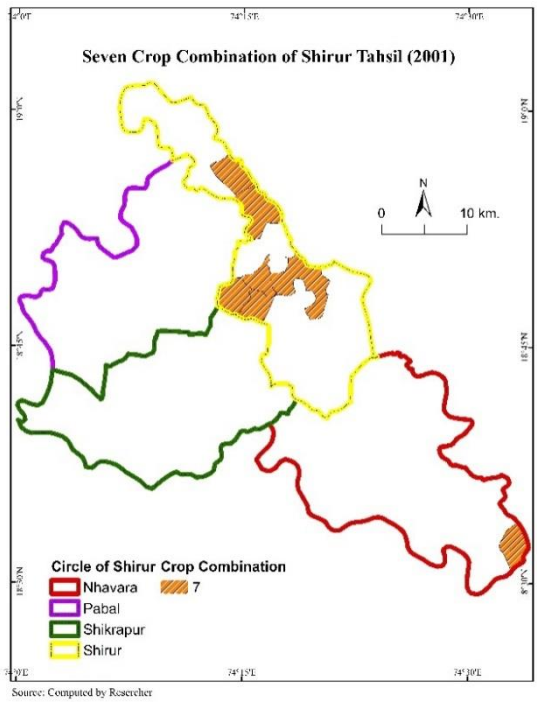


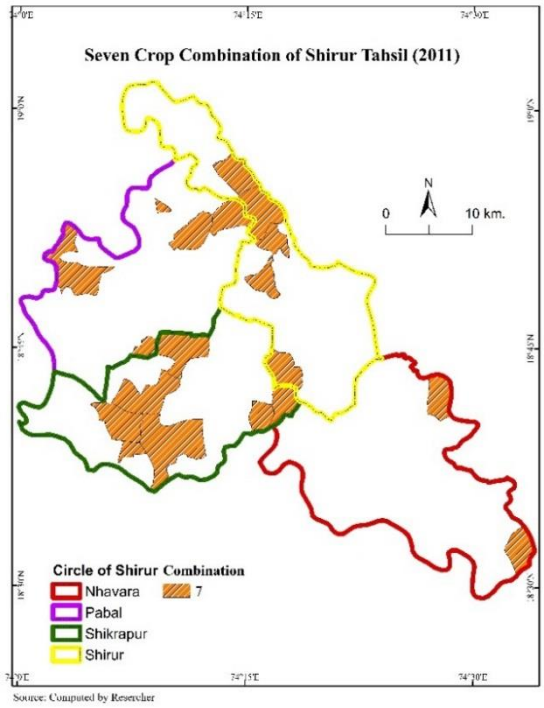


5.4.6 Seven Crop Combination:

Seven crop combinations was found 2001-2 in which seven villages dominantly were from Shirur Circle Such as Takalihaji, Pimparkhed, Chandoh, Fakate, Nimgaon Dude, etc. The crops in this combination are Bajara, Total pulses, Total Vegetable, Sugarcane, Jowar, Onion, and Fodder crop found in various villages. The area of this combination is reduced in 2000-01 (4.31 percent). And 2011-12 in which 19 village's area in 19557.85 hectors and 13.62 present. Is found in Shirur circle, Nahavra circle, Pabal Circle in an increasing a seven crop combination compare to 2001-2. And Kasari, Nimgaon Malungi, Sanawadi, jategaon. Etc. Shindodi and Tandali etc.

(2001)Seven crop combination Fig 5.13 **(2011) Seven crop combination** Fig. 5.14

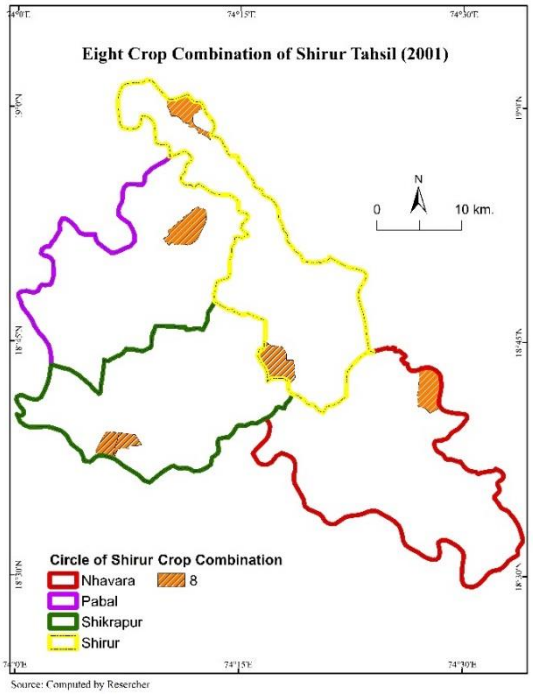


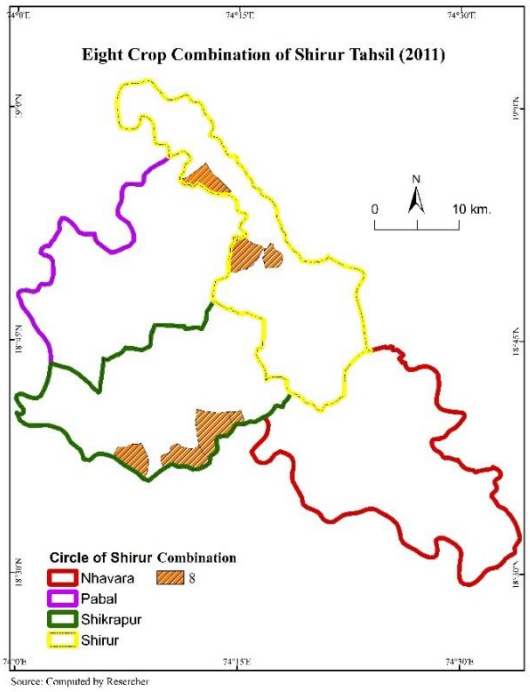


5.4.7 Eight Crop Combination:

Eight crop combinations was found 2001-2 in which six villages were from Shirur Circle Such as Jambut, Saradwadi, etc. The crops in this combination are Bajara, Total pulses, Total Vegetable, Sugarcane, Jowar, Onion, Fodder crop, and Wheat. The area of this combination is reduced in 2000-01 (2.77percent). And 2011-12, It was found in 4721.85 hectares (4.88 percent) in seven villages from Shirur circle Nahavra circle. this situation rarely improved compared to 2001-2002. In Pabal, Shikrapur circle this seven crop combination was rarely found.

(2001)Eight crop combination Fig. 5.15 **(2011) Eight crop combination Fig.5.16**

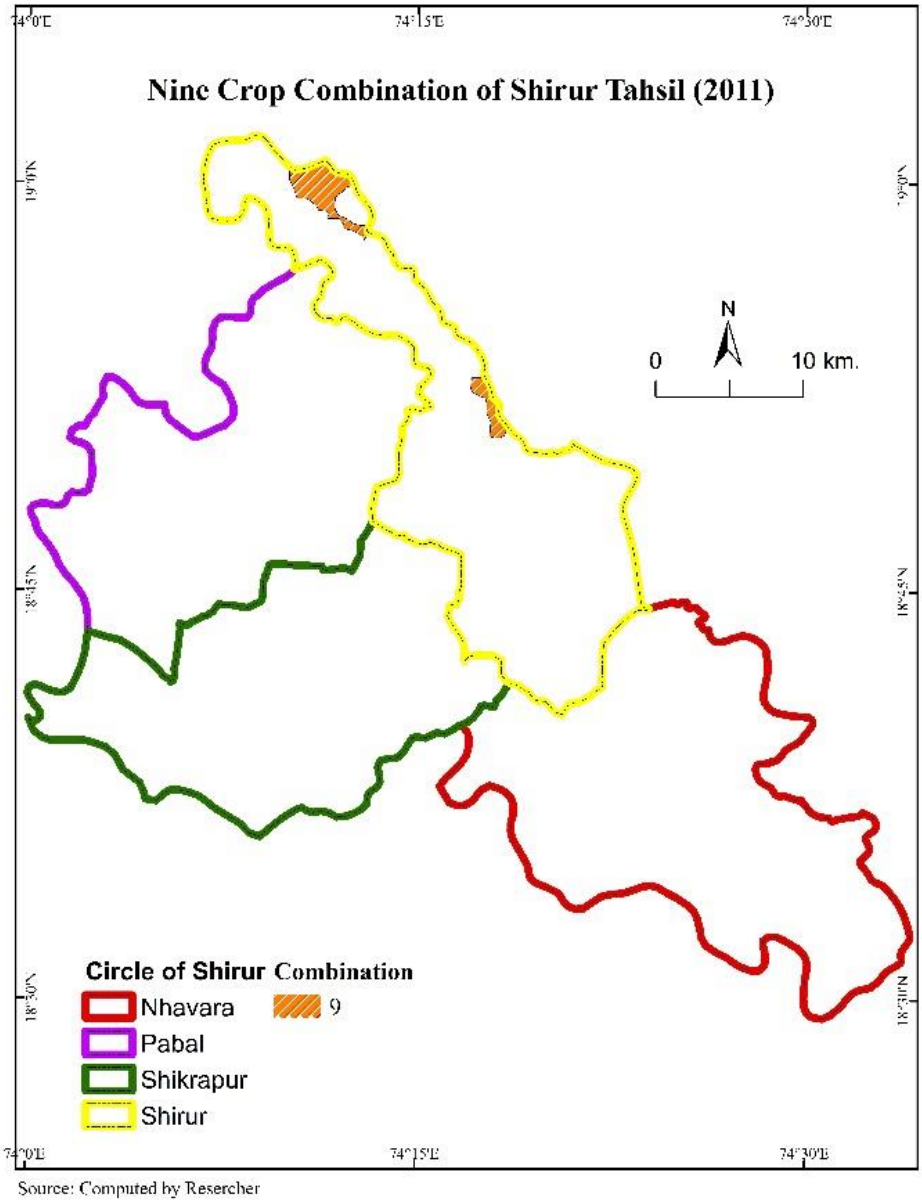




5.4.8 Nine Crop Combination:

Nine crop combinations was found in 2011-12 in which two villages, from Shirur Circle Such as Saradwadi, Mhase Bk. Pabal Circle, Shikrapur Circle and Nahavra Circle in a not found nine crop combination, the crops in this combination are Bajara, Total pulses, Total Vegetable, Sugarcane, Jowar, Onion, Flowers, Fodder crop, and Wheat. The area of this combination reduced in 2011-12 (1.36 percent). And 1312.19 area in hectors.

(2011) Nine crop combination Fig. 5.17

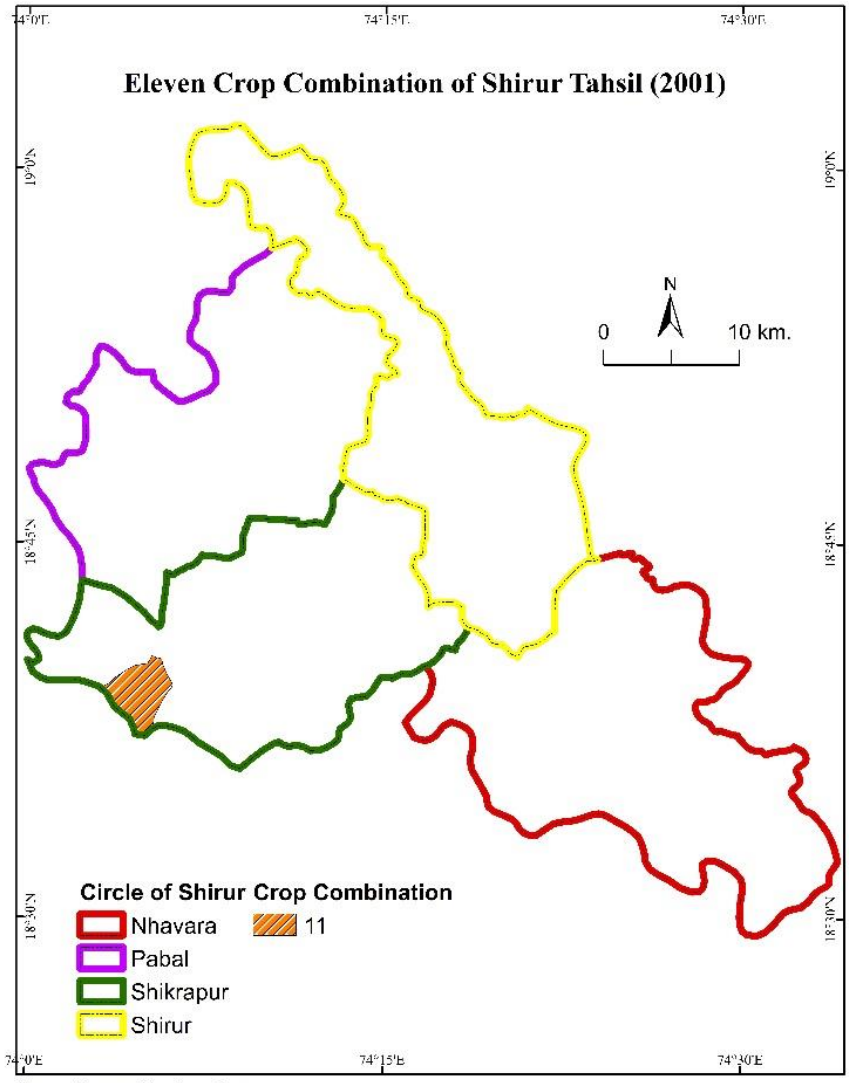


Source: Computed by Researcher

5.4.9 Eleven Crop Combination:

Eleven crop combinations was found in 2001-2002 in which one villages were from Shikrapur Circle that is as Koregaon Bhima. This is combination was not found in Pabal Circle, Shirur Circle and Nahavra Circle in a not found eleven crop combination, the crops in this combination are Bajara, Total pulses, Total Vegetable, Sugarcane, Jowar, Onion, Flowers, Fodder crop, Fruit, Spices and Wheat found in Koregaon Bhima. The area of this combination reduced in 2001-2 (0.63 percent).And 637.50 area in hectors.

Figure 5.18 **Eleven crop combination (2001)**



Source: Computed by Researcher

5.4.10 Twelve Crop Combination:

Twelve crop combinations was found in 2001-02 in which 15 villages were from Shirur Circle such as Aamdabad, Nimgaon Dude etc. In Pabal Circle, Khirenagad, Dhamari, Shikarapur and Nahavra circle this combination was rarely found, the crops in this combination are Bajara, Total pulses, Total Vegetable, Sugarcane, Jowar, Onion, Total Oil Seed, Fodder crop, and wheat found in various villages. The area of this combination is reduced in 2000-01 (18.47percent). And in 2011-12, it was found in 14 village's area in 16460 hectors and 17.02 present. It found in Shirur circle, Nahavra circle, Shikrapur Circle in an area (villages) really change an eight crop combination compare to 2001-2002.

Fig.5.19

Twelve crop combination (2001)

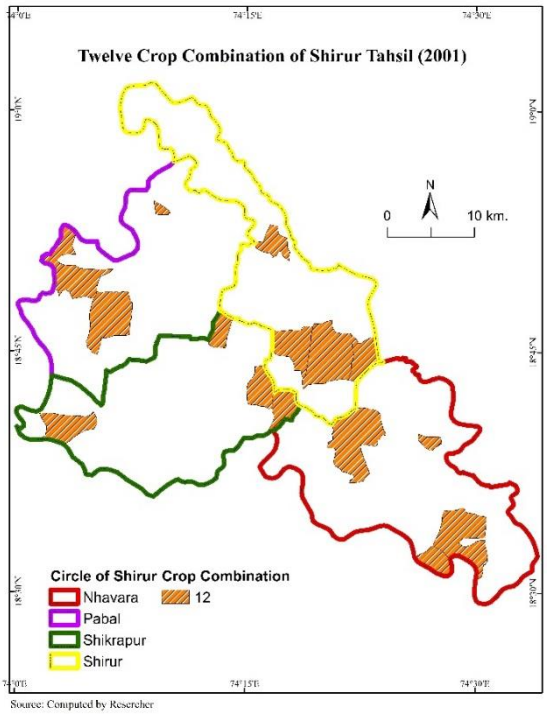
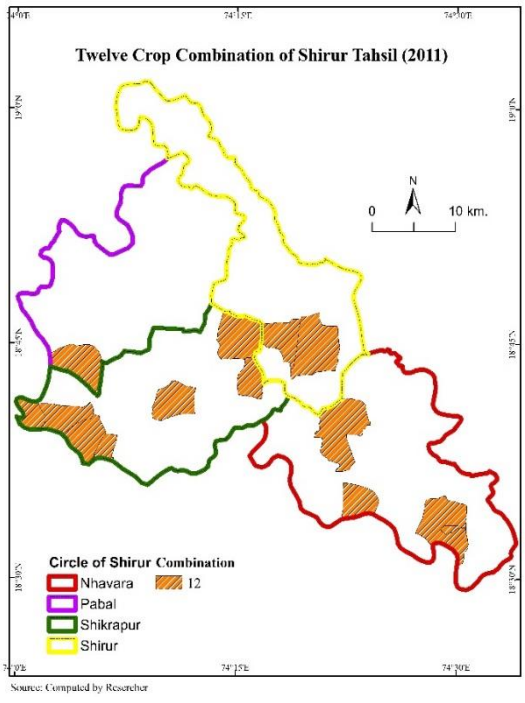


Fig.5.20

Twelve crop combination (2011)



5.5 Crop Diversification:

The level of crop diversification largely depends on the geoclimatic, socioeconomic condition and technological development in a region. . Later on, Tree (1938), Rainwald (1949), Gibbs-Martin (1974) and Horence (1942) have used this concept of diversification for computing measurement of diversification of employment in industry. Crop diversification means raising variety of crops from arable land. The remarkable feature of such study is that the increase in number of crops is indicative of intensification and diversification. It is based on many factors, but the extent of irrigation facilities along with the characteristics of rainfall and conditions of soils are the most important ones.

Clean (1930) initially applied this concept in order to identify the degree of diversification and concentration in manufacturing field, Bhatia in 1965 applied crop diversification technique in India to understand crop cultivation. This technique provides a method for generalizing relation between the relative strength and number of crops grown in study region. In this formula, he has considered the cropped area for computing crop diversification. He considered only those crops that individually occupy 10 percent or more of occupied area in regional unit. Bhatia's formula was modified by Jasbir Singh (1976).

5.5.1 Crop Diversification Method:

In order to identify spatial pattern of crop diversification in present study, the method (Bhatia 1965) has been adopted. The crops having less than ten percentages have been excluded from computation. This modified formula expresses as:

$$\text{Index of Crop Diversification} = \frac{\text{Percentage of sown area under } 'x' \text{ crops}}{\text{Number of } 'x' \text{ crops}}$$

Where,

'x' crops are those which individually occupy ten or more than ten percent of crop to net sown area in the villages.

5.5.2 Application and Results (Crop Diversification):

A variety of crops can be grown, and it is here that the farmer tends to diversify the cropping pattern with the result that most of the crops grown occupy only a small proportion of the sown area. Shirur Tahsil has been divided into four circles for the study purpose. The crop diversification index indicates highly variation in cropping pattern from circle wise as well as village wise. The index values were arranged to determine the distinguish four degrees of crop diversification. These classes are made on the basis of Bhatia's methods during 1965 as follows:

Table No.5.17 **Crop Diversification in Shirur Tahsil of 2011 year.**

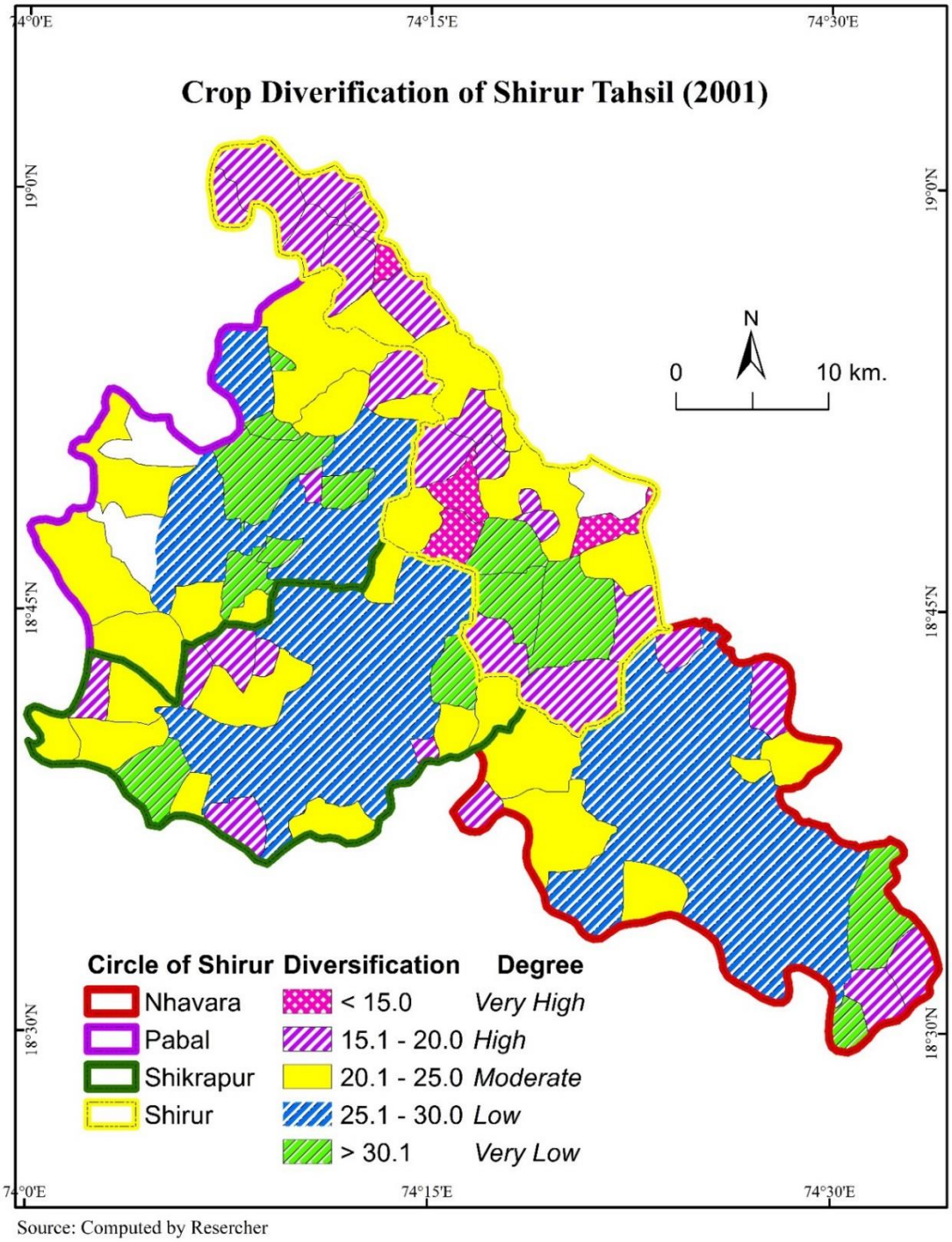
2001 Crop Diversification						
Class	Diversification	Shirur	Shikarapur	Pabal	Nahvara	2001
15	Very High	7	0	0	0	7
15-20	High	12	6	1	6	25
20-25	Moderate	5	9	9	6	28
25-30	Low	0	10	9	16	35
>30	Very Low	3	1	6	3	13
Total		27	26	25	31	108

(Source: Computed by Researcher)

Table No.5.18 **Crop Diversification in Shirur Tahsil of year 2011 year**

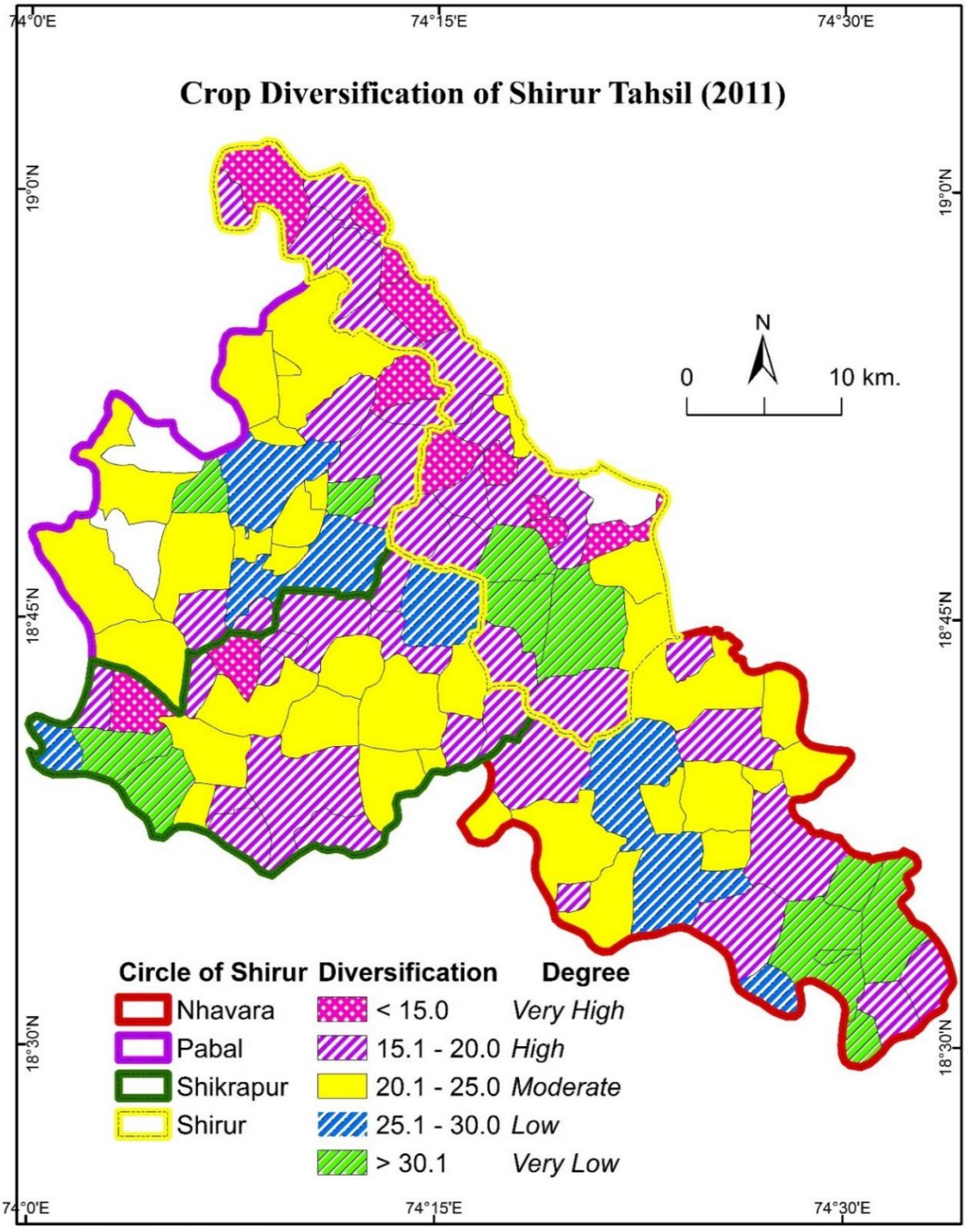
2011 Crop Diversification						
Class	Diversification	Shirur	Shikarapur	Pabal	Nahvara	2011
15	Very High	8	2	1	0	11
15-20	High	14	13	5	8	40
20-25	Moderate	3	9	13	10	34
25-30	Low	0	2	4	3	11
>30	Very Low	3	2	2	5	12
Total		28	28	25	26	108

(Source: Computed by Researcher)



Source: Computed by Researcher

Figure No.-5.21 Crop Diversification 2001



Source: Computed by Resercher

Figure No.- 5.22 Crop Diversification 2011

5.5.2 .1 Very High Crop Diversification:

Very High crop diversification is found largely in Shirur circle comparatively to all other circles. In 2001, seven out of the seven village were from Shirur circle in vary high crop diversification. Whereas Pabal circle and Nhavara circle and Shikrapur Circle did not have even a single village in this category. 2011-12 witnessed eight villages from Shirur circle two village from Shikrapur circle and one village from Pabal

circle in very high crop diversification category.

The very high crop diversification index is found in Shirur circle because this area has facilities relatively lowland area of Ghod river and so suitable for high irrigation. The topography of these parts of Shirur Tahsil is comparatively suitable for agricultural. The slope of this activities circle is relatively gentle and hence this area has high diversification index vice-versa the Pabal circle, Nahavra having high topographic variation. The area also has upstream region of Ghod river and hence less irrigation facility available in this part. Such as Pimparkhed, Takalihaji, Nimgaon Dude. etc. and Jategaon Bk., Pimpale jagatap in a Shikrapur circle has high diversification.

5.5.2 .2 High Crop Diversification:

High crop diversification is observed in Shirur circle comparatively to all other circles. Out of 25 villages they were Shirur circle 14 villages and Pabal circle had one village, Nahavra circle six village, Shikrapur circle six villages having in the class of high crop diversification from years of, 2001-02. The 2011-12 Out of 40 villages in Shirur circle 14 villages, Shikrapur Circle 13 villages, Pabal Circle five villages and Nahavra circle eight villages having in the class of high crop diversification from years.

The high crop diversifications were significantly increased. It shows that improvement in the index value of region. Nahavra and Pabal circles did not shows not much changes in this index value because Shirur circle already had very high crop diversification index. Nahavra circle also showed improvement in regional facility due to this facility. The index values as well as area under this index value were increased.

5.5.2 .3 Moderate Crop Diversification:

The Moderate diversification index is mainly observed in more villages in Shirur circle, Nahavra Circle, Shikrapur circle and Pabal circle area. But the Moderate crop diversification shows decreasing trend from year 2001-2002 to 2011-12. Out of 28 villages. They had Shirur circle5 villages and Pabal circle nine village, Nahavra circle 5 village, Shikrapur circle 9villages having in the class of high crop diversification in 2001-02. In 2011-12 Out of 34 villages in Shirur circle three villages, Shikrapur Circle nine villages, Pabal Circle 13 villages and Nahavra circle 10 villages were in the class of moderate crop diversification from years. Shikrapur circle showed relatively no change in 2001-2 to 2011-12. Some villages showed no change in crop diversification index because of effects of mountains topography.

5.5.2 .4 Low Crop Diversification:

The Low diversification index is mainly observed in more villages from Nahavra Circle, Shikrapur circle and Pabal circle area. But the low crop diversification shows decreasing trend from year 2001-2002 to 2011-12. The Out of 35 villages. Shirur circle had zero villages and Pabal circle nine village, Nahavra circle had 16 village, Shikrapur circle had ten villages having in the class of low crop diversification from years of 2001-02. The 2011-12 out of 11villages in Shirur circle zero villages, Shikrapur Circle two villages, Pabal Circle four viilages and Nahavra circle 3 villages having in the class of high crop diversification from years. Shirur circle shows relatively no change. 2001-2 to 2011-12 the some village's shows mostly change in crop diversification index because of effects of mountains topography and this area is less accessible from major highways and roads.

5.5.2 .5 Very Low Crop Diversification:

The Very Low diversification index is mainly seen in more villages in Nahavra Circle in 2011 years. Pabal circle is very low crop diversification showing decreasing trend from year 2001-2002 to 2011-12. Out of 13 villages. Shirur circle had three villages and Pabal circle six village, Nahavra circle three village, Shikrapur circle one villages having in the class of very low crop diversification from years of 2001-02. The 2011-12 out of 12 villages in Shirur circle three villages, Shikrapur Circle two villages, Pabal Circle two villages and Nahavra circle five villages having in the class of very low crop diversification from years. Shirur circle showed

relatively no change in 2001-2 to 2011-12 some village's showed mostly change in crop diversification index because of effects of mountains topography, water facility and this area is less accessible from major highways and roads.

5.6 The Crop Combination Regions of Shirur Tahsil:

The study of crop combination regions constitute an important aspect of agricultural geography as it provides a good basis agricultural regionalization. Crops are generally grown in combinations (Weaver, 1954). It gives us the relative position of crops on regional scale. Farmers grow crops in varied physical and cultural conditions. The pattern of crop combination gives rise to spatial predominance of certain crops or combination resulting the emergence of crop regions. Such analysis would ultimately minimize the change of over simplified generalization (Ali, M. 1978). Crop combination study in geography is fruitful in many ways, firstly it provides an adequate understanding of an individual crop. Secondly, combination is in itself an integrative reality that demands definition and distribution analysis and finally crop combination regions are essential for the construction of more complex structure of vivid agricultural region (Weaver, 1954).

First attempt for delineation of agricultural regions was made by Weaver in 1954. He studied crop combination for Middle East countries. Later on many more methods were introduced. Thomas (1963) modified Weaver's formula by including all crops with zero percent theoretical values in each step of the method, in the crop combination studies carried out in Wales but it did not yield different results than obtained by Weaver's method. Coppock (1964) also modified version of Weaver's method wherein he considered the rank in recognizing the leading crops.

Figure No.-5. 23 Crop Combination Region 2011

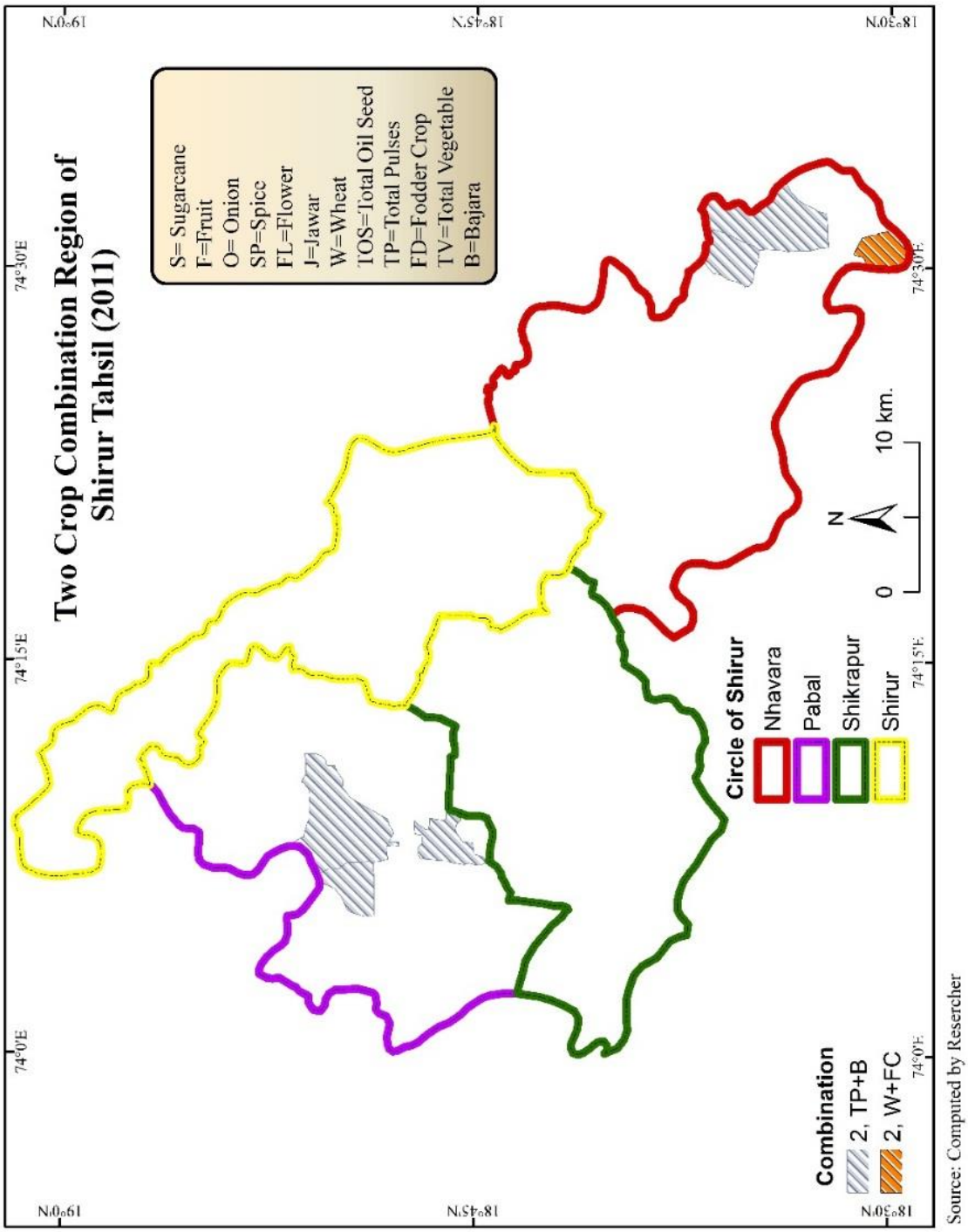
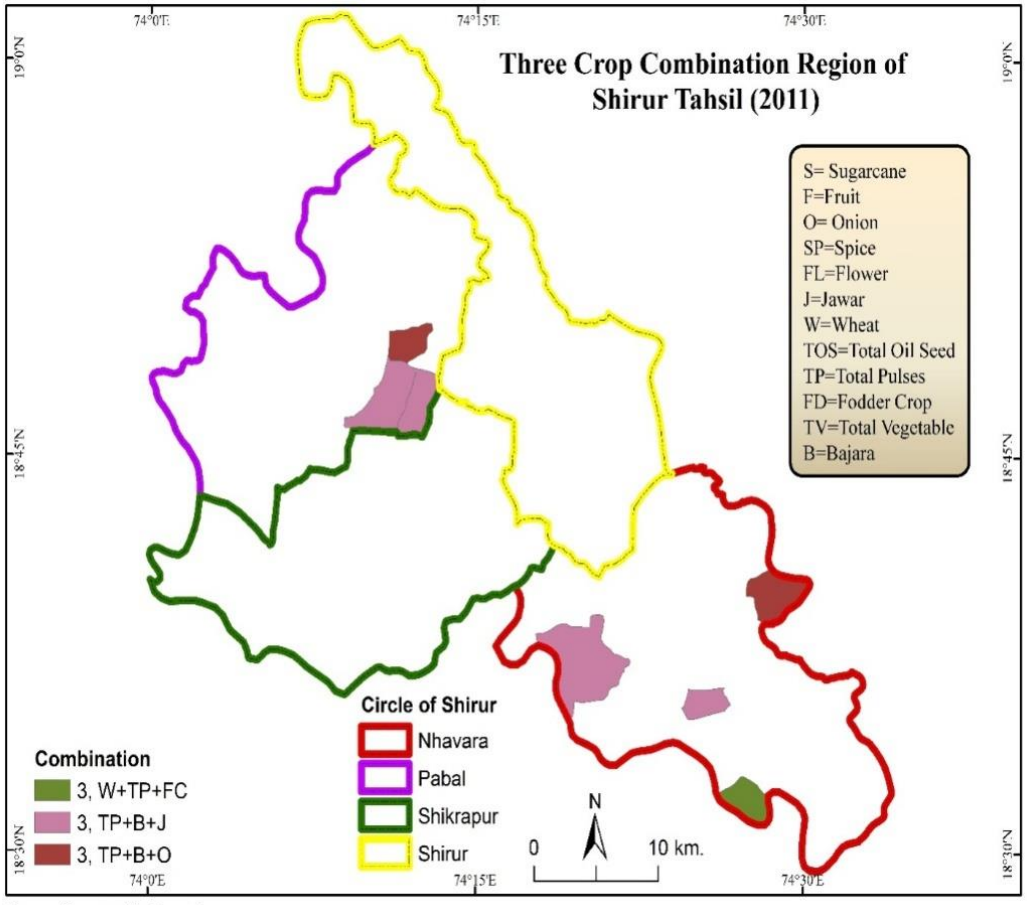


Figure No.-5.24 Two crop combination region 2011

5.6.1 Two crop Combination Regions:

In this crop combination region have four crops, namely total pulses, Bajara, wheat and fodder crop enter in two crop combination in different villages. (Fig.no.5.24) The TP+B reveals two crop combination four villages area is covered part of the study region. This Combination region included villages Kahnur Mesai, Khaire nagad, Hivre in Pabal circle and Inamgoan and Pimpalsuti village in Nahavra circle. In two crop combination is W+Fc wheat and fodder crop was located in Babulsar Bk. village in Nahavra circle. Babulasar Bk. village is located in along bank of Bhima River.

Figure No.- 5.25 Three crop combination region 2011

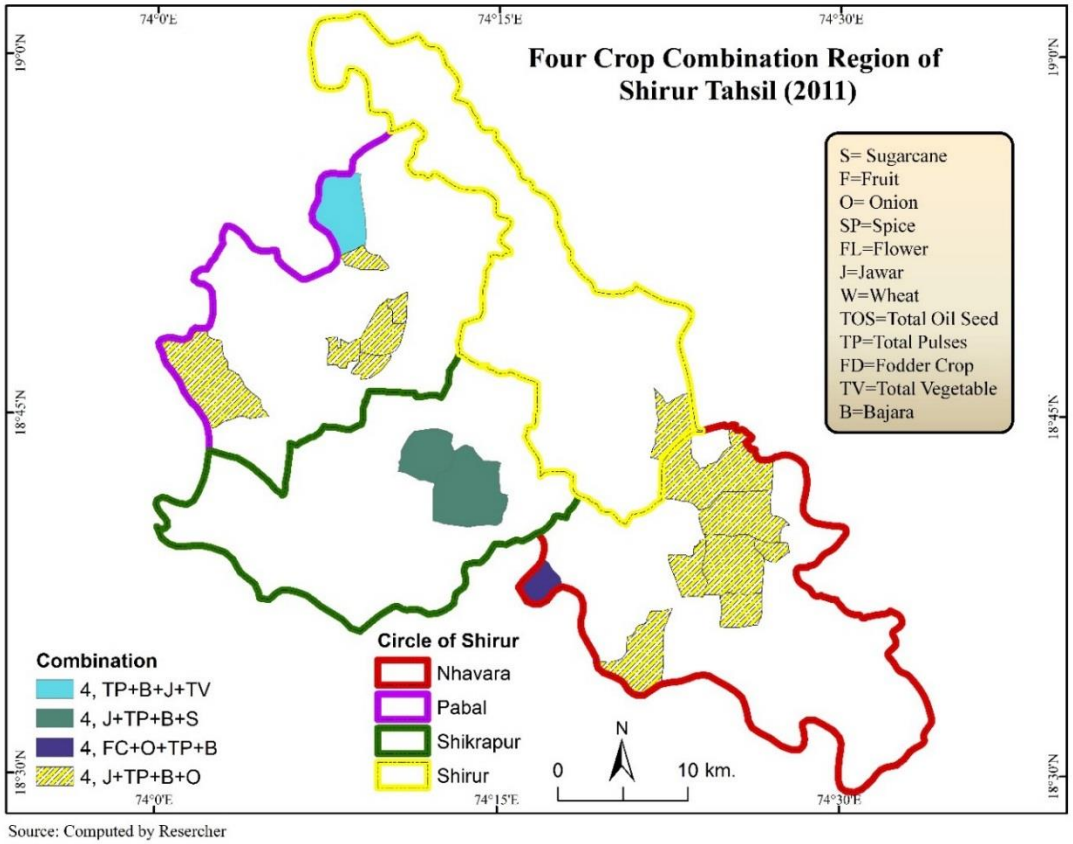


Source: Computed by Researcher

5.6.2 Three Crop combination Region:

When the first three crops were taken into consideration. the villages occupied by W+TP+FC, TP+B+J and TP+B+O three crop combination region. This W+TP+FC

combination region include crops such as wheat, total pulses and fodder crops. It is observed in Sadalgoan Nahavra circle. The TP+B+J combination is seen in Alegoan paga and kuruli in Nahavra circle and Varude, Waghale, Lakhewadi in Pabal circle. In this region total pulses, Bajara and Jowar are grown. The TP+B+O region is included total pulses, Bajara and Onion. It is covered to village's Chinchani and Shastabad in Nahavra and Pabal circle respectively. The three crop combination region is not observed in Shikrapur and Shirur circle. (Fig.no.5.25.)



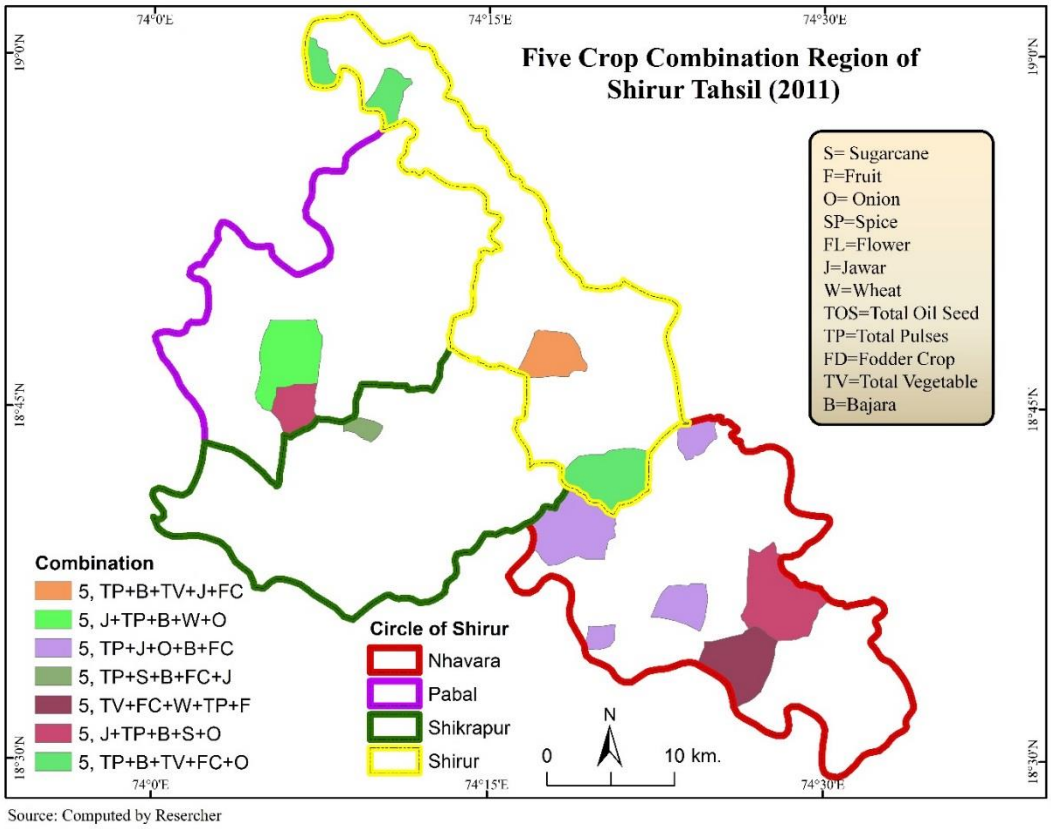
Source: Computed by Resercher

Figure No.- 5.26 Four crop combination region 2011

5.6.3 Four crop Combination region:

When the first four crops were taken into consideration for delimitation of crop combination of region, the combination is TP+B+J+TV which included Total Pulses, Bajara, Jowar, Total Vvegetable. This combination is covered in village is Kendur in Pabal circle. This J+TP+B+S combination of crops Jowar, Total Pulses, Bajara and Sugarcane. It is found only in Ranjangaon village in Shikrapur circle. The FC+O+TP+B combination region shows crops like Fodder crops, Onion, Total Pulses, Bajra. Four crop combination region located Aarngaon village in Nahavra circle. This

combination is covered thirteen villages such as Chavanwadi, Nimone, Gunat, Nirvi, Kolgaon dolas, Kohakdewadi and Ranjangaon Sandas in Nhavara circle and Kendur Chincholi, Shastabad and Lakhewadi in Pabal circle. (Fig.no.5.26.)

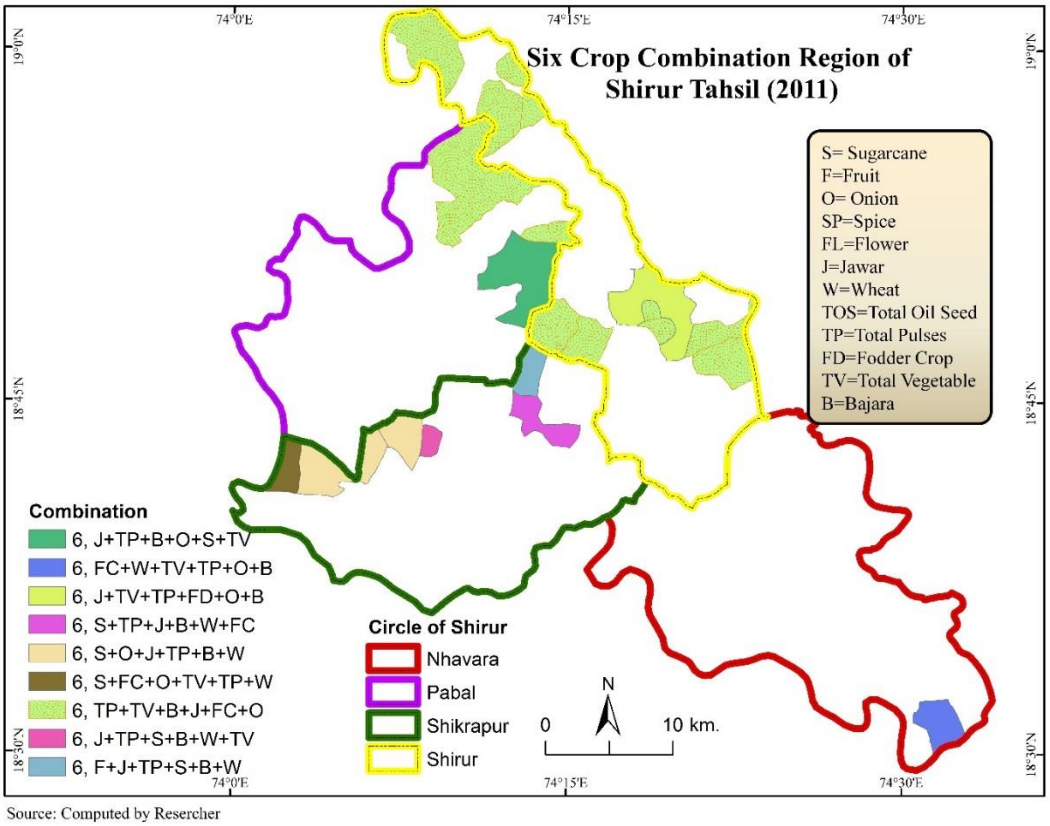


Source: Computed by Researcher

Figure No.-5.27 Five crop combination region 2011

5.6.4 Five crop combination Region:

In the five crop combination region observed seven different crop Combination. The combination region of TP+B+TV+J+FC is observed in Karegoan village of shirur circle.. The combination of J+TP+B+W+FC is showing Jowar, total pulses, Bajara, wheat and onion crops in Dhamari village. Combination TP+J+O+B+FC is observed in Uralgoan, Motewadi, Rakshewadi, Andhalgoan villages. It is covered dry land area. TP+S+B+S+O combination include one village Burunjwadi village. The crop combination TV+FC+W+TP+F and J+TP+B+S+O are found in Vadgoan rasai and Shirsgoan kata and Mukhai village. TP+B+TV+FC+O combination covered in Amble, Kathapur khurd and Chandoh Villages in Pabal circle. (Fig.no.5.27.)

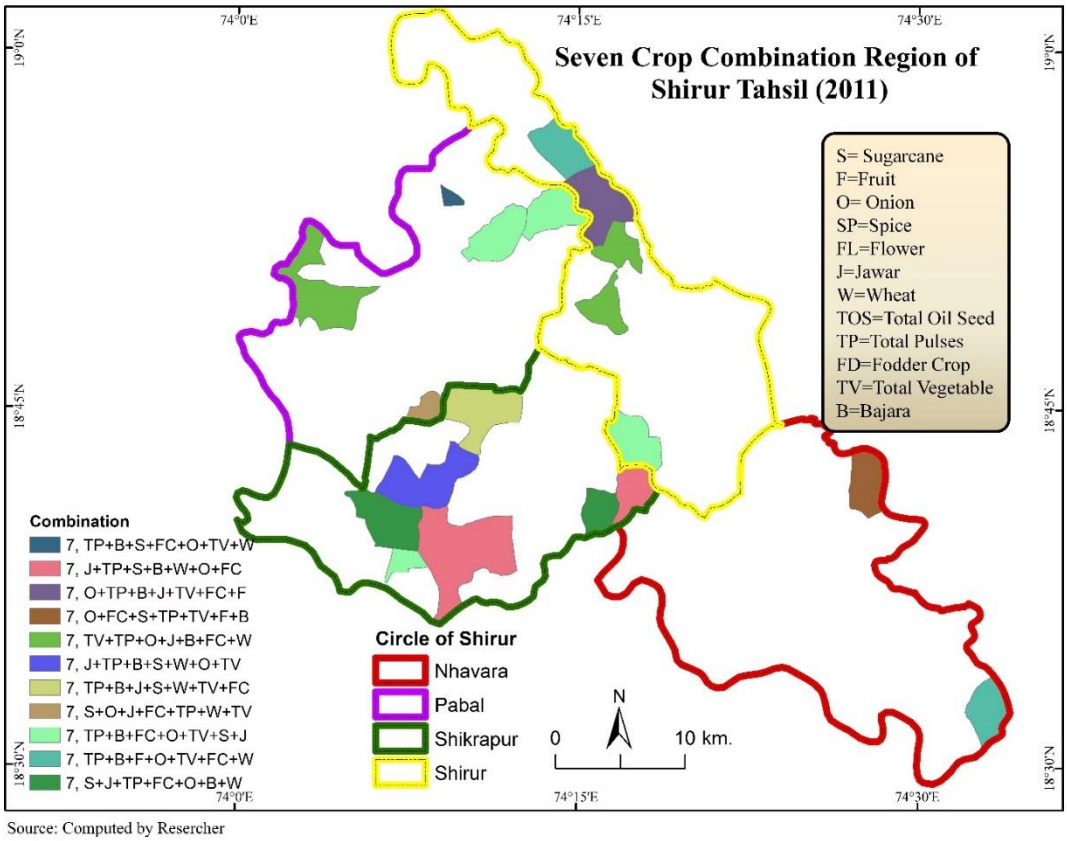


Source: Computed by Resercher

Figure No.- 5.28 Six crop combination region 2011

5.6.5 Six combination Region:

The Six crop combination region is distributed in Shirur circle, Pabal circle and Shikrapur circle and Nahavra circle. Crop combination J+TP+B+O+S+TV, FC+W+TV+TP+O+B and J+TV+TV+TP+FD+O+B is observed in Malthan, Ganegoan dumala and Shirur gramin respectively. There is low rainfall and less irrigation facility region. Combination region of S+TP+J+B+W+FC is important Pimpari dumala, and Rautwadi in Shikrapur tahsil. The combination S+O+J+TP+B+W and S+FC+O+TV+TP+W are located in pimpale jagtap, Jtegoan BK. and Jategoan Khurd dominate of Sugarcane and onion growing region. The region TP+TV+B+J+FC+O is located Amdabad and Nimgoan Bhogi and Golegoan. The crop combination region F+J+TP+S+B+W in Pimpari dumala village. It is fruit growing region near to sub urban center. (Fig.no.5.28.)

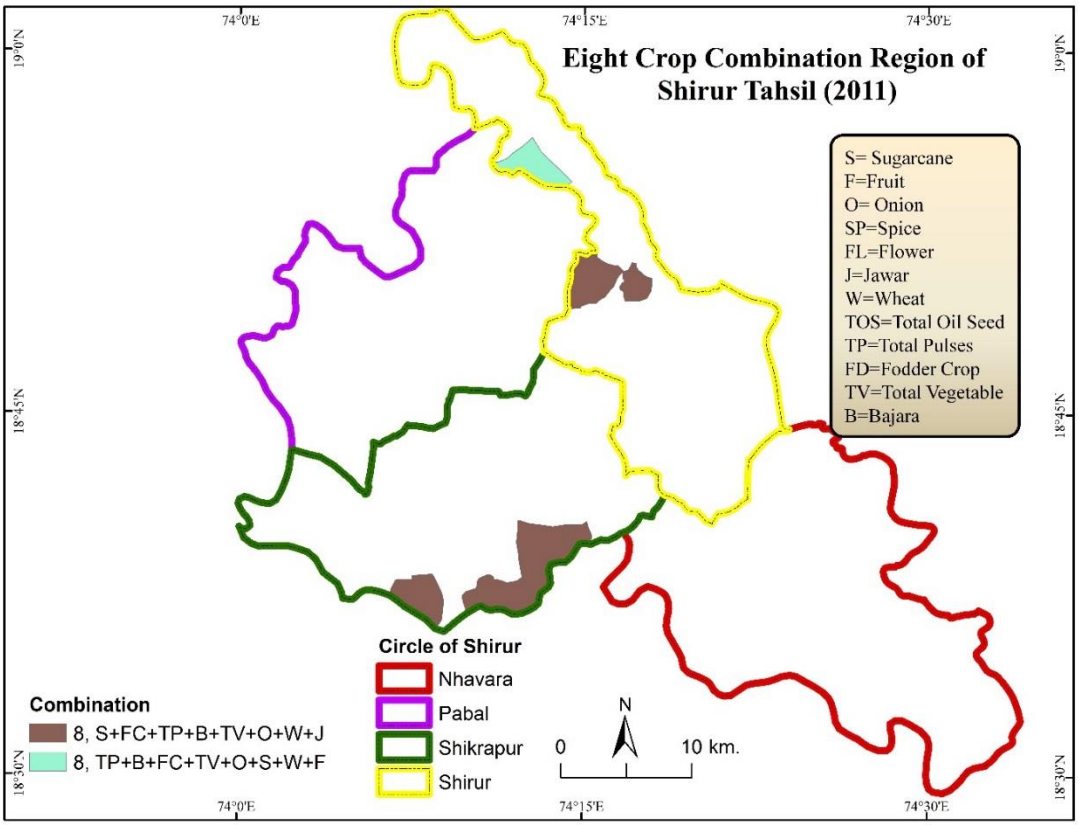


Source: Computed by Resercher

Figure No.- 5.29 Seven crop combination region 2011

5.6.6 Seven Crop Combination Region:

The seven crop combination region include eleven crop combination shown in (Fig.no.5.29.) This region covered crops including first rank Total pulses, Jowar, Onion. Total Vegetable, Sugarcane. This crop combination is covered area of Shirur circle, Nahavra circle, Pabal circle, Shikrapur circle. Seven crop combination mainly dominant in shikrapur circle. Because due to more farmers attitude toward the minimizing loss of crops cost and to make a agricultural landuse planning for more crops.

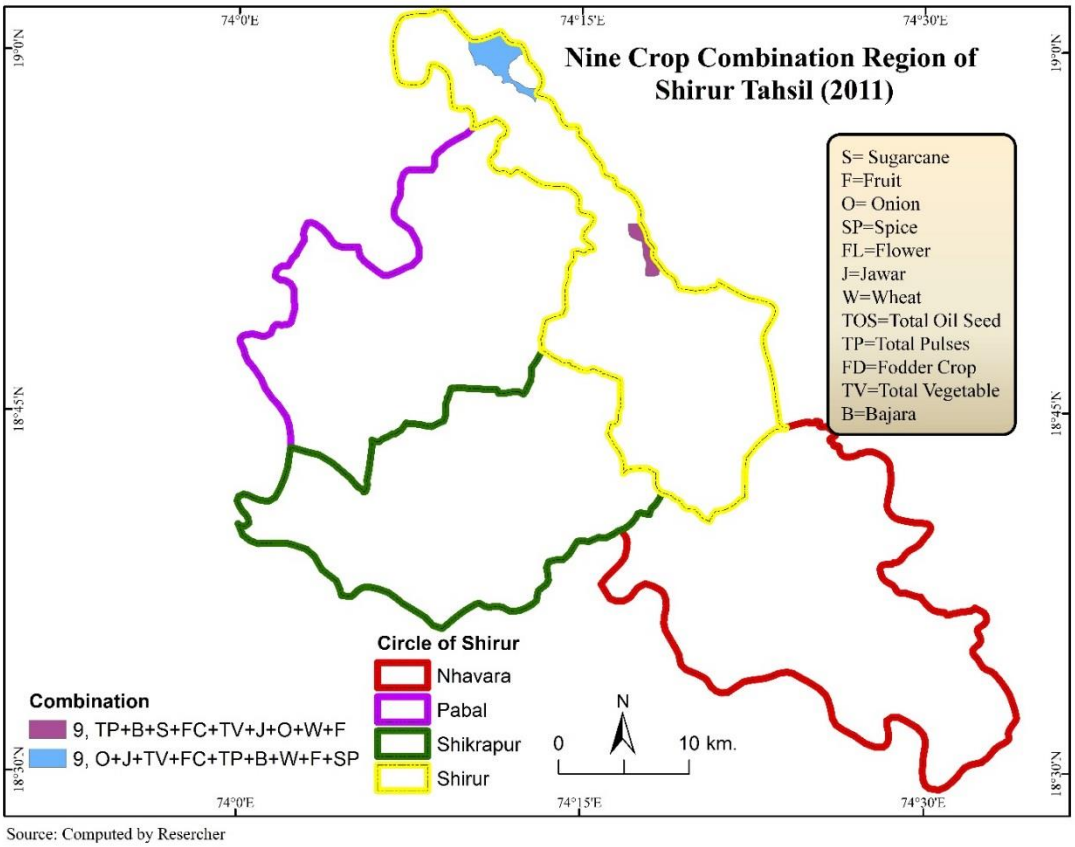


Source: Computed by Resercher

Figure No.-5.30 Eight crop combination region 2011

5.6.7 Eight Crop Combination Region:

The eight crop combination region is observed in Shikrapur and Shirur circle. Crop Combination S+FC+TP+B+TV+O+W+J is including Sugarcane, Fodder crop, Total Pulses, Bajara, Total Vegetable, Onion, Wheat and Jawar. It is covered area of villages such as Koregaon Bhima, Koregaon Bhima, Vittalwadi, Talegaon Dhamdhere, Darekarwadi, Amdabad and Aannapur. TP+B+FC+TV+O+S+W+F combination showing only one village that is Nimgaon dude. (Fig.no.5.30.)

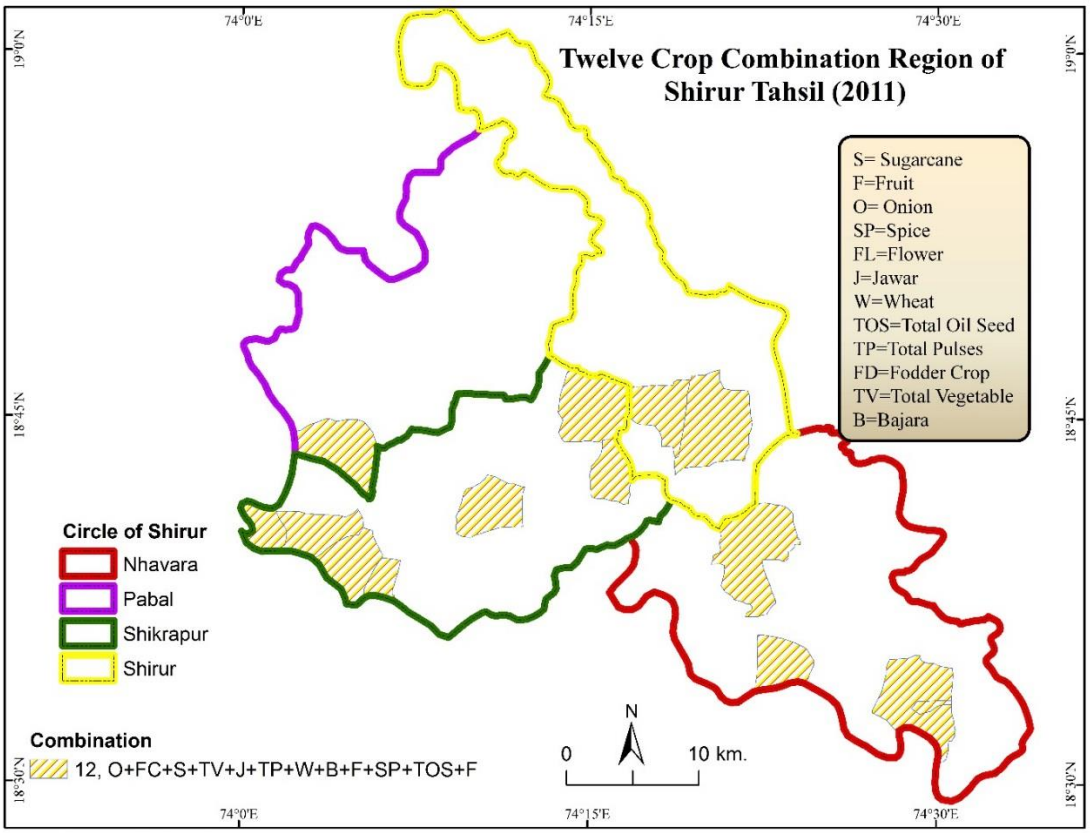


Source: Computed by Resercher

Figure No.-5.31 Nine crop combination region 2011

5.6.8 Nine Crop Combination Region:

The nine crop combination region is observed only in Shirur circle. This crop combination region is less dominate in study area. Crop Combination TP+B+S+FC+TP+O+W+F is seen Mhase village. The crop combination O+J+TV+FC+TP+B+W+F+SP is located in Jambut village. It is includes crops Onion, Jowar, Total Vegetable, Fodder crop, Total Pulses, Bajara, Wheat, Fruit and Spices. (Fig.no.5.31.)



Source: Computed by Resercher

Figure No.-5.32 Twelve crop combination region 2011

5.6.9 Twelve Crop Combination Region:

The twelve crop combination region is distributed in Nahavra, Shikrapur, Shirur and Pabal circle. It is includes crops Onion, Fodder crops, Sugarcane, Total Vegetable, Jowar, Total Pulses, Wheat, Bajara, Fruit, Spice, Total oil seed and Flower. (Fig.no.5.32.)

The combination O+FC+S+TV+J+TP+W+B+F+SP+TOS+F is observed in Mandavgaon Farata, Nagargaon, Nahavra, Babulasar khurd, Karde, Ranjangaon Ganpati, Karjavane, Apati and Vadhu budruk.

5.7 Summary:

In the present study, total 108 villages were observed and studied. The purpose of this chapter was to highlight the changes in agricultural LUCP during 2001-2002 to 2011-12. It was observed that the adoption of farm technology has increased found in the irrigated areas of study region. Intensive agricultural systems more accepted all over the study area. The major portion of the land area is being under cultivation is

positive change and significant change is noted that in cropping pattern. Although the entire cropping pattern seems to be governed by agro-climatic conditions, irrigation has played a prominent role by changing the nature and extent of cropping pattern. Sugarcane and fodder cultivation prevail in Shikrapur and Nahavra Circle in the study area. The southern, middle and eastern part of the study area. Facilitated by assured irrigation and fertile soils are also suitable for growing several crops.

It is made possible due to the increasing lift and canal sources of irrigation and also the special efforts made by co-operative, particulars sugar factory, farming equipments, labour and another facilities i.e. fertilizers, seeds, insecticides, electricity and credit also available from recent decades. Area under Sugarcane, Onion, Fodder crop and Total vegetable crops has increased during 2001-2002 to 2011-2012. And area under crops Bajara, Jawar, Wheat, fruit, Total Spices has decreased during period in 2001-02 to 2011-12. In case of overall change, it is observed that the crops shift from food grains to sugarcane is noteworthy in areas facilities by perennial sources of irrigation. While shift from cash crop to, flower and Onion crops it observed in the areas having only seasonal sources of irrigation facility.

The cropping pattern of Shirur Tahsil is complex in which crops are associated with other crops. In every circle of the Tahsil shows characteristics of multi crop combination. The 12 crop combination area is highly identified in cropping pattern because of the number of favorable conditions for these crops from the above observation. It is clear that there is a tendency of specialization of five major crops i.e. Sugarcane, Fodder crops, Onion, Jawar and Total pulses. The development in irrigation facilities, soil productivity, skill of farmers, using the modern techniques in agricultural land and based on demand and supply of markets will change the existing cropping pattern. The cropping pattern in Shirur circle shows dynamic nature in combination pattern specially eastern and central part of the circle. As compare to Pabal, Shikrapur and Nahavra circle having less variation from year 2001- 2002 to 2011-2012. It is because of partially better facility of irrigation, fertilize soil, relatively plain topography and use of partial modern technology. Shikrapur circle and Pabal circle is mainly under the Interior area therefore it has less develop in agriculture.

The index of diversification indicating the generalization of relationship between the relative strength and number of crops grown. In Shirur Tahsil in the study of 108 villages diversification, index indicates that the eastern part of study region has

very high crop diversification between 2001-2002 to 2011-2012. The highest diversification is found only in Shirur circle because of relatively gentle topographic conditions, favorable soils and partial higher irrigation facilities of Ghod River. Some part of Shikrapur circle has also increased the diversification area during 2011-12, because construction of KT wear, and canal, and available irrigation facilities for this circle. The high diversification area is also available in the southern part of Nahavra circle because of presence of Bhima River. In Pabal circle, crop diversification is very little because it is in agricultural backward area and unfavorable topographical condition. But because of land improvement program, the diversification index is changed from very little diversification too little or high diversification.

In the study area, nine crop combination region is also observed. The area in a major crops were taken into consideration for delimitation of crop combination of region. Two crop combination region, Three crop combination region, Four crop combination region, five crop combination region, Six crop combination region, Seven crop combination region, Eight crop combination region, Nine crop combination region and Twelve crop combination region were found in study area.

In the present study ten crop combination and eleven crop combination were not found as the farmer were not interested in taking any risk. They gave preference to multi crops and changing crops based on market prices.

CHAPTER - VI

VILLAGE BASE STUDY OF SHIRUR TAHSIL

6.1. Introduction:

In the developing country like India, 70 Percent of the population resides in rural area and cannot subscribe commercial software. Though number of tools are available for web based spatial information system, each one of them have some restrictions, such as cost, license, internet connectivity, availability of skilled person, etc. To overcome such problems, open source tools are better solutions. Open source geospatial tools provide facilities such as cost effectiveness and it can be customized according to user needs. Also, various spatial queries can be made for better decision making (Kale2015). They are helpful in monitoring various rural development schemes run by government.

An Information System is a recent concept and a research methodology which covers information regarding the village or circle or tahsil. Nowadays, it is used in all the fields with a great scope. Information System focuses on the basic concept of databases, data requirements and the mechanism to store, organize, process and analyze it. It is able to provide the required information. This chapter summarizes the concepts of Information Technology (IT), Information System (IS), Village Information System (VIS) and Circle Information System (CIS). It contains the role of GIS and RS in the creation of Village Information System, design and development of VIS.

6.2 Information Technology:

Data is the basic requirement in information system. Such data is collected through primary and secondary methods. Primary sources are field visits, surveys, questionnaires, local interviews etc. Census (human, livestock, agriculture etc.), Government records, Administrative Records, Financial Records, Publications and Magazines, Institutional Libraries etc. are the secondary sources of data and information collection. Besides these, Remote Sensing and the Computer Networks and Databases etc. are the advanced secondary sources. Even though most of the data and information is available at national, state and district level and village level accurate data is scarcely available.

Primary and secondary sources are time and resource consuming and more expensive. In the absence of updated and accurate information about all kinds of resources at village level, the government and people of the nation are handicapped in planning and controlling their own destiny (Khan et. al, 2005). To collect and store the village-

wise detail data, Information Technology is applied in all fields. Information Technology refers the various hardware components to prepare and operate the systems. It has a wide range of application in maintaining accurate records for planning and development of a region. It minimizes the manual effort, time and complexity of task and makes many things systematically and accurately. Hence, it is sensible to make use of IT in the generation of information System.

6.3 Information Systems:

According to Avison and Fitzerald, "An Information Systems can be defined as a collection of procedures, techniques, tools and documentation aids which will help the system developers in their efforts to implement a new information system". "A suitable information system is required at village level to give planning and development more effective and meaningful direction at micro level" (Khan, 2005).

Buckingham and et al. (1987) defined, "Information System as a system which assembles, stores, processes and delivers information relevant to an organization or to society in such a way that the information is accessible and useful to those who wish to use it. An Information System can support monitoring procedures as it provides current and changing patterns of land use in the area (Dale, 1999). It is a relation based processing system that includes storage of various aspects data and focuses on the basic concept of databases, data requirements and the mechanism to store, organize, process and analyze it.

There are several agencies like National Informatics Centre (NIC), SOI, Indian Space Research Organization (ISRO), Indian Council of Agricultural Research (ICAR), Indian Agricultural and Statistic Research Centre (IASRI) and other non-government agencies are working in the generation of comprehensive village level databases and information systems.

The information system helps for micro-level planning in the various fields such as land records, watershed management, agricultural planning, wasteland management, disaster management and mitigation, environmental impact assessment, urban planning, resource inventory and management, amenities management, market and retail planning, transportation and navigation and decision making process etc. Therefore, the information system refers all the components necessary to deliver its information and functions to the organizations. As results, information system is known as helpful and adaptable tool for decision making.

Village Information System (VIS).In India, VIS is an innovative and pioneering concept. It was initially introduced in the department of land records and known as Land Information System (LIS). It is recently applied in geography for micro level study especially in planning and development. VIS is the recent development in the field of Information System which covers entire information regarding the village. VIS stores and analyzes enormous spatial and non-spatial data regarding the village and displays results in the form of tables, charts, graphs and maps. It gradually incorporated the use of GIS and RS to make it more reliable and effective. For the proper planning and development of the village accurate and systematic information of all the physical and socio-economic aspects is necessary. It is window based or web based system. The definitions of VIS support in understanding the development, purpose and application of VIS.

According to Sitender (2012), "Management of the information about the village in a web-based environment is called Village Information System (VIS)". It deals with both spatial and non-spatial data at village level and comprises of all information related to households, population, infrastructure, amenities, utility services etc.

The VIS is a digital system with spatial and non-spatial data for each land holding and every household mainly based on 'Land Records Computerization' or 'Cadastral System' providing knowledge about old type of lands comprised in the village (Khan, S. 2005).

Information systems are generated with regards to aims and views. There are many information systems as per the requirements many information systems are generated. VIS can be prepared at circle, tahsil, district, state or national.

Information systems are generated with regards to aims and views. There are many information systems as per the requirements many information systems are generated. VIS can be prepared at circle, tahsil, district, state or national.

6.4 Introduction and Location of Sample villages:

Sampling can determine the adequate respondents from the total number of farmers in study region and adequate to warrant generalization of findings to target population. The sample size represents the characteristics of the whole population. The samplings possess economical and practical, faster and cheaper. It yields more

comprehensive information, accurately and savings of time and money. In addition to this sample survey makes possible the use of larger and more varied populations that would be possible for same expenditure if one makes a complete enumeration. In preceding chapters-IV and V regional pattern of agriculture land use is extensively described to study spatial and temporal variations in Shirur tahsil. The present study is carried out with analytical approach by applying quantitative measures to identify agricultural regions in Shirur tahsil. Physiography, soil, climate, irrigation facilities and many other socio-economic factors influence on crop pattern in study region. Village-wise study of landuse and cropping pattern at micro level helps for intensive landuse. Stamp and Mohammed Shafi have emphasized sample survey during their studies in order to save time, money and man power at village level. In present investigation, it is an attempt to study in-depth of eight sample villages in Shirur tahsil, namely, Nimone, Nagargaon, Khannur Masai, Kondhapuri, Karde, Takali Haji, Talegaon Dhamdhere, for these eight villages related to general land use and crop-land use have collected from the obtained data was then converted in percentage. The questionnaires have been circulated among farmers, sarpanch, talathi and gramsevak. Besides this, frequent personal visits were made to three sample villages to collect primary data and relevant information.

6.5 Base of sampling:

Sample villages were selected by purposive systematic sampling method for comprehensive study of problems of villages. The present study region has identified three agriculture regions, namely, backward region, and developed region. The main objective of this module is to store, manage, provide and update village-wise and circle-wise spatial and non-spatial and temporal data of the study area. Data is considered a backbone of information system hence both primary and secondary data is applied for the creation of VIS. Database is storage of data, which maintain the existing data efficiently, update the new information properly and it should be easy to handle (Chaugule, J. B., 2011).

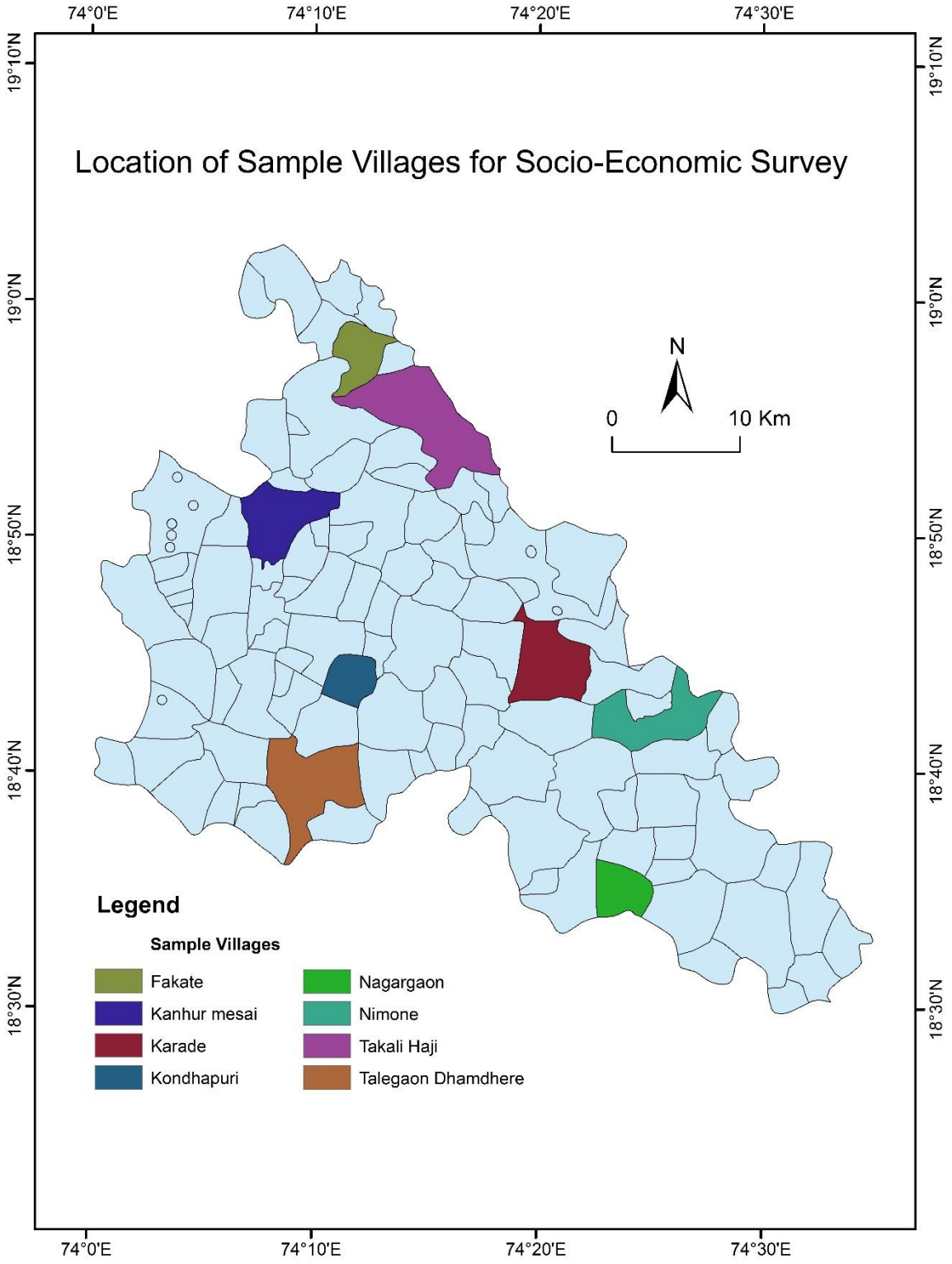


Figure No.-6.1 Location of Sample Village Map

6.6 Nahavra Circle:

6.6.1 Nagargaon:

Nagargaon is a village in Shirur taluka. It is located on latitude extent 18°34'35" longitude extent 74°22'13". It belongs to western Maharashtra region. It is located 66 km towards east from District Headquarters Pune and 32 km from Shirur. It is surrounded by Wadgaon Rasai, Ranjangaon Sandas, Nangaon, Khopodi, Sadalgaon etc. Marathi is the Local Language here.

Table No. 6.1

Nagargaon			
Sr. No.	Casts	No of population	Percent of Cast
1	Open	91	91.92
2	OBC	1	1.01
3	NT	7	7.07
4	ST	0	0.00
5	SC	0	0.00
Total	Total	99	100.00

Fig.No. 6.2

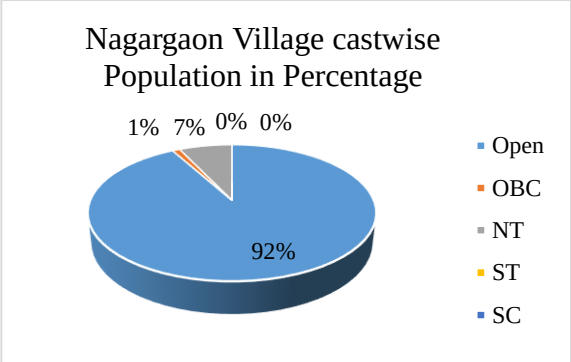


Table No. 6.2

Sr. No	Irrigation Types	Percent Irrigation facility
1	Irrigated Land	95.00Percent
2	Un Irrigated Land	5.00Percent

Fig.No. 6.3

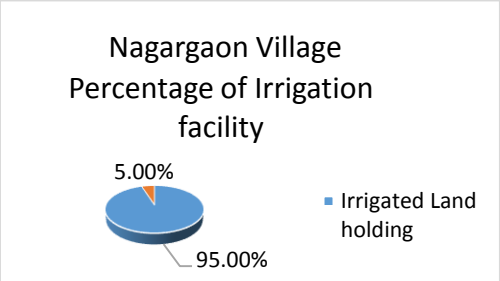


Table No. 6.3

Sr.no.	**Irrigation Facilities**	**No. of water Source**	Percent water Source
1	Well	5	11.63
2	Tubwell	5	11.63
3	Canal	0	0.00
4	Lift	31	72.09
5	Other	2	4.65
	Total	43	100.00

Fig.No. 6.4

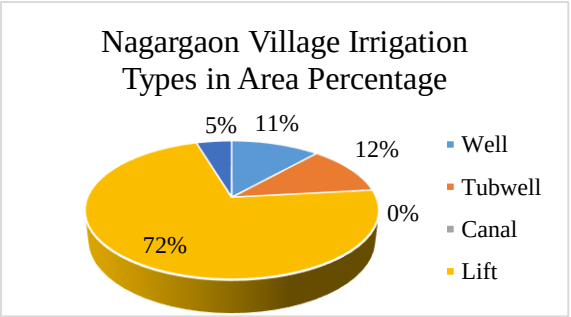


Table No. 6.4

Sr. No	Crop Name	Crop Production Rupees
1	Sugarcane	6560005
2	Onion	1555000
3	Jawar	7000
4	Bajara	0
5	Wheat	10003
6	Groundnut	0
7	other	200000

Fig.No. 6.5

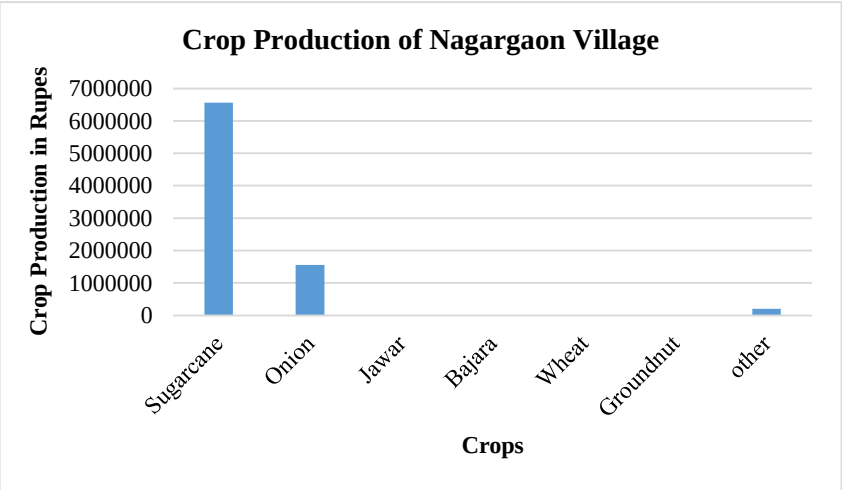


Table No. 6.5

Sr. No	Crop name	Area (acre)	Percent Crops Area
1	Sugarcane	85	51.52
2	Onion	39	23.64
3	Jawar	6	3.64
4	Bajara	6	3.64
5	Wheat	9	5.45
6	Groundnut	15	9.09
7	other	5	3.03
	Total	165	100.00

Fig.No. 6.6

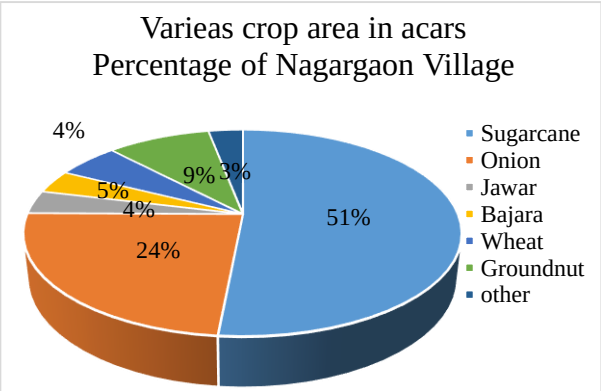
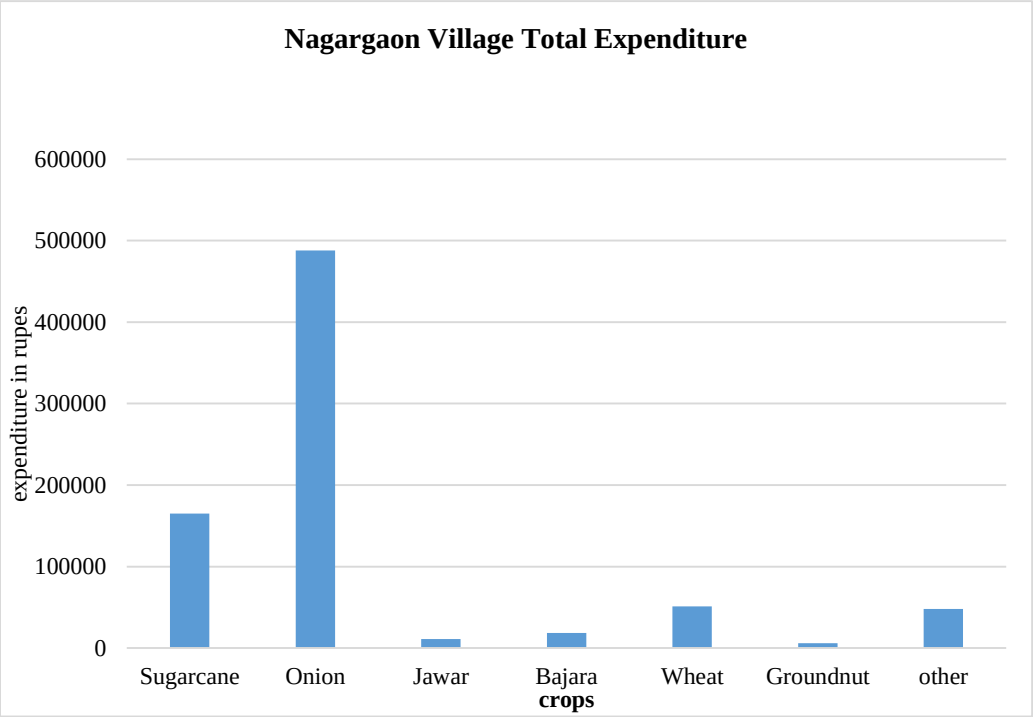


Table No. 6.6

Sr. No	Crop name	Total Expenditure
1	Sugarcane	165000
2	Onion	488000
3	Jawar	11200
4	Bajara	18400
5	Wheat	51000
6	Groundnut	6000
7	other	48000

Figure 6.7



6.6.1.2 Result and discussion:

In the present study Nagargaon village is randomly selected for the village information system in Shirur tahsil. This village is the basis of circle in the specific tahsil. This village is included in Nahavra circle. Caste wise population was studied in this village. In Nagargaon village, mostly open category people were found (91.92%). Another categories people such as OBC and NT were also found respectively 1.01, 7.07 percentage. The most people were engaged in agriculture in Nagargoan village. There is recorded 95 Percent irrigated land. In Nagargoan, most of the farmers give priority for sugarcane crop. Irrigation facility is provided through lift by Bhima River. In this village crops grown are Sugarcane, Onion, Bajara, Wheat, Groundnut etc.

6.6.2 Nimone Village:

Nimone village is on the Latitude extent 18°41'47" Longitude Extent 74°23'52". It belongs to western Maharashtra region. It belongs to Pune Division. It is located 71 km towards East from District Headquarters, Pune and 15 km from Shirur. The postal head office is Shirur (Pune).Nhavare (3 km), Motewadi (3 km), Chavhanwadi (6 km),Nirvi (8 km), Shindodi (8 km) are the nearby Villages to Nimone. Nimone is surrounded by Shrigonda taluka towards East.

Table No. 6.7

Nimone			
Sr. no	Casts	No of population	% of Cast
1	Open	103	72.03
2	OBC	38	26.57
3	NT	2	1.40
4	ST	0	0.00
5	SC	0	0.00
	Total	143	100.00

Fig.No. 6.8

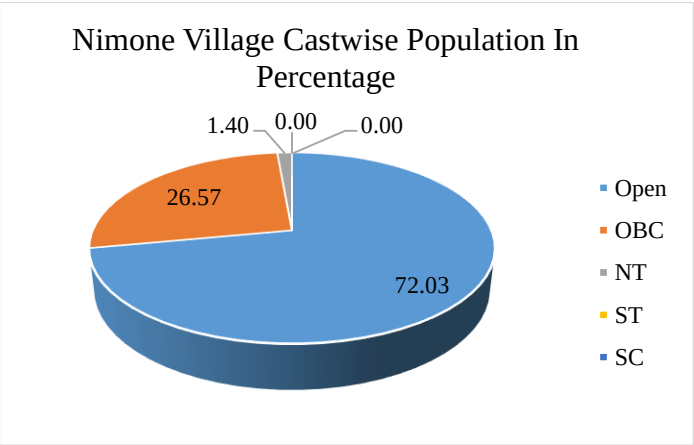


Table No. 6.8

Sr. No	Irrigation Types	Percentage of Irrigation facility (%)
1	Irrigated Land	89.29
2	Un Irrigated Land	10.70t

Fig. No. 6.9

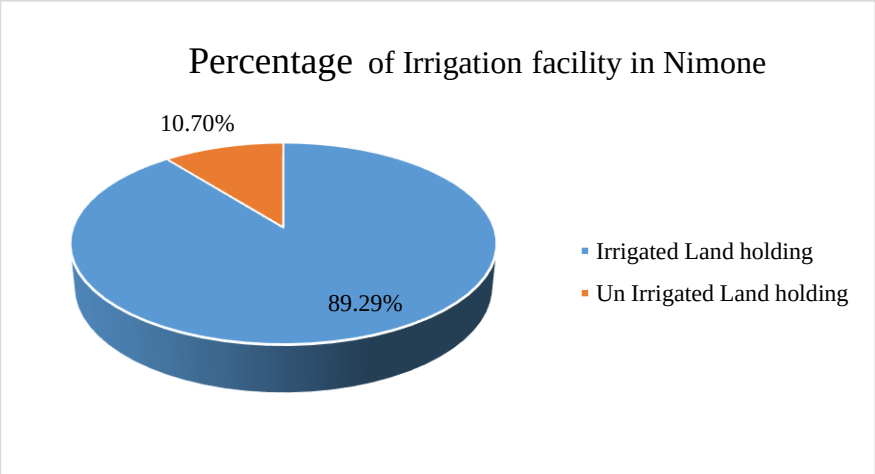


Table No. 6.9

Sr.no.	**Irrigation Facilities**	**No. of water Source**	Percent water Source
1	**Well**	16	26.67
2	**Tubwell**	8	13.33
3	**Canal**	8	13.33
4	**Lift**	16	26.67
5	**Other**	12	20.00
	Total	60	100.00

Fig.No. 6.10

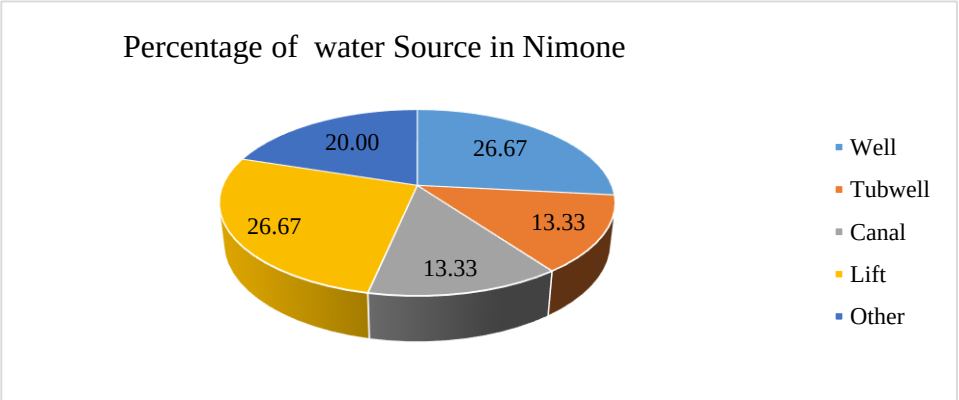


Table No. 6.10

Sr. No	Crop name	Total Expenditure
1	Sugarcane	2930000
2	Onion	822000
3	Jawar	54000
4	Bajara	43400
5	Wheat	0
6	Groundnut	420000
7	other	44000

Fig.No. 6.11

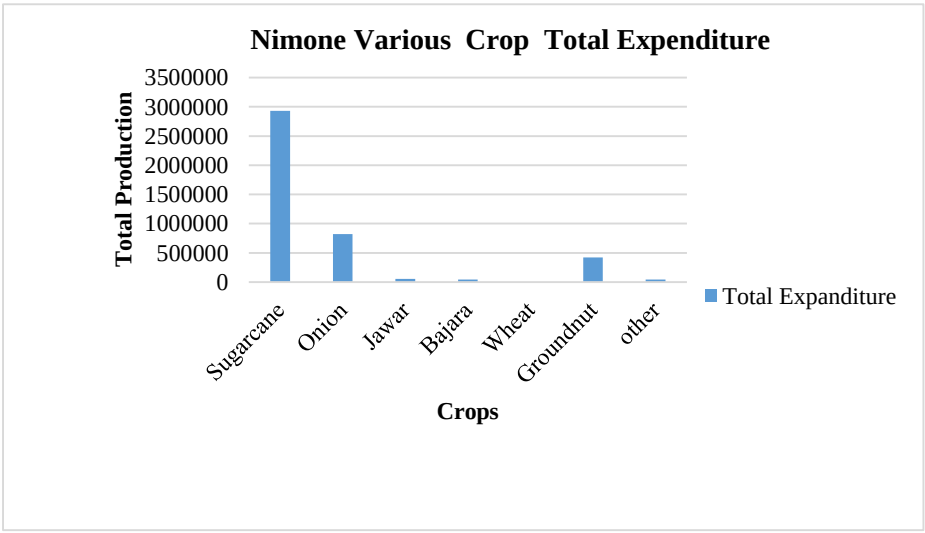


Table No. 6. 11

Sr. No	Crop Name	Crop Production
1	Sugarcane	11240000
2	Onion	2800000
3	Jawar	155000
4	Bajara	80000
5	Wheat	0
6	Groundnut	800000
7	other	200000

Figure 6.12

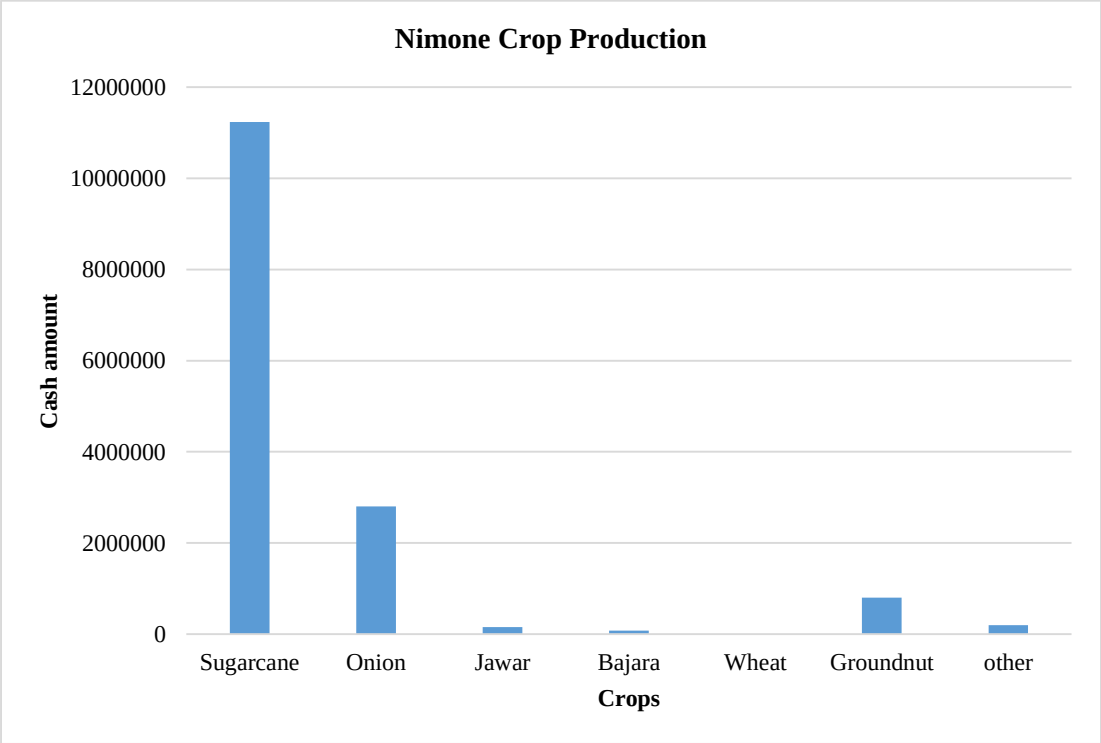
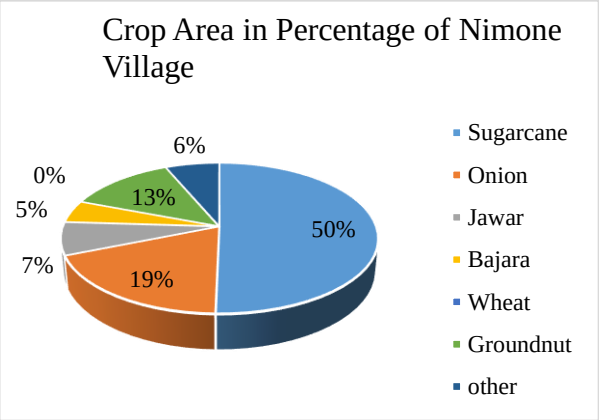


Table No. 6.12 **Fig.No. 6.13**

Sr. No	Crop name	Area (acre)	Percent Crops Area
1	Sugarcane	157	50.32
2	Onion	58	18.59
3	Jawar	22	7.05
4	Bajara	15	4.81
5	Wheat	0	0.00
6	Groundnut	40	12.82
7	other	20	6.41
	Total	312	100.00



6.6.2.2 Result and discussion:

In the present study, the researcher has Nimone village randomly selected for the village information system in Shirur tahsil. This village is the basis of circle in the specific tahsil. This villages cover in Nahavra circle. Cast wise population was studied in this village. In Nimone, mostly open category people were found (72.03%). Another category such as OBC, NT were also found respectively 26.57Percent, 1.40 percentage. The village location is in the North direction of the tahsil. The land is mostly irrigated by Ghod River. Around 89.29 % area is under irrigation. In Nimone, most of the farmers give to priority to cash crops. Various type of crops are taken in this village. Sugarcane crop covers 50.32Percent. Crop area in acre, after that in Second rank onion crop is 18.59Percent. Crop area in acre .Bajara, Jowar, Wheat, Groundnut crops cover area in percentages respectively 4.81 Percent, 7.05 Percent. Percent.12.82 & other 6.41 respectively percent. Irrigation facility is provided by well, canal, tub well, lift etc. Nimone village is located right bank of Ghod River. Crops grown are sugarcane, onion, Jawar, Bajara etc. on the basis of observation medium black soil is found. Canal irrigation provided by right bank. Irrigation facility in Nimone village is more dominant. In this village Lift Irrigation is 26.67 Percent, Well is 26.67 Percent, Tub well is 13.33 Percent and Canal 13.33Percent.

6.7 Shirur Circle:

6.7.1 Takali Haji:

Takali Haji Is located on Latitude 18°55’35” Longitude 74°12’52”. It belongs to Desh or Paschim Maharashtra region. It belongs to Pune Division. It is located 68 km towards North from District Headquarters Pune and 18 km from Shirur. Rawadewadi (5 km) , Amadabad (7 km) , Jambut (8 km), Malthan (8km), Kawathe (9 km) are the nearby Villages to Takali Haji. Takali Haji is surrounded by Parner Taluka towards East.

Table No. 6.13

Takalihaji			
Sr. no	Casts	No of population	Percent of Cast
1	Open	59	57.28
2	OBC	0	0.00
3	NT	36	34.95
4	ST	5	4.85
5	SC	3	2.91
	Total	103	100.00

Fig.No. 6.14

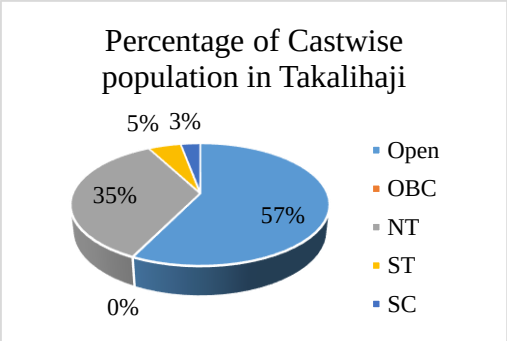


Table No. 6.14

Sr. No	Irrigation Types	Area Percent Irrigation facility
1	Irrigated Land	69.95Percent
2	Un Irrigated Land	30.50Percent

Fig.No. 6.15

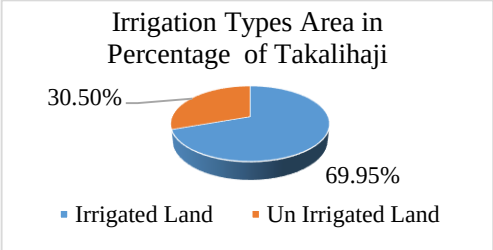


Table No. 6.15

Sr.no.	**Irrigation Facilities**	**No. of water Source**	**Percent No. of water Source**
1	Well	20	29.41
2	Tubwell	14	20.59
3	Canal	20	29.41
4	Lift	14	20.59
5	Other	0	0.00
	Total	68	100.00

Fig.No. 6.16

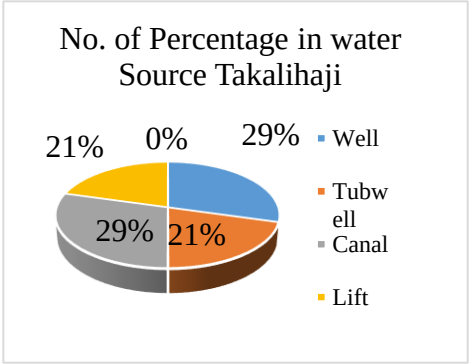


Table No. 6.16

Sr. No	Crop Name	Crop Production
1	Sugarcane	7060000
2	Onion	4600000
3	Jawar	0
4	Bajara	800000
5	Wheat	200000
6	Groundnut	150000
7	other	20000

Fig.No. 6.17

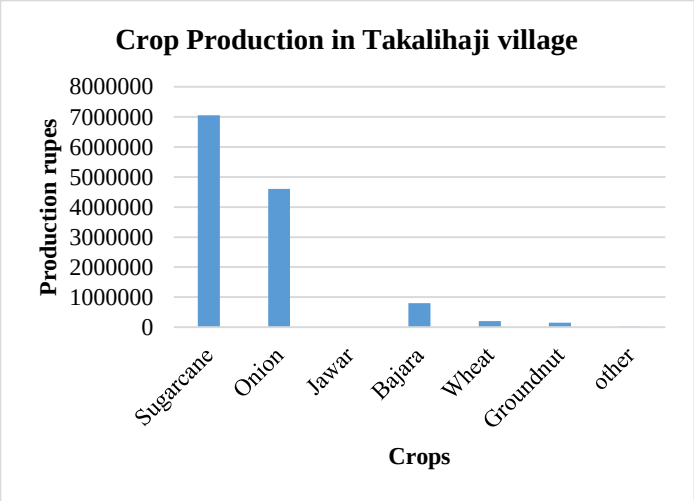


Table No. 6.17

Sr. No	Crop name	Total Expenditures
1	Sugarcane	6143500
2	Onion	836000
3	Jawar	32500
4	Bajara	21999
5	Wheat	31000
6	Groundnut	104500
7	other	15500

Figure no. 6.18

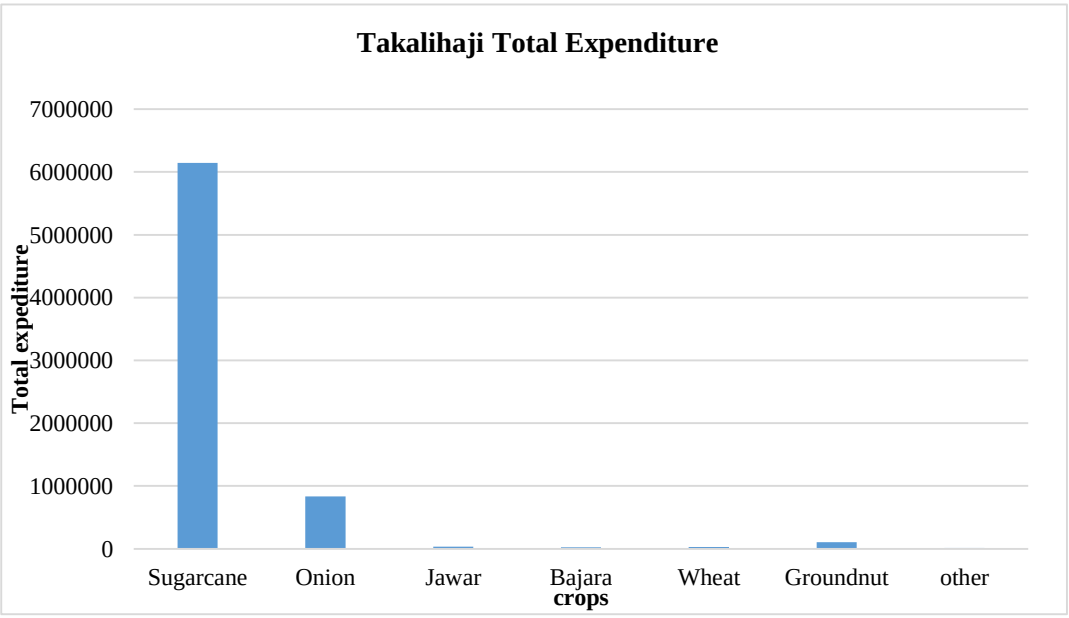
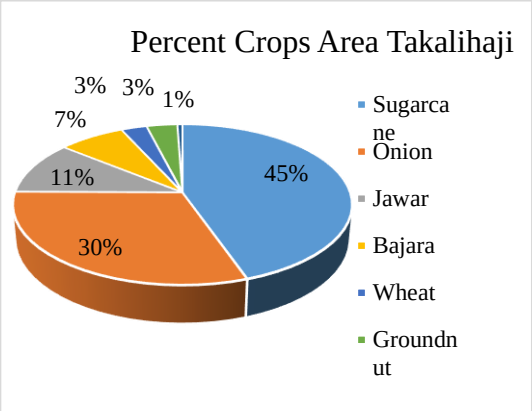


Table No. 6.18

CropsSr. No	Crop name	Area (acre)	Percent Crops Area
1	Sugarcane	79	44.63
2	Onion	54	30.51
3	Jawar	19	10.73
4	Bajara	13	7.34
5	Wheat	5	2.82
6	Groundnut	6	3.39
7	other	1	0.56
	Total	177	100.00

Fig.No. 6.19



6.7.1.2 Result and discussion:

In the present study, the researcher has selected Takali Haji village randomly selected for the village information system in Shirur tahsil. This village are the basis of circle in the specific tahsil. This village is included in Shirur tahsil. The cast wise population was studied in this village. In Takali Haji mostly open category people were found 57.28Percent. Another category such as OBC, NT, SC, and ST. found respectively 0Percent, 34.95Percent. 4.85Percent. 2.91percentage. The village located in the south direction of the tahsil. The land is irrigated by Ghod River. Around 69.95 % area is under irrigation. In Takali Haji most of the farmers give priority for cash crop. Various type of crops are taken in this village. Sugarcane crop is cover 44.63Percent. crop area in acre. After that, onion crop 30.51 Percent. And other crops like Bajara, jawar, groundnut, crops cover area in percentages respectively 7.34Percent, 10.73Percent. 2.82Percent.3.39Percent. Irrigation facility in Takali haji is more dominant. In this village, Lift Irrigation is 20.59Percent. and well is 29.41 Percent.

6.7.2 Karde:

Karde is a Village in Shirur Taluka in Pune District. It is on Latitude extent18°45’24" Longitude extent 74°19’12". It belongs to Desh or Paschim Maharashtra region. It belongs to Pune Division. It is located 66 KM towards East from District Headquarters Pune and 10 KM from Shirur. Chavhanwadi (5 KM), Bhambarde (6KM), Kalwantwadi (7KM), Motewadi (7KM), Saradwadi (7KM) are the nearby Villages to Karde. Karde is surrounded by Parner Taluka towards North, Shrigonda Taluka towards East, Daund Taluka towards South, Khed Taluka towards west .Shirur, Daund, Shrigonda , Manchar are the nearby cities to Karde.

Table No. 6.19

Karde.			
Sr. no	Casts	No of population	Percent
1	Open	74	85.06
2	OBC	0	0.00
3	NT	0	0.00
4	ST	0	0.00
5	SC	13	14.94
	Total	87	100.00

Fig.No. 6.20

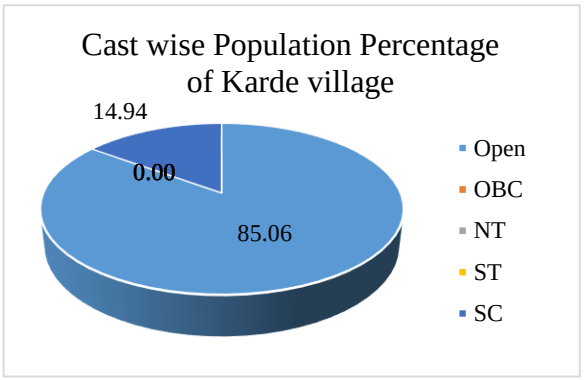


Table No. 6.20

Sr. No	Irrigation Types	Area Percent
1	Irrigated Land	71.25Percent
2	Un Irrigated Land	28.75Percent

Fig.No. 6.21

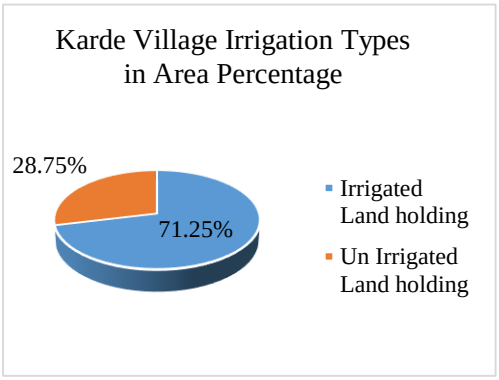


Table No. 6.21

Sr.no.	**Irrigation Facilities**	**No. of water Source**	Percent
1	**Well**	10	32.26
2	**Tubwell**	7	22.58
3	**Canal**	14	45.16
4	**Lift**	0	0.00
5	**Other**	0	0.00
	Total	31	100.00

Fig.No. 6.22

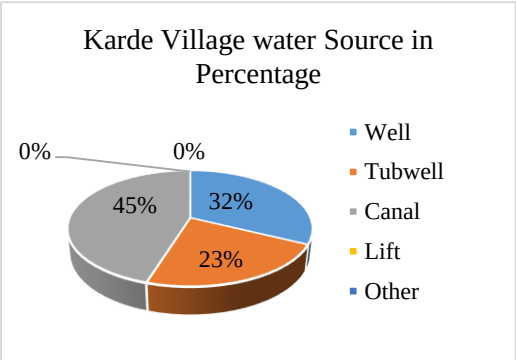


Table No. 6.22

Sr. No	Crop Name	Crop Production
1	Sugarcane	360000
2	Onion	1100000
3	Jawar	0
4	Bajara	10000
5	Wheat	0
6	Groundnut	80000
7	other	0

Fig.No. 6.23

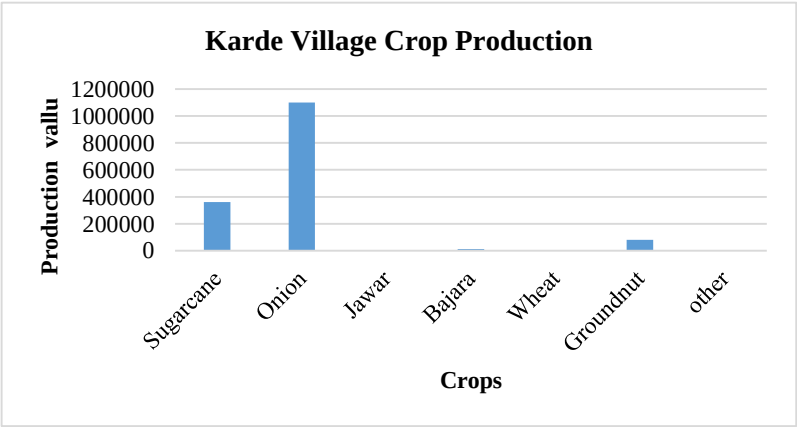


Table No. 6.23

Sr. No	Crop name	Total Expenditure
1	Sugarcane	92000
2	Onion	417000
3	Jawar	50800
4	Bajara	16000
5	Wheat	0
6	Groundnut	18000
7	other	0

Figure 6.24

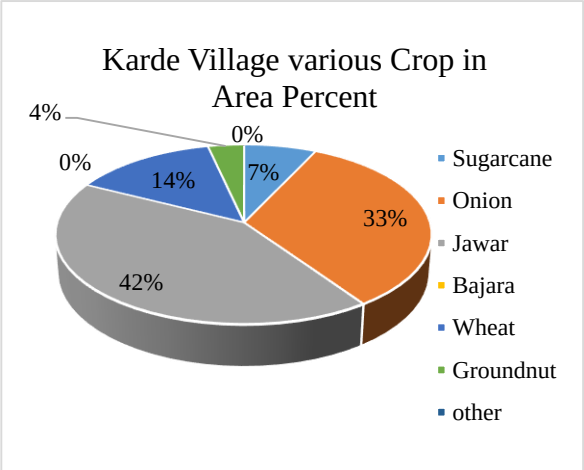
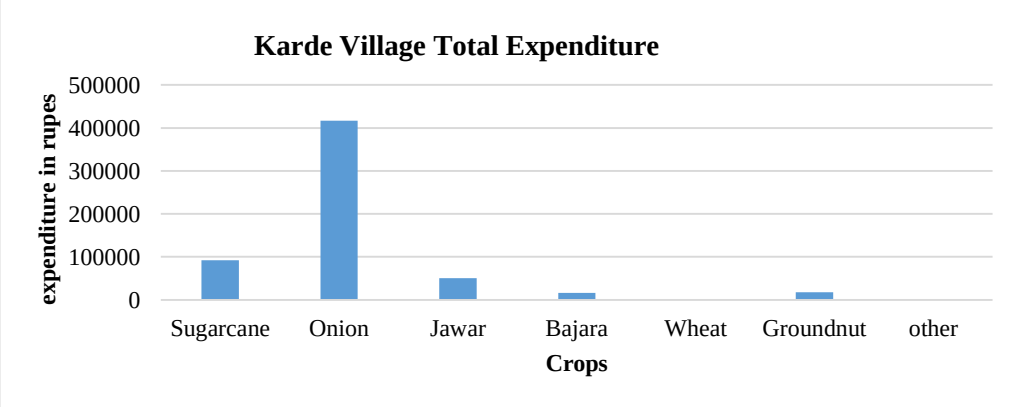


Table No 6.24

Sr. No	Crop name	Area (acre)	Percent
1	Sugarcane	4	7.02
2	Onion	19	33.33
3	Jawar	24	42.11
4	Bajara	0	0.00
5	Wheat	8	14.04
6	Groundnut	2	3.51
7	other	0	0.00
	Total	57	100.00

Figure No. 6.25



6.7.2.1 Result and discussion:

In the present study, Karde village is selected for the village information system in Shirur tahsil. This village is the basis of circle in the specific tahsil. This village is included Shirur circle. The caste wise population is studied in this village. In Karde, mostly open category people were found (85.06 %). Another categories such as OBC were also found 14.94 percentage. The village location is the south direction of the tahsil. Most of land is irrigated with Tub well Irrigation. Around 71.25 Percent area is under irrigation 28.75 Percent. In Karde, most of the farmers give priority to cash crop. Various type of crops are taken in this village. Sugarcane crop covers 7.02Percent. crop area onion crop is 33.33Percent. of crop area and other crop like. jowar, groundnut, crops cover area in percentages respectively 42.11Percent, 14.04Percent.3.51Percent respectively.

Irrigation facility in Karde village is more dominant. In this village, well Irrigation is 22.58 Percent. and Tub well is 45.16 Percent.

6.8. Shikrapur circle:

6.8.1 Kondhapuri:

The village Kondhapuri in on Latitude extent 18°43’55” Longitude extent 74°10’21”.It belongs to Desh or Paschim Maharashtra region. It belongs to Pune Division. It is located 49 KM towards East from District Headquarters Pune. 25 KM from Shirur. Kasari (3KM), Nimgaon Mhalunge (4 KM), Ganegaon Khalsa (5KM), RanjangaonGanpati (6KM), Burunjwadi (7 KM) are the nearby Villages to Kondhapuri. It is surrounded by KhedTaluka towards west, Parner Taluka towards North, Pune Taluka towards west, Pimpri-Chinchwad Taluka towards west. Shirur, Manchar, Pune. Pimpri-Chinchwad are the nearby Cities to Kondhapuri

Kondapuri			
Sr. no	Casts	No of population	Percent
1	Open	76	87.36
2	OBC	8	9.20
3	NT	0	0.00
4	ST	0	0.00
5	SC	3	3.45
	Total	87	100.00

Table No. 6.25

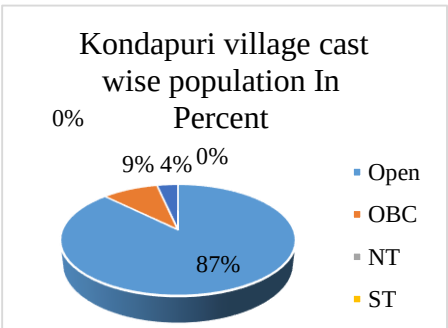


Fig.No. 6.26

Table No. 6.26

Sr. No	Irrigation Types	Area Percent
1	Irrigated Land	62.62
2	Un Irrigated Land	37.37

Fig.No. 6.27

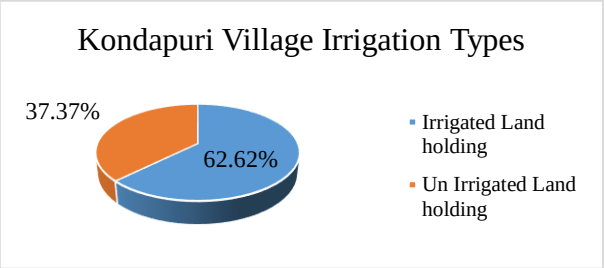


Table No. 6.27

Sr.no.	**Irrigation Facilities**	**No. of water Source**	Percent
1	**Well**	12	32.43
2	**Tubwell**	9	24.32
3	**Canal**	16	43.24
4	**Lift**	0	0.00
5	**Other**	0	0.00
	Total	37	100.00

Fig.No. 6.28

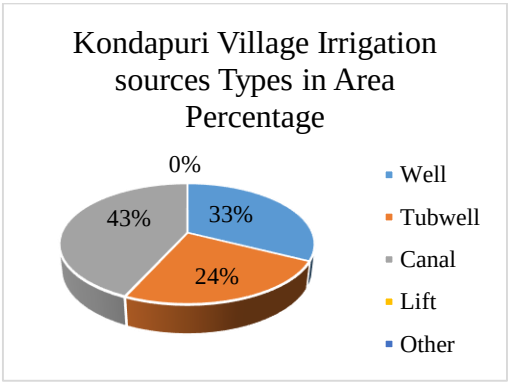


Table No. 6.28

Sr. No	Crop Name	Crop Production
1	Sugarcane	280000
2	Onion	1250000
3	Jawar	0
4	Bajara	10000
5	Wheat	0
6	Groundnut	80000
7	other	0

Fig.No. 6.29

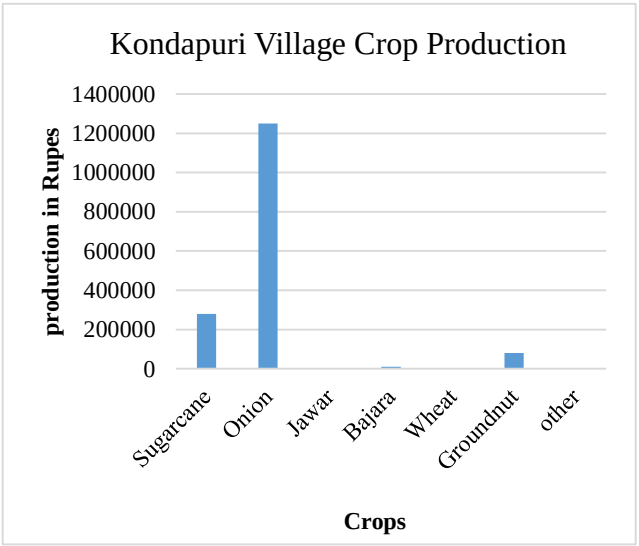


Table No. 6.29

Sr. No	Crop name	Area (acre)	Percent
1	Sugarcane	3	4.62
2	Onion	23	35.38
3	Jawar	29	44.62
4	Bajara	8	12.31
5	Wheat	0	0.00
6	Groundnut	2	3.08
7	other	0	0.00
	Total	65	100.00

Fig.No. 6.30

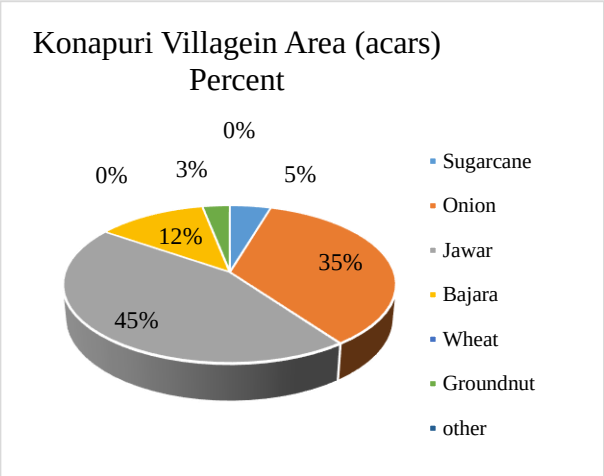
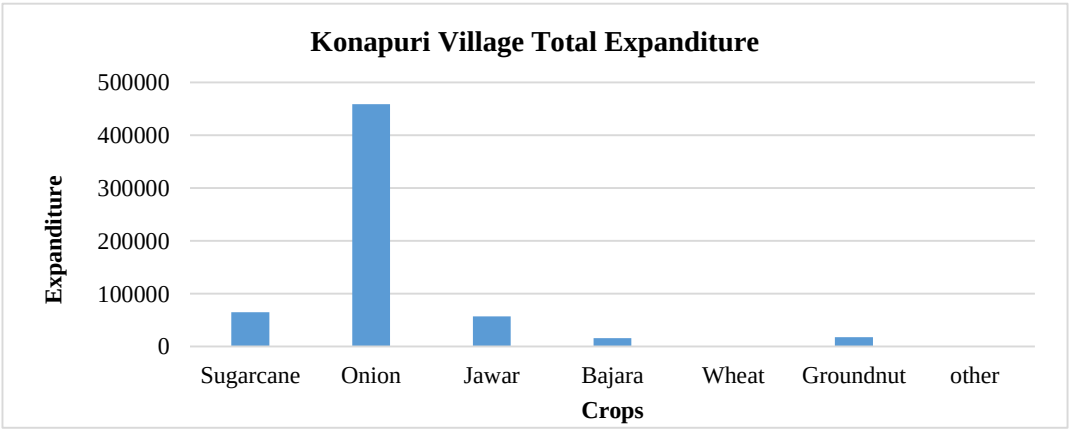


Table No. 6.30

Sr. No	Crop name	Total Expenditure
1	Sugarcane	65000
2	Onion	459000
3	Jawar	57300
4	Bajara	16000
5	Wheat	0
6	Groundnut	18000
7	other	0

Fig.No. 6.31



6.8.1.2 Result and discussion

In the present study, Kondapuri village is selected for the village information system in Shirur tahsil. This village is the basis of circle in the specific tahsil. This village is included in Shirur circle. The cast wise population studied in this village. In Kondapuri village mostly open category people were found 87.36 Percent. Another categories such as OBC, and ST were also found respectively 9.20Percent, 3.45 percentage. The village location is in the south direction of the thasil. Most of land is irrigated with Tub well Irrigation. Around 62.62 Percent area is under irrigation 37.37Percent. In Kondapuri, most of the farmers give priority to cash crop. Various type of crops are taken in this village. Sugarcane crop covers 4.62 Percent. of crop area onion crop covers 35.38Percent. of crop area and other crops like .Bajara, Groundnut, crops cover area in percentages respectively 12.31Percent, 44.62Percent. 3.08Percent.Irrigation facility in Kondhapuri village is more dominant. In this village well Irrigation is 32.43Percent, Tub well is 24.32 Percent, and Canal 43.24 Percent.

6.8.2 Talegaon Dhamdhere:

Talegaon Dhamdhere is on Latitude extent 18°37’53” & Longitude extent 74°8’13” on the right (south) bank of the Vel River. Administratively, TalegaonDhamdhere is under Shirur Taluka of Pune District in Maharashtra. There is only a single village of Talegaon Dhamdhere in Talegaon Dhamdhere gram panchayat. The village of TalegaonDhamdhere is 4 km by road southeast of the village of Shikrapur, and 6 km by road north of the village of Vittalwadi. In the 2001 census, the village of TalegaonDhamdhere had 13,410 inhabitants, with 6,912 males (51.5Percent) and 6,498 females (48.5Percent), for a gender ratio of 940 females per thousand males

Table No. 6.31

TalegaonDhamdhere			
Sr. no	Casts	No of population	Percent of Cast
1	Open	74	74.00
2	OBC	23	23.00
3	NT	0	0.00
4	ST	0	0.00
5	SC	3	3.00
	Total	100	100.00

Fig.No. 6.32

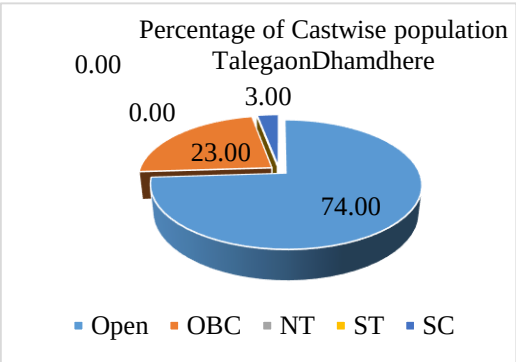


Table No. 6.32

Sr. No	Irrigation Types	Area Percent Irrigation facility
1	Irrigated Land	91.90Percent
2	Un Irrigated Land	8.09Percent

Fig.No. 6.33

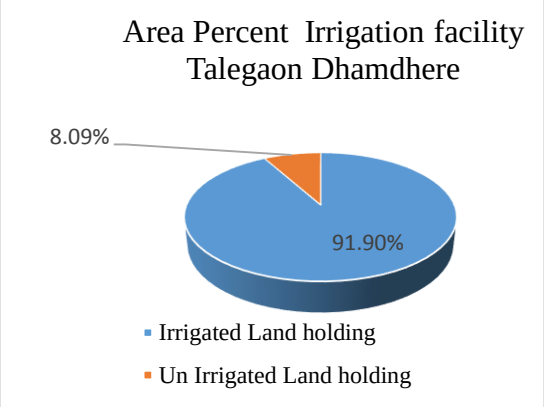


Table No. 6.33

Sr.no.	Irrigation Facilities	No. of water Source	Percent No. of water Source
1	**Well**	5	10.64
2	**Tubwell**	9	19.15
3	**Canal**	0	0.00
4	**Lift**	31	65.96
5	**Other**	2	4.26
	Total	47	100.00

Fig.No. 6.34

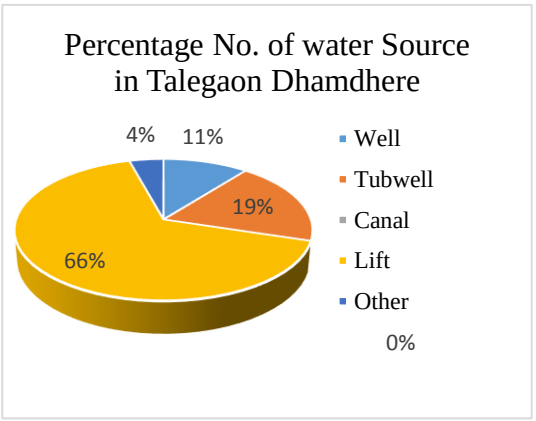


Table No. 6.34

Sr. No	Crop name	Area (acre)	Percent Crops Area
1	Sugarcane	132	30.14
2	Onion	255	58.22
3	Jawar	6	1.37
4	Bajara	6	1.37
5	Wheat	15	3.42
6	Groundnut	15	3.42
7	other	9	2.05
	Total	438	100.00

Fig.No. 6

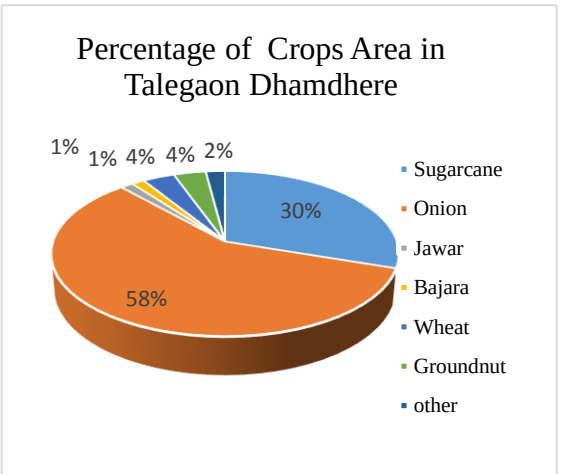


Table No. 6.35

Sr. No	Crop name	Total crop Expenditure
1	Sugarcane	1551000
2	Onion	578000
3	Jawar	11200
4	Bajara	18400
5	Wheat	82000
6	Groundnut	6000
7	other	48000

Fig.No. 6.36

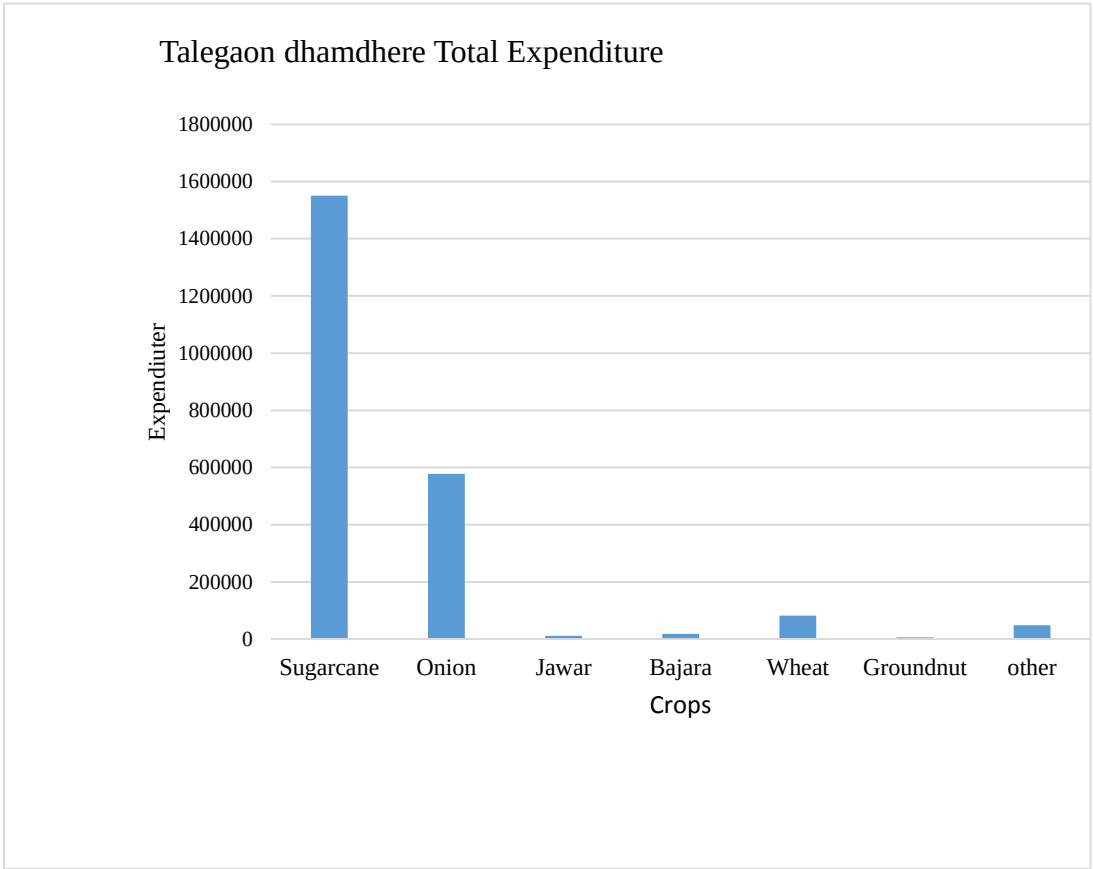
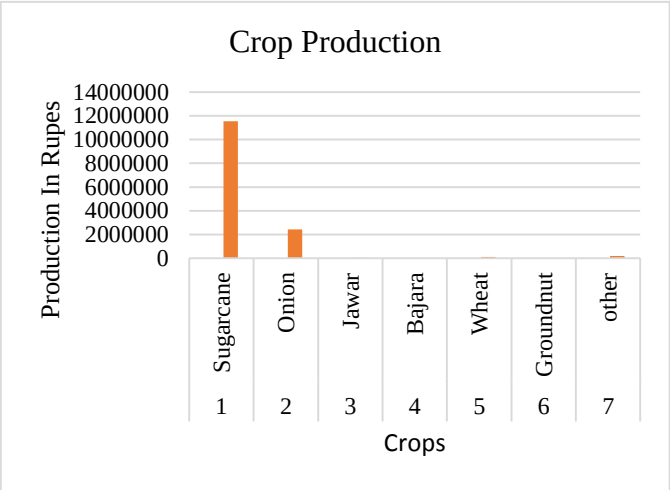


Table No. 6.36 **Fig.No. 6.37**

Sr. No	Crop Name	Crop Production
1	Sugarcane	11530005
2	Onion	2425001
3	Jawar	7000
4	Bajara	0
5	Wheat	110003
6	Groundnut	0
7	other	200000



6.8.2.1 Result and discussion:

In the present study, the researchers has randomly selected Talegaon Dhamdhere village for the village information system in Shirur tahsil. This village is the basis of circle in the specific tahsil. This village comes under Shirur circle. The cast wise population was studied in this village. In Talegaon Dhamdhere mostly open category people were found 74 Percent. And another categories such as OBC, and ST were found respectively 23 Percent, 3 percentage. The village location is in the south side of the tahsil. There is Most the land is irrigated with Tub well Irrigation. Area under irrigation is 91.90 Percent and unirrigated area is 8.09Percent. In Talegaon Dhamdhere, most of the farmers give priority for cash crop. Various types of crops are taken in this village. Sugarcane crop covers 30.14Percent. of crop area onion crop covers 58.22 Percent. of crop area and Bajara, jowar, Groundnut, crops cover respectively 1.37 Percent, 1.37 Percent. 3.42 Percent.3.42 Percent. & other 2.04 persenteges. Irrigation facility in Talegaon Dhamdhere village is more dominant. In this village well Irrigation is 32.43Percent, Tub well is 24.32 Percent, Canal 43.24 Percent and other water facility is 0 Percent in this village.

6.9 Pabal circle:

6.9.1 Kanhur Masai:

Kanhur Mesai village is located in Shirur Tahsil of Pune district in Maharashtra, India. Kannur Mesai is on latitude 18°51’36" longitude 74°74’2". Shirur is nearest town to Kanhur Mesai village. Kanhur Mesai Population - Pune, Maharashtra. Kanhur Mesai is a large village located in Shirur of Pune district, Maharashtra with total 830 families residing. The Kanhur Mesai village has population of 4028 of which 2021 are males while 2007 are females as per Population Census 2011. In Kanhur Mesai, population of children with age 0-6 is 416 which makes up 10.33 Percent of total population of village. Average Sex Ratio of Kanhur Mesai village is 993 which is higher than Maharashtra state average of 929. Child Sex Ratio for the Kanhur Mesai as per census is 1133, higher than Maharashtra average of 894. Kanhur Mesai village has lower literacy rate compared to Maharashtra. In 2011, literacy rate of Kanhur Mesai village was 76.38 Percent compared to 82.34 Percent of Maharashtra. In Kanhur Mesai Male literacy stands at 86.58 Percent while female literacy rate was 65.96 Percent. Kanhur Mesai village.

Table No. 6.37

Khannur Masai			
Sr. no	Casts	No of population	Percent
1	Open	95	92.23
2	OBC	0	0.00
3	NT	0	0.00
4	ST	4	3.88
5	SC	4	3.88
	Total	103	100.00

Fig.No. 6.38

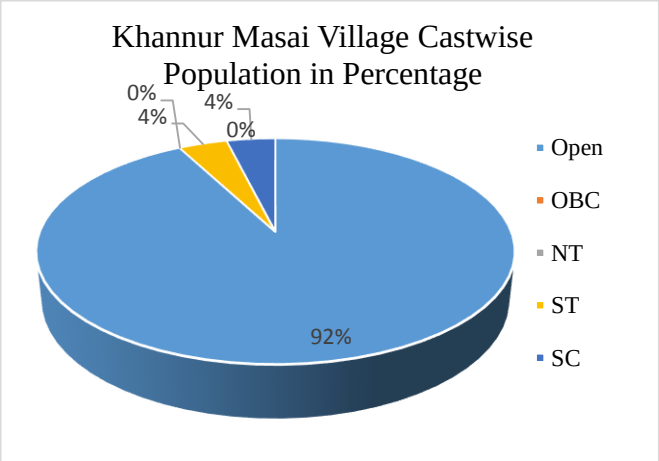


Fig.No. 6.39

Table No. 6.38

Fig.No. 6.39

Sr. No	Irrigation Types	Area Percent
1	Irrigated Land	10.67Percent
2	Un Irrigated Land	89.32Percent

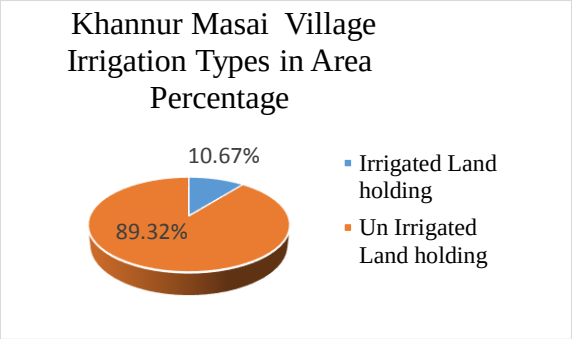


Table No. 6.39

Fig.No. 6.40

Sr.no.	**Irrigation Facilities**	**No. of water Source**	Percent
1	**Well**	7	46.67
2	**Tubwell**	5	33.33
3	**Canal**	3	20.00
4	**Lift**	0	0.00
5	**Other**	0	0.00
	Total	15	100.00

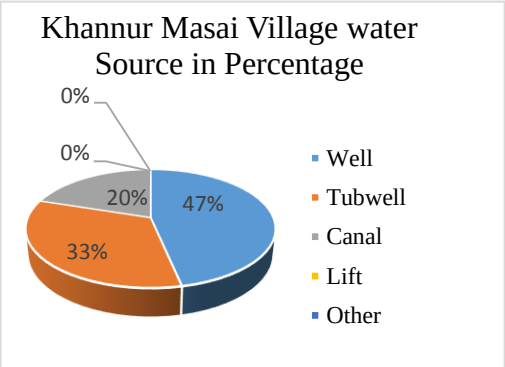


Table No. 6.40

Fig.No. 6.41

Sr. No	Crop Name	Crop Production
1	Sugarcane	0
2	Onion	400000
3	Jawar	0
4	Bajara	10000
5	Wheat	0
6	Groundnut	0
7	other	0

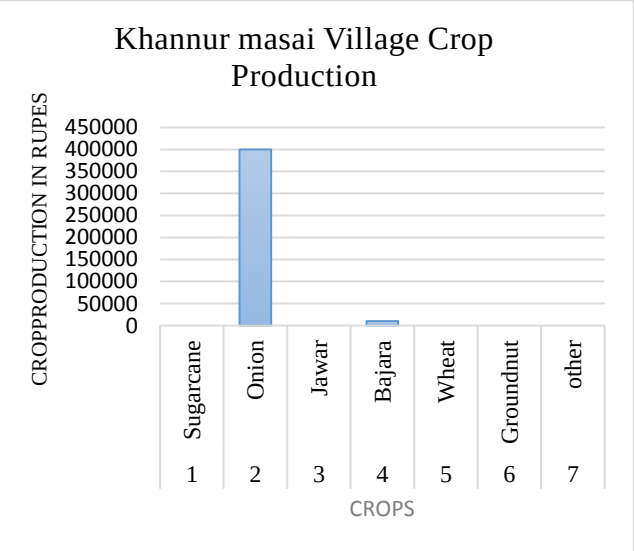


Table No. 6.41

Sr. No	Crop name	Area (acre)	Percent
1	Sugarcane	0	0.00
2	Onion	6	27.27
3	Jawar	14	63.64
4	Bajara	2	9.09
5	Wheat	0	0.00
6	Groundnut	0	0.00
7	other	0	0.00
	Total	22	100.00

Fig.No. 6.42

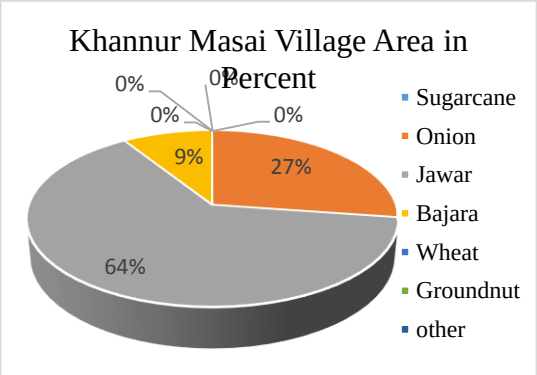
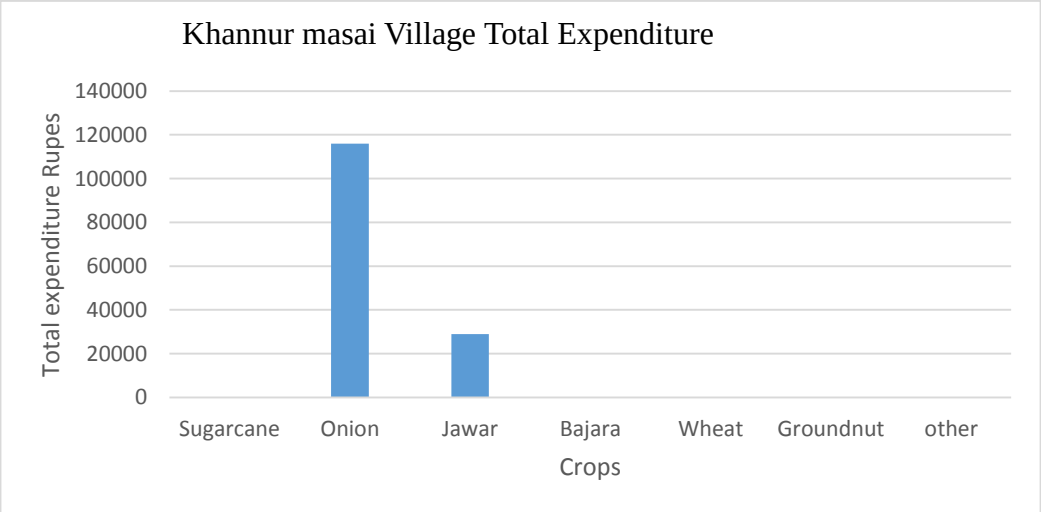


Table No.6.42

Sr. No	Crop name	Total Expenditure
1	Sugarcane	0
2	Onion	116000
3	Jawar	28900
4	Bajara	0
5	Wheat	0
6	Groundnut	0
7	other	0

Fig.No. 6.43



6.9.1.2 Result and discussion:

In the present study, the researcher has Khannur Masai village randomly selected for the village information system in Shirur tahsil. This village is the basis of circle in the specific tahsil. This village comes under Pabal circle. The caste wise population is studied in this village. In Khannur Masai, mostly open category people were found 92.23 Percent. And other category like SC, and ST were also. Found respectively 3.88 Percent.3.88 percentage. The village location is in the south side of the tahsil. Mostly the land is irrigated with Tub well Irrigation. Area under irrigation is 10.67Percent and unirrigated area is 89.32 Percent. In Khannur Masai, most of the farmers give priority for cash crop. Various types of crops are taken in this village. Sugarcane crop covers 0Percent. Of crop area onion crop covers 27.27 Percent. of crop area and Bajara, jowar, crops cover 9.09Percent, 63.64 Percent respectively. Irrigation facility in Khannur Masai village is more dominant. In this village, well Irrigation is 46.67Percent, Tub well is 33.33 Percent and Canal 20.00 Percent in this village.

6.9.2 Karandi:

Karandi is a large village located in Shirur Tahsil with total 1084 families residing. Karandi Latitude 18°44’29" Longitude 74°2’54". The Karandi village has population of 5248 of which 2711 are males while 2537 are females as per Population Census 2011. In Karandi village population of children with age 0-6 is 608 which makes up 11.59 % of total population of village. Average Sex Ratio of Karandi village is 936 which is higher than Maharashtra state average of 929. Child Sex Ratio for the Karandi as per census is 930, higher than Maharashtra average of 894. Karandi village has lower literacy rate compared to Maharashtra. In 2011, literacy rate of Karandi village was 80.65 % compared to 82.34 % of Maharashtra. In Karandi Male literacy stands at 87.48 % while female literacy rate was 73.35 %. As per constitution of India and PanchyatiRaaj Act, Karandi village is administrated by Sarpanch (Head of Village) who is elected representative of village. Karandi village is administrated by Sarpanch (Head of Village) who is elected representative of village. As per constitution of India and PanchyatiRaaj Act, Karandi village is administrated by Sarpanch (Head of Village) who is elected representative of village.

Table No. 6.43

Karandi.			
Sr. no	Casts	No of population	Percent
1	Open	95	95.96
2	OBC	4	4.04
3	NT	0	0.00
4	ST	0	0.00
5	SC	0	0.00
	Total	99	100.00

Fig.No. 6.44

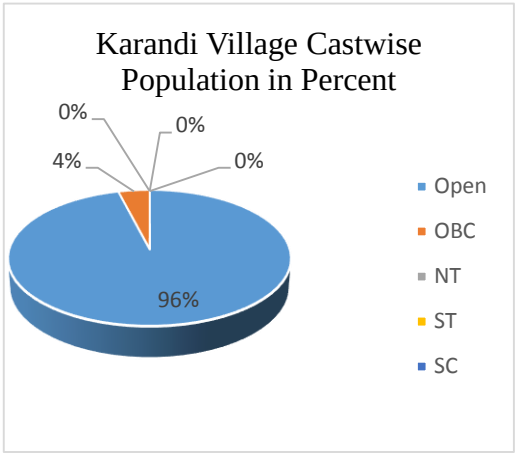


Table No. 6.44

Sr. No	Irrigation Types	Area Percent
1	Irrigated Land	96.75Percent
2	Un Irrigated Land	3.25Percent

Fig. No. 6.45

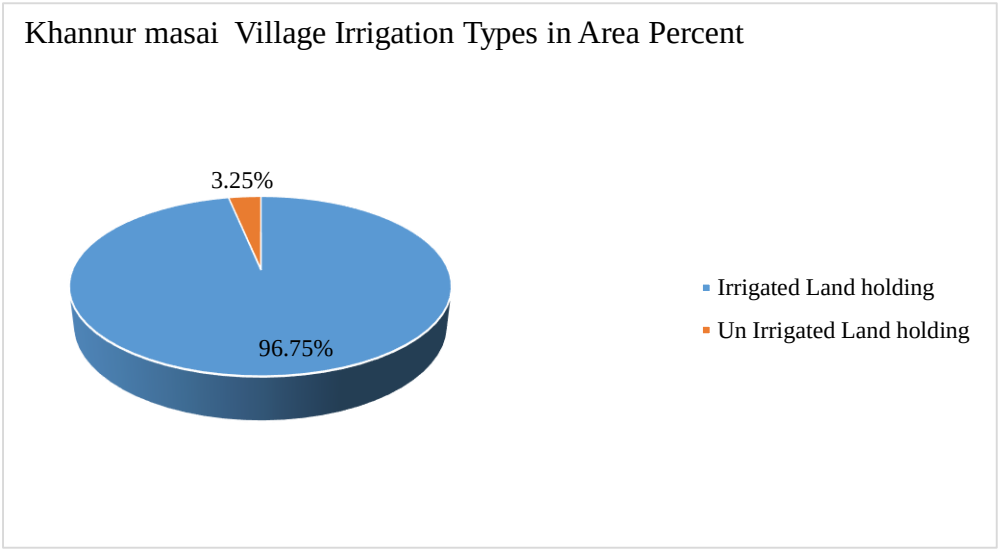


Table No.6.45

Sr.no.	**Irrigation Facilities**	**No. of water Source**	Percent
1	**Well**	16	19.51
2	**Tubwell**	20	24.39
3	**Canal**	8	9.76
4	**Lift**	38	46.34
5	**Other**	0	0.00
	Total	82	100.00

Fig. No. 6.46

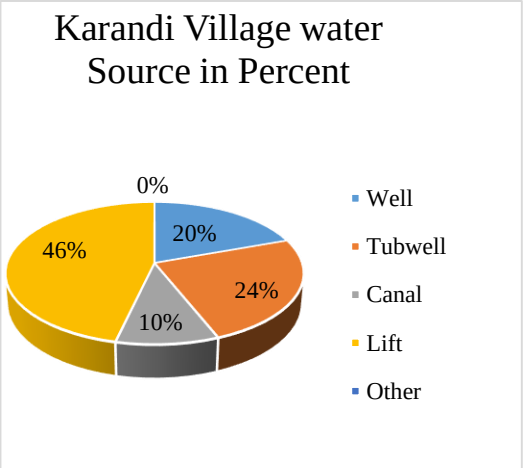


Table No. 6.46

Sr. No	Crop Name	Crop Production
1	Sugarcane	6850000
2	Onion	3050000
3	Jawar	0
4	Bajara	0
5	Wheat	0
6	Groundnut	1600000
7	other	251500

Fig.No.6.47

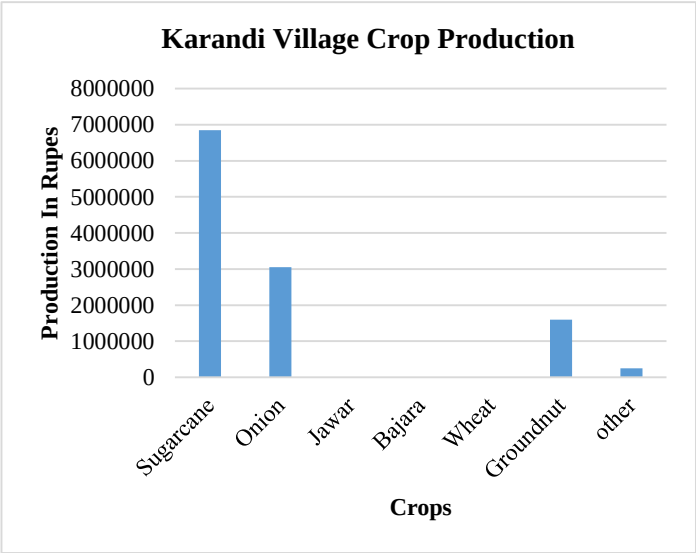


Table No. 6.47

Sr. No	Crop name	Area (acre)	Percent
1	Sugarcane	78	48.45
2	Onion	44	27.33
3	Jawar	0	0.00
4	Bajara	0	0.00
5	Wheat	2	1.24
6	Groundnut	17	10.56
7	other	20	12.42
	Total	161	100.00

Fig.No.6.48

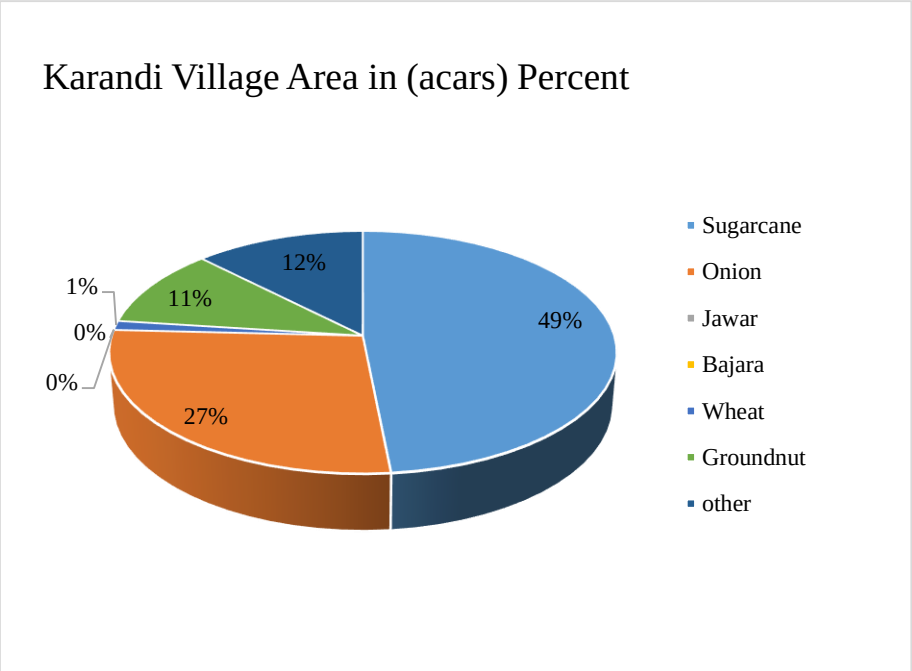
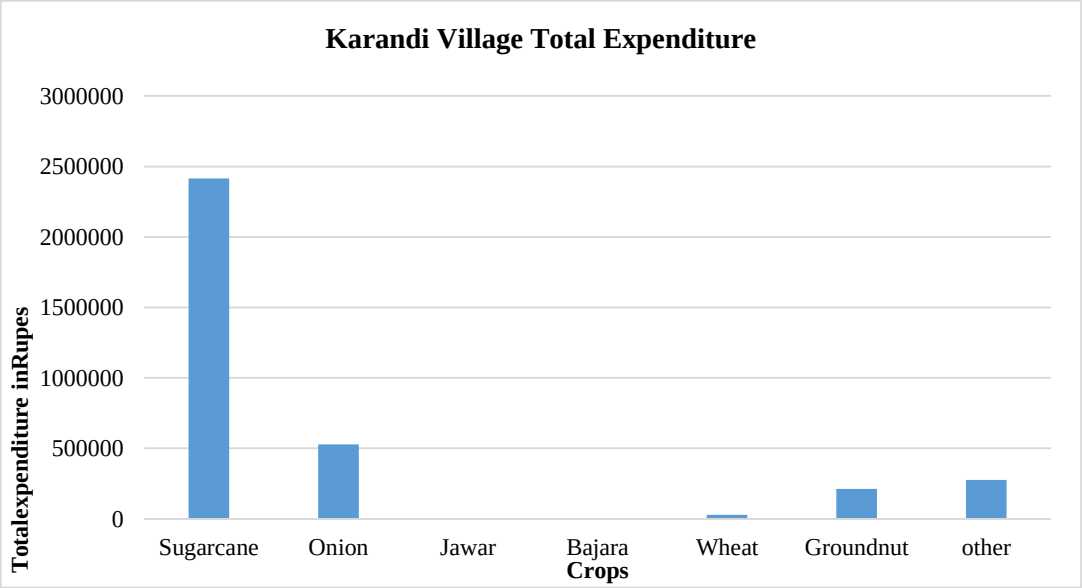


Table No. 6.48

Sr. No	Crop name	Total Expenditure
1	Sugarcane	2414000
2	Onion	529000
3	Jawar	0
4	Bajara	0
5	Wheat	28000
6	Groundnut	213000
7	other	276000

Fig.No.6.49



6.9.2.1 Result and discussion:

In the present study, the researchers has randomly selected Karandi village for the village information system in Shirur tahsil. This village is the basis of circle in the specific tahsil. The village comes under Pabal circle. The cast wise population was studied in this village. In Karandi, mostly open categories were found 95.96 Percent and another category OBC found 4.04 Percent. The village location is the west side of the tahsil. There is most of land irrigated due to the Tubwell Irrigation. Area under irrigation is 96.75Percent and unirrigated area is 3.25Percent. In Karandi village most of the farmers give priority for cash crop. Various type of crops are taken in this

village. Sugarcane crop covers 48.45 Percent. of crop area and onion crop is 27.33Percent. of crop area in acre. Bajara, groundnut crops cover area in percentages respectively 1.24Percent.10.56Percent. & other 12.42 percentages. Irrigation facility in Karandi village is more dominant. In this village well Irrigation is 19.51Percent, and Tub well is 24.39 Percent, Canal 9.76 Percent and Lift 46.34 percent in this village.

6.10 Summary:

The present study Random sample has used for selected eight villages in a four circle include for the village information system in Shirur Tahsil. In the present study, random samples were taken from eight villages in four circles in Shirur Tahsil. These villages were chosen on the basis of circle in the specific tahsil. These villages are from entire Shirur Tahsil. The present work also studied caste wise population of the villages. It also studied the land irrigated and unirrigated area in the villages. In these villages, most of the farmers give priority to cash crops. Various type of crops are taken in this villages. Sugarcane crop is cover most dominant of crop area, after that onion ranks the second crop. Bajara, jawar, groundnut, crops cover area were found in this region. Irrigation facility in villages is more dominant. In these villages Lift Irrigation, well, canals and Tub well irrigation facilities are found in these villages.

CHAPTER – VII

CONCLUSION AND SUGGESTION

CONCLUSION AND SUGGESTION

1.1 Conclusion

Agricultural is the main primary economic activity of the people of the study area. Traditionally, the emergence of agriculture has been regarded as revolutionary, but the evidence from archeological site prove that is developed and spread gradually in the evolutionary process. Agriculture sector occupies a key position in the Indian economy. The Agriculture of any area is generally controlled by physical, socio-economic and technological factors. It contributes nearly 17percent to the national GDP (Gross Domestic Product), sustains livelihood of about two-thirds of the population, accounts for 52 percent of the national work force and forms the backbone of the agro-based industry.

Agricultural practices such as irrigation, crop rotation, fertilizers, and pesticides were developed long ago but have made great strides in the past century. The Haber-Bosch method for synthesizing ammonium nitrate represented a major breakthrough and allowed crop yields to overcome previous constraints.

In the past century, agriculture has been characterized by enhanced productivity, the substitution of labour for synthetic fertilizers and pesticides, selective breeding, mechanization, water pollution, and farm subsidies. In recent years, there has been a backlash against the external environmental effects of conventional agriculture, resulting in the organic movement.

The Shirur Tahsil lies in the eastern part of Pune district of Maharashtra. Shirur tahsil of Pune district in Maharashtra state has been selected for the proposed work. The tahsil comprises of 118 villages and one urban centers. The absolute geographical location of study area can be expressed as from 18º49’N to19º34’N latitude and74º22’E to 75º03’E longitude. Shirur City is located on the boundaries of the Pune and Ahmednagar districts on the banks of the River Ghod. The town Shirur is also known as Ghodnadi. Shirur has a significant historical and cultural reference. The area of Shirur tahsil extent form north to south 24 km and 50 km from east to west. The study area is included in Survey of India Topographic Index Numbers 47J/1, 47J/2, 47J/5, 47J/6, 47J/10 and 47J/11on 1: 50,000.This tehsil is confined by Ahmednagar District to east and north-east, Ambegaon tahsil to north-west and Haveli tahsil to South. Its total area occupied was1552 sq.km.

Shirur tahsil constitutes an area of 155811 hectors. Ghod, Bhima and Kukadi rivers go through the tahsil from three directions Shirur Tahsil may be divided into two physiographic region according to altitude. The one is gently sloping belt along Ghod and Bhima there are two water divides; one divides the Ghod the Bhima basin while the other runs from west to east. The hilly zone locally called as Malran (open, non-cultivated land) shows that agriculture is poor.

The riverine belt along Ghod and Bhima occupy 40 percent area of the Shirur tahsil. This tahsil offers favorable situation for irrigation and hence agro based development, topographically it is almost a plain region with alluvial soil. The black colour of the soil is indicator of high fertility status. The generalized direction of slope is from north-west to south-east in the Ghod River's basin of another direction of slope is from north-west to south-east in the Bhima River. Shirur Tahsil is mainly drained by river Ghod. Ghod Rivers it is natural boundary is between Pune and Ahmednagar District. The Shirur city is located on the bank of the river Ghod and the river is non perennial.

The basaltic lava flows belonging to the Deccan traps of late cretaceous to palaeogene age and mainly of Upper Ratangarh and Indrayani formation stratigraphic status. The lava flows generally consist of "Pahoehoe" and "aa" type. Both "pahoehoe" and "aa" types are found in the Bhima and Bhama basin within the tahsil. Central part of the Shirur Tahsil is covered by the Indrayani formation which comprises a thick succession of five "aa" basaltic lava with 50 to 180 m thickness.

Most of the part of Takali Haji Circle and northern part Shirur Tahsil is of three compound pahoehoe flows with 50 -220 m thickness. The southern part of the Vadgaon Rasai Circle of Shirur Tahsil is bounded by river Bhima and it is also made up of the same geological strata. It is the upper Ratangarh formation which is observed in the valley of Ghod, Kukadi and Bhima Rivers. The five "aa" and compound pahoehoe basalticlava flows with 50 to 220 m thickness and ten to fifteen "aa" and simple basaltic lava flows with 50 to 350 m thickness are found on a very minor scale in the circle of Pabal mainly in the western part of Shirur Tahsil.

Shirur Tahsil has very less diversified geomorphology. Geomorphologically it can be categorized into two categories – the middle level plateau and the older flood plain of Ghod, Bhima and Vel Rivers. Most of the part of Nahavra, Vadgaon Rasai and Talegaon Dhamdhere is made up of Bhima, Vel and Ghod Rivers older flood plain. Northern part of Pabal circle, western part of Shirur circle and Takali Haji circle have

middle level plateau region while Nahavra, Vadgaon Rasai circles have older flood plain region.

Plain area is distributed along the bank of Bhima River that is the southernmost part of the Shirur tahil and also at the confluence of Bhima and Ghod River in the south-eastern part of the Shirur Tahsil. The height is ranging between 540 to 560 meters above the mean sea level. The maximum proportion of Vadgaon Rasai circle is occupied by plain area. The plateaus of 600 -750 m elevation are known as region of middle level plateaus. Such plateaus are located in the central and northern part of the study area. It is distributed in Takali Haji, Shirur, Nahavra and in the northern part of Talegaon Dhamdhere circle.

Slope of a land is one of the important physiographic aspects that influence the overall suitability of the natural elements. The southern and south-eastward slope of the study area has gentle and it is less than 5^0. The central part has occupied by the eastern offshoots of the Sahyadri ranges and this area has 5^0 to 10^0 slope with undulating topography. The eastern part of Shirur circle, southern and western part of the Takali Haji circle and the eastern part of Nahavra circle have 10^0 to 15^0 slope. The direction of the slope of this study region is from north-west to south-east.

It is observed in the narrow belt along the rivers Bhima and Ghod. This is nothing but the alluvial deposits subjected to the development of deep black soil. This soil varies in depth from 5 to 20 feet. The crop cultivation is supplemented by irrigation. Vegetables, sugarcane, wheat, fodder crops are grown in this soil. Medium deep black soil is observed in Vadgaon, Mandavgaon, Sadalgaon,Babulsar, Koregav Bhima etc. villages. These soils are found between hilly tract and riverine belt. Deep brown colour Indicates good fertility status. These soils originate from alluvial deposits from the hilly tract.

Vel River is flowing through Pabal to Shikrapur and then Talegaon Dhamdere and then exits from the tehsil. The south-eastern part of this tehsil has almost floodplain of the Bhima and Ghod river. Generalized slope of the area is from north-west to south-east. The range of rainfall is about 700 mm to 1250 mm.

The tahsil has part of three major basins of the rivers Bhima, Ghod and Vel. The course of the rivers Bhima and Ghod basin in the tahsil about 120km and 75 km. respectively These rivers are the main sources of water in the study area. Kolhapur types (K.T.) weirs constructed on the river Ghod to provide water for agriculture and drinking purpose. The largest forest cover is identified in Vadgaon. Nagargaon,

Mandavgaon, Andalgaon and Ranjangaon Sandasetc. Open Forest is areas of mostly barren and vegetation has been degraded due to human interference like cutting fire wood, timber etc. The growth of forest in this area is poor the tress like Bar, Hiver, Palas, Khair etc. the patches indicates the ecological potential of biodiversity in the region. Dry deciduous forest is observed in eastern part of tehsil, the species include Anjan, Apta, Babal, Bhokar, Bor, Bundara, Chinch, Pimpal, Neem etc.

In there is only one state road and the total length of this MSH 5 is 45 km which connects Pune –Aurangabad. Shirur is located on Pune –Ahmednagar Major State Highway (MSH) 5. It is only 67 km from Pune and 55 km from Ahmednagar. Koregaon Bhima, Sanaswadi, Shikrapur, kondhapuri, Ranjangaon, Khandale, PimpriDumala, Kardilwadi, Ganegaon, Karegaon, Saradwadi and Shirur villages are located on this MSH 5. State Highway 55, 103, 117, 118, 128 and 129 are well distributed in the study area. Shikrapur, Ranjangaon, Shirur, Nahavra, Malthan, Kawathe, Kanhur and Pabal villages are well connected by MSH and State Highway (SH).

The lowest sex ratio recorded in Koregaon Bhima and Sanaswadi villages below 700 Sex ratio as compare 1000 male population. In the decade of 2011total population increased by 24.9 per cent. The study region has population growth rate higher than National as well as Maharashtra state.

The major markets are Shirur city, Talegaon Dhamdhre, Nahavra, Mandavgaon Farata Vadgaon Rasai, Malthan, Pabal, Takali haji, Shikarpur, Koregaon Bhima, Sanaswadi, Ranjangaon, Koregaon and Nimone etc.

The Shirur Tahsil has classified supervise classification technique in to Six Land use and Land cover classes. The composition and distribution of land use Land cover classes of image included Water body, Vegetation, Cropland, Fallow land, Barren land and Settlement. The study areas land use and land cover map show the spatial and temporal variation. The finding reveals that there was a drastic and rapid change increase in the built up area and decrease in Cropland area.

The analysis of spatial changes explanation of urban settlement is taking place in the of prime agriculture land in the study area.

The area under the settlement was 9.01 sq.km in November 2001, 139.81 sq. km in November 2013, 33.60 sq. km in March 2001 and March 2013 (117.24 sq. km.).The study area is experiencing rapid changes because of the opportunity of available jobs, strip developments along highways, transportation, power and communication facilities, shopping centers and complexes are included in this category.

Rapid growth of human population and settlement attributed the increased growth in settlement coverage. The communication lines have also increased in total length and so the density of roads in the Tahsil has increased. The Settlements in the study area have increased from March 2001 and March 2013 because increase in population, therefore agricultural low laying area are converted into built up area in the study area .Ambale, Shikrapur, Jategaon, Ranjangaon, Shirur, Takli Haji, Sanaswadi, Karegaon, Nahavra, Mandavgaon Farata and other major villages are affected with the changes. These villages are rapidly increasing in population as well as built up area in the study region.

The barren land in November 2001 to November 2013 was respectively 850.28 sq. km and 404.24 sq. km. and March 2001 to March 2013 713.03 sq. km and 352.97sq. Km respectively. Because of canal and developed irrigation facility barren land was converted into fertile land. The Fallow land in November 2001 to November 2013 was respectively 101.02 sq. km and 220.33 sq. km. and March 2001 to March 2013s 331.48 sq. km and 441.69sq. Km respectively.

The Crop land in November 2001 to November 2013 was respectively 405.63 sq. km and 551.52 sq. km., in March 2001 to March 2013 400.06 sq.km and 566.04 sq. km. respectively. Crop land increased because of irrigation facility and development of agro base industry. The Vegetation cover suddenly increased in the span of 2001. But, in the 2013 the forest area decreased suddenly because of average low rainfall, therefore fallow land in 2013 suddenly decreased as compared to 2001. The Fallow land in November 2001 to November 2013 was respectively 6.51% and 14.20% and March 2001 to March 2013 21.35% and 28.37% respectively. Fallow land suddenly increased in the March 2013 and November 2013 because of the summer season. And available water facility is low of the in this season.

Surface water means perennial and seasonal streams, lakes, ponds, marshes, water sources and other bodies of water. The water body in November 2001 to November 2013 was respectively 21.52 sq. km and 71.93 sq. km. and March 2001 to March 2013 18.51 sq.km and 29.38 sq. km. respectively. Water bodies rapidly change because canals provide water in small tank, ponds and God dams. The water bodies in the Ghod watershed was1.39% and 4.63% in November 2001 and November 2013. 1.19% and 1.89% in March 2001 and March 2013 respectively.

The vegetation land in November 2001 to November 2013 was respectively 143.12 sq. km and 164.11 sq. km. and March 2001 to March 2013 55.33 sq. km and

45.61 sq. km. respectively. The changes of area in vegetation because effect on industrial and agricultural development. In the study area, Vegetation cover is good. It is above the average forest cover of India and Maharashtra. In the study area, forest cover was9.22%, 10.57% respectively in November 2001 to November 2013. And 3.56%, 2.93% in March 2001to March 2013.

The factors for such as changes in cropping patterns differ from village to village and region to region. The cropping system is an important component of any farming system. It is the proportion of area under various crops at a point of time. This study has attempted to assess the spatial distribution of agricultural crops in study area. Jowar, wheat, sugarcane, fodder crops, vegetables and other crops are mainly grown in study region on different soil types, amount of rainfall, irrigation and farmers' decision. All major crops divided into total 12 major crops categories have been included in the study area.

The major crops cultivated in kharif season [June to October, November] are Bajara Onion, Total Pulses, Total Oilseed, Fodder crop, Sugarcane, Fruit (Cash crops) etc. In rabbi season [October to March] crops such as (Cereals) wheat, Jowar, etc. and Mix Crops are (Kharif, Rabbi and Summer Seasons) e.g. Sugarcane, All Fruits, Vegetables, Flowers and Fodder Crops etc. are grown in the study area. In summer groundnut and fodder crops are grown in summer season in the area where irrigation and water is available. Sugarcane is cultivated as Adsali, pre-seasonal and Surur.

It is observed that the agricultural land use is decreasing during the study period. This is mainly because of the agricultural land is being converted into residential and other uses for the growth and development of the specific area of the study region. It is observed from the study area that there is a greater variation in the changes regarding to land use and cropping pattern, during the study period i.e. 2001 to 2011.

In the study area farmers have adopted partially modern technology i.e. drip irrigation facility, HYV seeds material, sugarcane, fruits, vegetables, food grain and other crops, increasing usage of composting biomass, machineries, improved plantation technology and micro irrigation systems, available for nearby village inputs (seeds, fertilizers, insecticides, cattle feeds and veterinary services), agricultural labor bullock power, crop loans, electricity, irrigation, dairy centers and processing units, nearby sugar factory, good network of transports and markets, good communication facilities, agricultural advisory centers etc. are available in the study area.

The total actual cropped area was 115449.5 hectares during 2001and98781.00 hectares during 2011.The area under sugarcane was 5539 hectares and 4.80percent in Shirur Tahsil in 2001and 8221.20 hectares 8.04percent in 2011. (Table No. 4.2).The highest land occupied under sugarcane crop registered at Shikrapur Circle in 2001 (12.03percent) and in 2011 (18.91percent) at Shikrapur, Jategaon, Vadu bk. Sanaswadi Villages. And the lowest land occupied under sugarcane crop was registered at Nahavracirclein 2001 (1.45 percent) and in 2011 (2.75percent) at Gunat, Nhavara, Nirvi, Sirasgaon Kata, Dahivadi, Aalegaonpaga, Kolagaondolas, Kuruli etc. villages. The sugarcane crops are cultivated by progressive farmers.

The fodder crops in ShirurTahsil include Kadwal, Green grass and Maize. The area under Fodder crop was 7793.40 hectares (6.75percent in 2001and 8305.50 hectares (8.12 percent) in 2011. The highest percent under this crop was in Shirur Circle 2001 (9.04Percent) in south-west part and lowest was at Pabal circle 2001 (4.60 Percent) in south-central part. The area under fodder crop was noticed in villages like Golegaon, TakaliHaji, Aannapur, Saradwadi, Kardalwadi, Aambale, Jambut, Chavanwadi. These villages registered the highest Production of Fodder Crop in Shirur circle. The lowest area under Pabal Circle in 2011(5.62percent)and highest was in Shirur circle in 2011 (9.73 Percent).

Onion crop is a dominant crop in the study region since it is a cash crop. Onion is cultivated in Kharif season. It is drought resistant crop. The area under Onion crop was 9470 hectares (8.20percent) in 2001and 11775 hectares (11.51percent) in 2011 in Shirur Tahsil. The highest land occupied under Onion crop was registered at Shirur Circle, in 2001 (13.71percent) and in 2011 (14.60 percent) at Saradwadi, Karegaon, Golegaon, Chavanwadi, Karde etc. And the lowest land occupied under Onion crop was registered at Shikrapur circle in 2001 (4.80percent) and in 2011 (12.70percent) at Kuruli, Pimpalsuti, Ganegaondumala, Nirvi, Nimone, Gunat, etc. villages. The Onion crops are taken by progressive farmers.

The area under Fruits crop was 2161.61 hectares (1.87 percent) in 2001and 28.54 hectares (2.89 percent) in 2011 in Shirur Tahsil.

The area under vegetables crop was 5220.40 hectares (4.52 percent) in 2001and 3512.40 hectares (3.43 percent) in 2011.

Pulses crop covered27325.00 hectares (23.67percent) in 2001 18804 hectares (18.38 percent) in in 2011.

Spice crop occupied252.60 hectares (0.22 percent) in 2001 and 283.50 hectares (0.28 percent) in 2011.

The area under Bajara crop was 20864 hectares (18.07 percent) in 2001 18422 hectares (18.01percent) in 2011 in Shirur Tahsil.

Flower crop covered 51.50 hectares (0.04 percent) in 2001and 58.60 hectares (0.06 percent) in 2011.

Jawar registered 32990 hectares (28.58 percent) production in 2001 and 25594 hectares (25.02 percent) in 2011.

Wheat crop covered 3686 hectares (3.19percent) in 2001 and 4356 hectare (4.26percent) in 2011.

In the present study, the agricultural data of 108 villages is observed and studied. The purpose of this chapter is to highlight the changes in agricultural LUCP during 2001-2002 to 2011-2012 in the study region. It was observed in the study area that the adoption of farm technology is increasingly found in the irrigated areas. Intensive agricultural systems are accepted all over the study area. The major portion of the land is being under cultivation of positive change and a significant change is noted that in the cropping pattern. Although the entire cropping pattern seems to be governed by agro-climatic conditions, irrigation has played a prominent role by changing the nature and extent of cropping pattern. Sugarcane and fodder cultivation prevail in Shikrapur and Nahavra Circle in the study area. The southern, middle and eastern part of the study region are facilitated by assured irrigation and fertile soils are also suitable for growing several crops.

It is made possible due to the increasing in lift and canal sources of irrigation and also the special efforts made by co-operative Banks, particulars sugar factory, farming equipment, labour and another facilities i.e. fertilizers, seeds, insecticides, electricity and credit facility in recent decades. The area under Sugarcane, Onion, Fodder crop and Total vegetable crops increased during2001-02 to 2011-12. And the area under Bajara, Jawar, Wheat, fruit, Total Spices decreased during period of 2001-02 to 2011-12. In case of overall change, it is observed that the shift from food grains to sugarcane is noteworthy in the areas facilitated by perennial sources of irrigation. While shift from cash crop to, flower and onion it observed in the areas having only seasonal sources of irrigation.

The cropping pattern of Shirur Tahsil is complex as the crops are associated with other crops. In every circle of the Tahsil showing characteristics of multi crop

combination. The 12 crop combination area is highly identified in cropping pattern because of the number of favorable conditions for these crops from the above observation. It is clear that there is a tendency of specialization of 5 major crops i.e. Sugarcane, Fodder crops, Onion, Jawar and Total pulses. The development in irrigation facilities, soil productivity, skill of farmers, using the modern techniques in agricultural land and based on demand and supply of markets will change the existing cropping pattern. The cropping pattern in Shirur circle shows dynamic combination pattern specially in the eastern and central part of the circle. As compare to Pabal, Shikrapur and Nahavra circle had less variation in the year 2001- 2002 to 2011-2012. It is because of partially better facility of irrigation, fertilize soil, relatively plain topography and use of partial modern technology. Shikrapur circle and Pabal circle is mainly under the interior area at joining bank of river and therefore it has less development in agriculture.

The index of diversification indicating the generalization of relationship between the relative strength and number of crops grown. In Shirur Tahsil, the study of 108 villages' diversification index indicates that the eastern part of study region had very high crop diversification between2001-2002 to 2011-2012. The highest diversification was found only in Shirur circle because of relatively gentle topographic conditions, favorable soils and partial higher irrigation facilities of Ghod river basin. Some part of Shikarapur circle also increased the diversification area during 2011-12, because construction of KT and canal, and available irrigation facilities for this circle. The high diversification area is also available in the southern part of Nahavra circle because of presence of Bhima River. In Pabal circle, crop diversification is very little because it is in agriculturally backward area and unfavorable topographical condition. But, because of land improvement program, the diversification index has changed from very little diversification to little or high diversification.

In the study area, nine types of crop combination regions are observed. In the study area major crops were taken into consideration for delimitation of crop combination of region. The following crop combination regions were found in the study area including two crop combination region, three crop combination region, four crop combination region, five crop combination region, six crop combination region, seven crop combination region, eight crop combination region, nine crop combination region and twelve crop combination region.

The present study Random sample has used for selected eight villages in a four circle include for the village information system in Shirur Tahsil. In the present study,

random samples were taken from eight villages in four circles in Shirur Tahsil. These villages were chosen on the basis of circle in the specific tahsil. These villages are from entire Shirur Tahsil. The present work also studied caste wise population of the villages. It also studied the land irrigated and unirrigated area in the villages. In these villages, most of the farmers give priority to cash crops. Various type of crops are taken in this villages. Sugarcane crop is cover most dominant of crop area, after that onion ranks the second crop. Bajara, jawar, groundnut, crops cover area were found in this region. Irrigation facility in villages is more dominant. In these villages Lift Irrigation, well, canals and Tub well irrigation facilities are found in these villages.

in this villages. Sugarcane crop is most dominant crop area, after that in followed by onion. Bajara, jawar, groundnut crops cover area in this region.

7.2 Observation:

1. South western, north western and extreme western and extreme southern part having undulating topography that's why the area under crops is very less or negligible and land use is very less.
2. The only one Cooperative Sugarcane industries and one Private Sugar industries are located in study area.
3. High proportion of population is engaged in agricultural activities.
4. The agricultural crops cultivation by farmers are not according to availability of soil types.
5. Sugarcane crop is most dominant crop area, after that in followed by onion. Bajara, jawar, groundnut crops cover area in this region.

7.3 Suggestion:

1. If in the eastern part of Tahsil agro-based industries will established. Accordingly the population will engaged in secondary activities but High proportion of population is engaged in agricultural activities.
2. The agricultural crops cultivation by farmers is not according to availability of soil types.

   If the farmers study the types of soil with the help of soil department, agricultural universities and various NGOs, who are working in the favors of farmers, the production of various crops may increase.

3. The study area having infertile soils such as Karde, Fakate, Malthan, Khannur Masai, etc and due to this, the area under crop is very less. With the help of chemical fertilizers, Organic fertilizers and Compost fertilizers this infertile soil can be turn into fertile soil and the production of agricultural crops will increase.
4. There are very less digged Percolation tanks in the study area, due to this, the irrigation is very less available in the study area.

   If the Percolation tanks will increase in the study area, there will be increase in irrigated area.
5. Government should give firm price for the crops in the region where backwards farmers are cultivating agricultural land. Due to which, the farmers will interested to cultivate land.
6. Adapting agricultural policies and practices according to changing climate condition for the farmers.
7. Use of High Yield Varieties.
8. The only one Cooperative Sugarcane industries and one Private Sugar industries are located in study area. In the study area need to established another Cooperative Sugar industry. Because sugarcane crop production is high and more demand of sugarcane industry by farmers.
9. Agro-based industries should be established in the study area due to which, the production of agriculture will increase.
10. For increasing the production of all crops, farmers should discuss with various agricultural experts, experienced agricultural scientists and farmers..
11. Government should provide various means of awareness regarding conservation and development of natural resources.
12. Local self-government should provide various information about new techniques for cultivation of various kinds of crops.
13. The farmers in this area should be guided and trained for the advanced method of irrigation such as drip, sprinkler etc. which saves water and decreases threat of salinization.
14. The Government should established climatic observatory, which is useful to forecasting about suddenly climatic hazards.

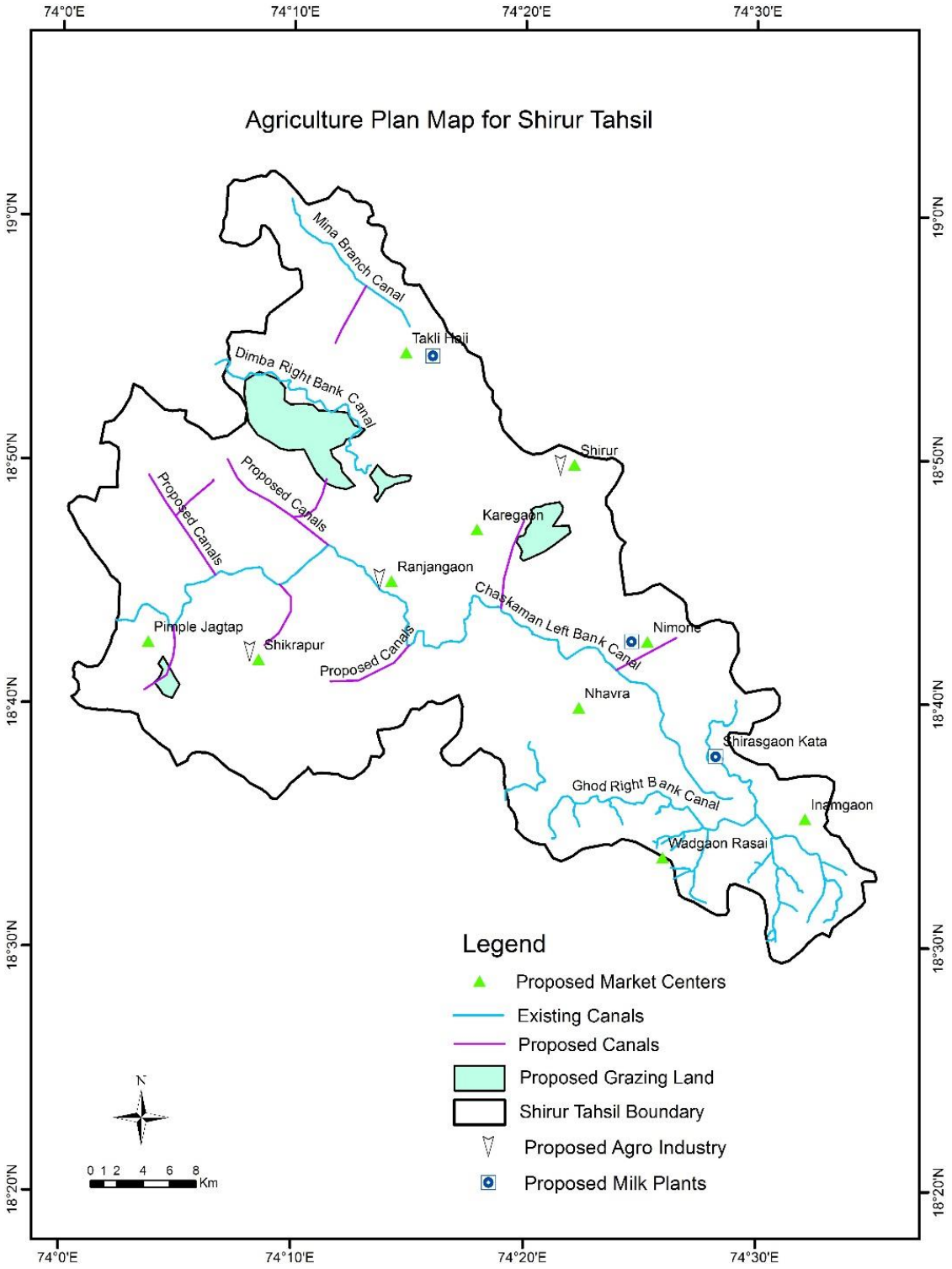


Figure No. -7.1 Agriculture Plan Map

Figure no. 7.1 Shows the Development plan in Shirur Tahsil. the plan shows that market centres should be developed in Wadgaon Rasai, Nahavra, Inamgaon, Ranjangaon, Nimone, Karegaon, Shikarapur, PimpaleJagatap, and Takali Haji villages. These market centers will be very important for the economic development of the region. Moreover, Milk Plants, and Agro base Industry is the main need in Shikrapur Circle because this region is the leader in production of sugarcane. The villages like Karde, Khondapuri, Nimgavmalungi, Karegaon, Sardwadi, Khannur Masai, Kendur are in a needs of canal irrigation. These facilities are the important needs of Shirur Tahsil.

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APPENDIX

Appendix I
Administrative Division of Shirur Tahsil

Pabal Circles	Shirur Circles	Shikrapur Circles	Nhavara Circle
Pabal	Shirur	Shikrapur	Kohakdewadi
Kendur	Saradwadi	Rautwadi	Uralgaon
Karandi	Tardobachiwadi	Jategaon Bk.	Arangaon
Dhamari	Annapur	Jategaon Kh.	Nirvi
Khaire Nagad	Kardilwadi	Pimpale Jagtap	Chinchani
Khairewadi	Dhok Sangavi	Sanaswadi	Dhumalwadi (N.V.)
Mukhai	Golegaon	Darekarwadi	Alegaon Paga
Hivare	Chavhanwadi	Wajewadi	Ranjangaon Sandas
Pimpale Khalsa	Babhulsar Kh.	Wadhu Bk.	Rakshewadi
Varude	Bhambarde	Apti	Nimone
Waghale	Karegaon	Koregaon Bhima	Motewadi
Shingadwadi	Karade	Dingrajwadi	Gunat
Kanhur mesai	Ambale	Dhanore	Shindodi
Midgulwadi	Takali Haji	Talegaon Dhamdhere	Shirasgaon Kata
Chincholi	Jambut	Vitthalwadi	Kolgaon Dolas
Shastabad	Saradwadi	Takali Bhima	Kuruli
Malthan	Vadner Kh.	Nimgaon Mhalungi	Inamgaon
Lakhewadi	Dongargan	Shivtakrar Mahalungi	Pimpalsuti
Nimgaon Dude	Sawlewadi (N.V.)	Kasari	Vadgaon Rasai
Kawathe	Mhase Bk.	Kondhapuri	Sadalgaon
Munjalwadi	Malwadi (N.V.)	Parodi	Tandali
Echakewadi	Sone Sangavi	Dahiwadi	Ganegaon Dumala
Savindane	Nimgaon Bhogi	Karanjawane	Bambhulsar Bk.
Ravadewadi	Chandoh	Ranjangaon Ganpati	Mandavgan Farata
	Fakate	Pimpari Dumala	Faradwadi (N.V.)
	Pimparkhed	Khandale	Nagargaon
	Kathapur Kh.	Ganegaon Khalsa	Andhalgaon
	Amdabad	Burunjwadi	Nhavara

Appendix II

Major Crops at village Level of Shirur Tahsil of 2000-01

Village Name	Sugarcane	Fruit	Onion	Spice	Flower	Jawar	Wheat	Total Oil	Total Pulses	Fodder Crop	Total Veg	Bajara
Shirur rural	14	11.95	65	2.5	1	271	37	1	103	47	77	70
Sardwadi	10	9	30	1.7	0	105.4	22	0.6	62	42.902	51.8	70
Tardobachiwadi	10	10.1	40	1.1	0	48.2	22	1	92	60	49.2	50
Annapur	22	8.95	40	1.5	1	132	22	1	68	61.6	72.8	25
Kardalwadi	5.4	6.75	31	0.5	1	54	29	1.5	92	75	59	50
Dhoksangavi	5.8	8	37	0.6	0	67	33	0.5	33	33	56	40
Golegav	11	6	153	2.2	0	352	45	1	255	43	95.6	215
Chavanwadi	14	42.01	165	1.2	0	387	26	5.2	120	64	53.3	132
Babulsar	13	43	254	2.6	0	476	65	1.2	105	62.5	56.9	55
Bhabarde	32	8	44	1.5	0	167.7	52	1	78	50	39.4	20
Karegaon	10	11.18	30	1	0	107	43	2.2	389	64	67.3	415
Karde	12	42	269	1.5	0	1550	22	11.2	204	43.3	49	70
Aambale	57	61.9	235	2.6	0	173	20	1.2	420	148.7	102.3	238
Takali Haji	44	152.1	470	2.6	0	335	39	2.4	284	134.2	128.5	164
Jambut	36	45.05	189	5	0	150.7	42	1.4	75	83.3	119.8	45
Saradwadi	21	5.1	54	1.4	0	48	24	1.2	86	132	77.6	65
vadner	21	7.1	59	1.6	0	65	35	1.7	88	86	74.7	74
Dongargan	12	11.3	17	1.8	0	29	17	1.6	155	49.2	42.5	77
Sabalewadi	22	8.9	44	2.4	0	8	65	1.2	125	39.6	41.8	89
Mhase	47	11.35	12	1.5	0	68.7	23	1	189	57	39	150
Malwadi	22	63	45	1.2	0	25.3	48	0.6	109	41.2	57	85
Sonesangavi	5	12.2	101	1.5	0	178	32	0.8	54	41	100.7	40
Nimgaon Bhogi	11	11.55	85	3.4	0	96	57	0.7	108	65.4	106.3	89
Chandoh	11	2.4	89	3	0	59	43	2.5	189	67	123.3	150
Fakate	15	6.5	78	4.2	0	95	22	1.2	183	65	120	158
Pimparkhed	15	12	134	4.4	6	87	47	1.3	139	166	65	97
Khathapur	12	9.7	105	2.8	0	64	35	1.4	201	86	123	189
Aamdabad	23	9.3	100	2.7	2	52	32	1.2	67	54	111	70
Total shirur	533.2	636.39	2975	60	11	5251	999	48.8	4073	1961.902	2159.8	2992
Nhavara	0	56	166	0	9	1215	15	0	380	73	15	350
Khohakdewadi	0	9.4	75	0	3	410	11	0	190	29	21	150
Uralgaon	0	32.4	175	0	4	35.740	12	0	435	222	32.5	301
Aarngaon	0	0	67	0	0	1	12	0	53	121	37	35
Nirvi	0	55.4	164	0	0	510	110	0	475	73	31	450
Chinchani	0	4	101	0	0	5	10	0	89	42	9	45
Dumalwadi	0	9	70	0	0	370	15	0	96	45	12	70
Aalegaon Paga	0	11	145	0	2	450	10	0	430	30	15	328
Ranjangaon Sandas	0	11	75	0	0	145	21	0	112	20	12	15
Raksewadi	0	2	15	0	0	65	5	0	43	10	2	16
Nimone	13	48.5	190	0	0	485	35	0	653	200	22	570

Motewadi	5	10.9	32	0	0	32	2	0	65	34	10	43
Gunt	49	8.1	120	0	0	550	70	0	359	86	43	230
shindhodi	48	20.4	90	0	0	30	10	0	54	121	22	20
Sirasgaon Kata	56	64	87	0	0	643	30	0	473	86	15	321
Kolgaon dolas	23	12	78	0	0	436	13	0	323	65	20	121
Kuruli	34	11	74	0	0	403	12	0	541	85	14	463
Inamgaon	65	34	31	2	3	1	21	0	654	121	6	652
Pimpalsuti	38	6	12	2	1	164	10	0	452	32	6	200
Vadgaon Rasai	0	11	8	0	4	2	12	0	112	32	45	9
sadalgaon	0	0.5	5	0	3	1	64	0	22	22	8.5	10
Thandali	0	8.3	22	0	0	0.5	26	0	13	50	16	10
Ganegaon Dumala	0	3.4	12	0	0	0.5	21	0	15	46	16	11
Babulsar Budruk.	0	1.2	5	0	0	0	33	0	7	30	5.5	5
Mandavgan Farata	10	12	32	2	2	0	79	16	23	321	121	25
Faratwadi	5	5	8	2	0	62	2	0	180	32	21	120
Nagargaon	7	5.7	6	0	0. 6	43	22	0	120	100	12	112
Aandalgaon	10	25.8	88	0	0	400	24	0	225	82	20	210
Total Nhavara	363	478	195 3	8	33	7164	707	16	659 4	2210	609.5	489 2
shikarapur	113	32	130	6	0	400	200	0	680	52	140	600
Rautwadi	35	4	10	3	0	45	25	0	50	13	24	45
Jategaon Budruk	89	11.1	110	4.2	1. 6	112	54	0	179	36	50.5	130
Jategaon Khurd	98	11.5	75	3	0	147	43	0	89	30	23	58
pimpale jagtap	111	3	87	4	0. 5	247	45	0	274	22	41.9	89
sanaswadi	44	4.7	47	8	0	268	23	0	367	45	24	258
Darekarwadi	30	4	32	5	0	34	23	0	123	34	23	76
vajewadi	155	5.5	85	1	0	25	35	0	36	113	65.5	15
Vadu Budruk	354	1.35	65	2.4	0	22	32	0	55	119	98	39
Aapti	120	1	24	1	0	215	14	0	214	90	50.5	15
Koregaon Bhima	366	2	30	0	0	34	32	0	32	74	31.5	36
Dingrajwadi	122	0.9	41	0	0	15	21	0	17	47	24	14
Dhanore	134	1.4	30	0	0	233	22	0	164	78	29	94
Talegaon Damdere	346	54	107	1	0	1565	136	0	687	196	54	586
Vitthalwadi	257	8.9	45	0.5	0	274	45	0	234	102	46	63
Takli Bhima	283	7.8	45	0	0	436	45	0	247	60	43	70
Nimgaon Mhalungi	232	32	121	0.5	0	1212	32	0	486	70	54	493
Shivtkarar Mha.	101	1	17	0	0	12	11	0	26	58	34.4	35
Kasari	34	11.1	80	2	0	576	55	2	308	57	36	243
Kondapuri	102	11.45	32	2	0	452	63	2	342	50	27	322
Parodi	255	5.5	40	1	0	142	32	0	75	75	22	351
Dadivadi	104	6	45	0.5	0	371	35	0	148	65	21	61
Karnjavane	100	4	57	0.5	0	567	46	0	112	75	30	76
Ranjangaon Ganpati	55	121	121	4.5	0	1700	65	0	674	213	45	586

Pimpri												
Dumala	46	121	26	2.5	0	265	34	0	275	45	30.8	65
Khandale	87	9	23	7	0	264	34	0	252	42	11	65
Ganegaon												
Khalsa	132	32	34	12	0	345	86	0	563	61	75	457
Burangwadi	89	5.8	34	4	0	323	32	0	342	65	16.6	253
	399		159	75.	2.	1030	132		705		1170.	519
Shikrapur	4	513	3	6	1	1	0	4	1	1987	7	5
				17.								
Pabal	15	34.8	432	5	1	1654	50	10	459	188	180.4	390
Kendur	40	25	820	25	0	1432	27	10	453	152	129.5	355
Karandi	76	16.8	154	12	0	435	45	1	342	275	83.5	25
Dhamari	5	16	152	3	0	1294	255	5	467	75	72	360
Khierenagar	0	52.42	45	1.5	1	136	22	0	476	32	51	479
Khierewadi	0	4.2	45	0	0	256	3	1	236	13	12	79
Mukhai	40	12	87	3	0	367	23	0	123	30	20	145
									120			
Hivare	12	5	87	0	0	450	12	0	0	15	23.5	890
Pimpale												
Khalsa	56	2	48	0	0	45	10	0	11	21	19.5	12
Varude	10	112	121	2	0	456	10	0	515	32	40	505
Vagale	34	35	78	1	0	235	5	0	563	24	20.5	360
Singadwadi	5	12	45	0	0	67	10	0	356	12	11	342
Khannur									122			124
Mesai	0	42	121	7	0	456	23	0	3	76	46	5
Midagulwad												
i	0	2	56	0	0	654	2	0	354	21	32	287
chincholi	3	23	121	0	0	345	3	0	435	19	34	357
Shastabad	0	5	46	0	0	34	1	0	40	12.5	25.5	56
Malthan	87	45	121	9	2	565	25	0	375	54	67	307
Lakhewadi	0	4	34	0	0	21	3	0	243	12	21	231
Nimgaon												
Dude	78	32	65	12	1	322	31	0	232	233	132	172
Kavate	65	22	122	5	0	365	42	0	512	120	87	455
Munjalwadi	32	4	25	0	0	165	12	0	147	54	30	40
Ichakewadi	32	2	23	0	0	11	12	0	261	22	11	54
savidane	56	5	36	6	0	306	11	0	371	41	98	362
					0.							
Ravadewadi	3	21	65	5	4	203	23	0	213	101	34	277
		534.2	294	10	5.	1027			960		1280.	778
total Pabal	649	2	9	9	4	4	660	27	7	1634.5	4	5

Appendix III

Major Crops at village Level of Shirur Tahsil of 2010-11

Village Name	Sugarcane	Fruit	Onion	Spice	Flower	Jawar	Wheat	Total Oil Seed	Total Pulses	Foder Crop	Total Veg	Bajara
Shirur rural	25	22.95	85	2.5	1	240	37	1	93	87.5	97.7	70
Sardwadi	15	20.6	55	1.7	0	65.4	32	0.6	88	62.902	71.8	70
Tardobachi wadi	18	17.1	60	1.4	0	60.2	32	1	76	71.5	69.2	50
Annapur	53	68.95	90	1.5	1	125	42	1	78	81.6	152.8	45
Kardalwadi	13.4	26.75	70	0.5	1	56	27	1.5	72	88.5	79.8	50
Dhoksangavi	9.8	16.3	67	0.6	0	50	22	0.5	67	73.3	74	40
Golegav	25	17.1	170	2.2	0	510	42	1	249	87.2	95.6	215
Chavanwadi	19	55.01	275	1.2	0	560	32	5.2	188	73.8	73.3	160
Babulsar	13	59.6	220	2.6	0	680	32	1.2	83	70.5	71.9	65
Bhabarde	82	11.05	55	1.5	0	140.7	32	1	68	70	55.4	40
Karegaon	13	21.18	40	1	0	85	22	2.2	368	83	88.3	355
Karde	25	71.95	380	2.5	0	1250	52	21.2	154	113.3	109	110
Aambale	68	81.9	345	3.6	0	90	52	1.2	378	168.7	119.3	337
Takali Haji	87	142.1	450	4.6	0	235	59	2.4	307	164.2	178.5	260
Jambut	45	40.05	175	1.6	0	150.7	42	1.4	75	83.3	119.8	45
Saradwadi	21	5.1	54	1.4	0	48	22	1.2	104	98.1	96.6	80
vadner	25	15.1	50	1.6	0	54	22	1.7	78	86	64.7	60
Dongargan	19	13.3	27	1.8	0	39	27	1.6	95	49.2	42.5	70
Sabalewadi	26	18.9	27	2.4	0	8	22	1.2	78	39.6	31.8	60
Mhase	57	13.35	25	1.5	0	30.7	22	1	164	41.8	32.49	150
Malwadi	27	73.85	57	1.2	0	25.3	32	0.6	103	41.2	53	85
Sonesangavi	5	12.2	110	1.5	0	167	32	0.8	63	41	100.7	40
Nimgaon Bhogi	22	21.55	85	3.4	0	75	42	0.7	98	45.4	98.3	70

Chandoh	19	2.4	70	3	0	41	37	2.5	178	80.7	103.3	150
Fakate	18	11.5	60	4.2	0	75	32	1.2	163	83.5	130.1	140
Pimparkhed	19	16	105	4.4	6	65	37	1.3	108	75.2	89.7	80
Khathapur	19	9.7	75	2.8	0	35	32	1.4	193	104.6	135.6	170
Aamdabad	52	29.3	80	2.7	2	72	52	1.2	84	75.4	128	50
Total shirur	840.2	914.84	3362	60.9	11	5033	968	58.8	3853	2241.002	2563.19	3117
Nhavara	0	85.2	210	0	9	1115	25	0	360	93	25	300
Khohakdewadi	0	13.4	95	0	3	310	15	0	170	25	21	150
Uralgaon	0	33.4	185	0	5.4	630	12	0	355	232	52.5	301
Aarngaon	0	0	90	0	0	1	18	0	72	129	38	65
Nirvi	0	55.4	230	0	0	410	90	0	275	53	21	250
Chinchani	0	4	90	0	0	5	10	0	82	34	9	75
Dumalwadi	0	12	90	0	0	250	15	0	97	34	7	90
Aalegaon Paga	0	21	165	0	2	480	10	0	320	30	15	310
Ranjangaon Sandas	0	18	86	0	0	185	20	0	120	40	17	115
Raksewadi	0	2	15	0	0	20	5	0	23	10	2	15
Nimone	25	68.5	290	0	0	385	45	0	503	110	22	450
Motewadi	5	10.9	45	0	0	40	2	0	76	40	10	60
Gunt	70	18.1	220	0	0	450	90	0	259	95	43	230
shindhodi	48	30.4	110	0	0	10	12	0	36	90	31	20
Sirasgaon Kata	186	96.45	134	0	0	412	40	0	347	98	29	315
Kolgaon dolas	35	19.5	112	0	0	309	15	0	285	56	30	235
Kuruli	49	12.19	94	0	0	301	16	0	329	96	19	295
Inamgaon	95	51.4	35	5	4	1	25	0	535	90	9	510
Pimpalsuti	72	9.5	20	4	1	20	20	0	315	49	6	300
Vadgaon Rasai	0	13	10	0	6	5	25	0	25	42	45.4	10
sadalgaon	0	0.5	5	0	3	1	85	0	35	30	8.5	10
Thandali	0	8.3	22	0	0	0.5	26	0	13	50	16	10
Ganegaon Dumala	0	3.4	12	0	0	0.5	21	0	15	46	16	11
Babulsar Budruk.	0	1.2	5	0	0	0	33	0	7	30	5.5	5

Mandavgan Farata	20	17	40	4	4	0	36	17	45	231	107	30
Faratwadi	5	13.5	20	2	0	35	35	0	160	45	21	150
Nagargaon	10	5.7	10	0	0.6	2	34	0	29	130	17	14
Aandalgaon	10	25.8	100	0	0	400	24	0	225	82	20	210
Total Nhavara	630	649.74	2540	15	38	5778	804	17	5113	2090	662.9	4536
shikarapur	213	42	150	8	0	600	200	0	480	52	140	400
Rautwadi	55	4	20	3	0	65	35	0	60	13	24	45
Jategaon Budruk	112	18.1	120	4.2	1.6	120	86	0	153	47	50.5	120
Jategaon Khurd	117	21.5	85	3	0	65	55	0	62	25	26.5	40
pimpale jagtap	115	6.55	110	4	0.5	110	75	0	108	32	41.9	79
sanaswadi	65	4.7	70	8	0	150	60	0	205	59	36.6	180
Darekarwadi	40	4	50	5	0	80	30	0	113	49	34.6	95
vajewadi	155	5.5	85	1	0	25	35	0	36	113	65.5	15
Vadu Budruk	510	1.35	95	2.4	0	27	45	0	70	163	78	40
Aapti	210	1	30	1	0	12	25	0	26	90	50.5	15
Koregaon Bhima	535	3.6	70	0	0	50	45	0	66	91	31.5	46
Dingrajwadi	225	0.9	51	0	0	20	30	0	27	67	26.5	14
Dhanore	235	1.4	40	0	0	33	35	0	94	113	30	76
Talegaon Damdere	534	61	205	1	0	1265	250	0	593	205	64	465
Vitthalwadi	375	12.9	60	0.5	0	105	50	0	120	122	69	75
Takli Bhima	425	10.8	75	0	0	200	60	0	147	90	53	90
Nimgaon Mhalungi	354	45	135	0.5	0	980	82	0	470	83	60.9	410
Shivtkarar Mha.	112	1	27	0	0	20	22	0	50	57	34.4	35
Kasari	45	11.1	110	5	0	485	65	2	207	78	66.2	140
Kondapuri	183	11.45	40	2	0	380	70	2	287	60	37	250
Parodi	300	5.5	60	1	0	160	45	0	92	89	23	52
Dadivadi	205	11	55	0.5	0	210	55	0	120	87	23	70
Karnjavane	125	7	75	0.5	0	460	60	0	137	85	40	80
Ranjangaon Ganpati	65	154.7	130	4.5	0	1600	75	0	532	153	59	452
Pimpri Dumala	77	136.4	39	2.5	0	132	48	0	105	29	30.8	65

Khandale	129	9	30	7	0	107	50	0	124	50	22.4	82
Ganegaon Khalsa	196	46.25	69	12	0	242	105	0	436	81	97.3	372
Burangwadi	125	7.8	35	4	0	62	39	0	153	72	16.6	119
Shikrapur	5837	645.5	2121	80.6	2.1	7765	1832	4	5073	2255	1332.7	3922
Pabal	15	34.8	582	17.5	1	1470	50	10	459	188	180.4	390
Kendur	50	38.3	820	25	0	1215	27	10	395	165	129.5	355
Karandi	100	16.8	285	12	0	60	45	1	57	275	83.5	25
Dhamari	5	16	161	3	0	1055	255	5	390	75	72	360
Khierenagar	0	52.42	45	1.5	1	54	25	0	385	51	61.7	370
Khierewadi	0	4.2	100	0	0	70	3	1	130	19	16	125
Mukhai	80	16	125	3	0	240	30	0	170	60	20	145
Hivare	24	10	150	0	0	280	15	0	905	28	23.5	890
Pimpale Khalsa	70	2	60	0	0	50	20	0	22	31	19.5	12
Varude	10	117	150	2	0	345	10	0	515	32	40	505
Vagale	50	55.5	90	1	0	195	10	0	370	34	20.5	360
Singadwadi	5	12	100	0	0	101	10	0	225	17	14	220
Khannur Mesai	0	61	140	7	0	326	35	0	1122	80	59.5	1110
Midagulwadi	0	2	70	0	0	74	2	0	230	25	38	225
chincholi	3	35.5	140	0	0	202	3	0	285	19	34	275
Shastabad	0	5	60	0	0	46	1	0	80	12.5	25.5	75
Malthan	127	52	150	9	2	421	36	0	255	70	92	205
Lakhewadi	0	4	40	0	0	28	3	0	155	16	21	135
Nimgaon Dude	126	41.4	137	18	1	125	42	0	225	154	127	200
Kavate	86	27.2	152	7	0	295	48	0	414	120	97	355
Munjalwadi	46	4	40	0	0	30	19	0	101	67	40	65
Ichakewadi	47	2	30	0	0	22	15	0	104	32	26	75
savidane	63	10.2	40	11	0	204	18	0	281	47	102	255
Ravadewadi	7	25	85	10	0.4	110	30	0	136	102	54.5	115
total Pabal	914	644.32	3752	127	7.5	7018	752	27	7411	1719.5	1397.1	6847
Total Total	8221.2	2854.4	11775	283.5	58.6	25594	4356		18804	8305.502	3512.4	18422

Appendix IV

Questionnaires for Farmers

1) Name of the Head family -

_____

2) Name of the village - _____ Tahsil - _____ District - _____

3) Family Details –

Sr. No.	Name Of the person	M/F	Relation with HH	Age	Educational status	Occupation	Income
1							
2							
3							
4							
5							

4) Details regarding the land holding :

[A] Size of land owned by family (Total) :

(Hect//Acre)

[B] Irrigated Land : _____ Hect./Acre

[C] Unirrigated Land : _____

5) Last year (2013-14) cropping details :

Sr. No	Crop	Area	Production	Home Consumed	Sold	Cost of Production
1						
2						
3						

4						

6) Details regarding expenditure for 2013-2014

Sr. No.	Crop	Seed	Fertilizers	Pesticides	Labour	Irrigation	Other	Total
1								
2								
3								

7) Current year cropping details.

Sr. No	Crops	Area	Production	Price (Rs.)
1				

8) Details regarding expenditure for current year:

Sr. No.	Crop	Seed	Fertilizers	Pesticides	Labour	Irrigation	other	Total
1								
2								
3								

9) Details of Irrigation –

Sr. No.	Type	Perennial Area	Seasonal Area	Total Expenditure
1	Well			
2	Canal			
3	Lift			

10) Other income sources –

Sr. No.	Source	Monthly / Yearly	Income (Rs.)
1	Service		
2	Dairy		
3	Poultry		
4	Self-employment		
5	Other		

11) State your personal / regional problems with probable solutions.

Sr. No	Field	Problems	Solutions
1	Agriculture		
2	Irrigation		
3	Dairy		
4	Market		
5	Employment		
6	Migration		
7	Other		

Name & Signature of House Holder

Appendix V

Village Information

1) Name of the village - Tahsil - Dist. –

2) Population –

3) Number of households –

4) Geographical background of the village –

[a] Location (Site and situation) :

[b] Local Physiography :

[c] Soil Type and its Distribution:

5) Details Regarding Crops –

[a] Kharif Crops

Sr. No.	Crops	Area (Hect/Acre)	Production
1			
2			
3			

[b] Rabi Crops

Sr. No.	Crops	Area (Hect/Acre)	Production
1			
2			
3			

6) Irrigation details

Sr. No. Type Area in Kharif Rabi area Perennial area

Sr. No.	Type	Area in Kharif	Area Perennial	Area in Rabi

1				
2				
3				

7) Group discussion with villagers on the following points:

Sign Talathi

PHOTOGRAPHS

Photo- Plates

Photo No. 01 Farmer'swork in their Farm (Onion Crop)

Photo No. 02Livestock, Supplementary Occupation

Photo No. 03Irrigation System in Farm

Photo No. 04 Cropping Pattern of Sugarcane and Onion Crop

Photo No. 05 PhotoWheat Crop cultivation

Photo No. 06 Onion Seed cultivation

Photo No. 07 Inter Crop Farming cultivation

Photo No. 08 Water melon cultivation

Photo No. 08 Fodder Crop cultivation

Photo No. 09 Fodder Crop cultivation

Photo No. 10Pole try farm

Photo No. 11 Irrigation Facilities of Bhima River

Photo No. 11 Irrigation Facilities of Ghod River

ABBREVIATIONS

ABBREVIATIONS

1. DEM: Digital Elevation Model.
2. LUCP: land use and cropping pattern.
3. LULC: Land Use Land Cover.
4. GIS: Geographic Information System.
5. SOI: Survey of India.
6. ETM (+): Enhanced Thematic Mapper Plus.
7. OLI: Operational Land Imager.
8. TIRS: Thermal Infrared Sensor.
9. VIS: Village Information System
10. RS: Remote Sensing
11. IT: Information Technology
12. IS: Information System
13. CIS: Circle Information System
14. NIC: National Informatics Centre
15. ISRO: Indian Space Research Organization
16. ICAR: Indian Council of Agricultural Research
17. IASRI: Indian Agricultural and Statistic Research Centre
18. LIS: Land Information System
19. PWD: Public Work Department.
20. ZP: ZilaParishad.
21. VR: Village Road.
22. PMGSY: Pradhan Mantri Gram SadakYojna.
23. MDR: Major District Road.
24. SH: State Highway
25. ETM: Enhance Thematic Mapper
26. LANDSAT: L-Satellite
27. LU: Land Use
28. LC: Land Cover
29. m : Meters
30. Sq.Km: Square Kilometer's
31. NRSA: National Remote Sensing Agency
32. TM: Thematic Mapper