CHAPTER I

APPRIASAL OF THE PROBLEM

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1.1 INTRODUCTION:

Irrigation is an artificial supply of water to land for growing crops and to increase the per hector yield. Irrigation is necessary particularly in and uncertain rainfall areas. It is essential and artificial application of water to overcome the deficiencies in rainfall for growing crops (contor1967). Irrigation is one of the indispensable input in the transformation of agriculture. However, it is recognized as basic necessity of cultivators in arid and semiarid regions for sustaining high productivity of crops and also to bring more and more land under cultivation. The need of irrigation is greater in the part here rain fall is seasonal and un-assured Moreover, it is life giving agent to plant hence the artificial supply of water has become most essential. Other inputs such as fertilizers and plant protection measures are hardly effective without supplemental irrigation to mitigate water stress. Therefore, there is need of the development of water resources, creation of irrigation of facilities is, however only the means to end of their effective use for crop production.

Irrigation plays a vital role in meeting rising demands of food and fodder, for growing human diestock population; moreover it is an age old practice of ancient civilization design to reduce moisture deficiency. Investment in irrigation leads to multiple benefits, such as it enables farmer to harvest two or three crops a year.

Irrigation is a prerequisite for adopting the new technology in the use of cultivable land cultivated land is the area regularly ploughed and includes both tillage (net cropped area) and follow land. Irrigation leads to better productive use of cultivated land. To be successful and well developed agriculture requires supply of water at regular interval and required quantities. The transformation partly or fully depends upon the nature and mode of irrigation; hence it is regarded as an integrated part of sound infrastructure of agriculture.

It is in this contest that the present study of irrigation and its impact on cultivated area in Satara district of Maharashtra is under taken.

1.2 AREA UNDER STUDY

Satara district is one of the economically and culturally proper our district of the state Maharashtra. It lies in southern part of the state. On deccan plateau. Major portion of Satara district in Krishna river basin and remaining in Bhima river basin. The longitudinal and latitudinal extent of Satara district is 73°33’ to 74°54’ east and 1705' to 18011' north. Respectively area wise Satara district ranking 15th in the state. It comprised by 11 taluka like Satara, Wai, Khandala Medha (Jaoli), Phaltan, Man (Dahiwadi), Khatav (Vaduj) Koregaon, Karad, Mahabaleshwar and Patan. Satara city is located in Satara taluka on Mumbai- Bengalore highway (NH-4). Satara, Wai, Karad and Phaltan are the revenue divisions of Satara district.

Sahyadri mountain range, undulating range and flat leveled plain are the general physical features of Satara district. The western side of Satara district is bordered by Sahyadri ranges near about 93 kms from South to North known as Bamnoli range. Mahadeo is the another range of Sahyadri lies to north of Mahabaleshwar is the highest place from the sea level, having height 1436mt. Western side is hilly and mountainous and central part is of river basin, Eastern part is rigged and off rugged land of Satara district. According to 2001 cencus the population of district is 28.09 lakh. Male population is 14.08 lakh and female population is 14.01 lakh. The sex ratio is 995 per thousand males.

As per 2001 cencus area of Satara district is 3.4percent of total area of Maharashtra state and ratio of population is 2.89percent of the total population of the state. Density of the population is 268 per sq. km. Density of Maharashtra State is 314 persons. High density of population observed in Karad taluka that is 561 persons per sq.km and lowest density of population recorded in Man taluka that is just 138 persons per sq.km near about 86percent population residing in village area maximum urban population (70.45 percent) concentrated in Satara, Karad and Phaltan city of Satara district. Remaining 29.55 percent urban population concentrated in other cities of the district.

The region under study is a part of basaltic plateau of Maharashtra with an average height 8oomts above means sea level. Topographically it is hilly, plain. The rugged hilly topography is observed in western and central part of the study area. The hilly topography is also found in eastern part of the district, many flat topped off shoots terminate in the central and eastern part. The river Krishna is main source of water flowing from north to south getting originating from Mahabaleshwer. Climate is the principal aspect of the physical environment affecting almost every aspect of our life.

Venna, Tarali, Urmodi, Vasana, Vangana are the other rivers and Koyana is the main tributary, of Krishna. Koyana is a right bank tributary which enters from west into Karad taluka. The river Krishna flows from north by entering in taluka, Satara Koregaon and Karad taluka, Dhom dam constructed on it near to Wai and Many more area brought under irrigation from various taluka, Kanher dam construct of on other tributary of Krishna that is venna. This site is near to Satara city just 10 kms. away from it. There is dam on the river Koyana near to Helwalk. This river is considered as life line of the Maharashtra. It is boon to the study area due to availability unbroken and continuous supply of electricity. There is also another dam on the river Urmodi which is under construction it is beneficial for the taluka like Man and Khatav. The other rivers like Tarali, Vang and Manganga rivers.

The climate of study area is generally cool, at high mountain and hot and dry in plains there's is no sudden changes in climatic condition. According geographical condition some changes are seeing in the climate. In summer climate of western part is cool and pleasant but in rainy season is cool. At the plains of Wai taluka temperate type climate. In the central part of the district warm climate in summer and in winter warm during daytime and cool in night time. As compare to western and central part there is hot climate in eastern part of study area.

The maximum and minimum average temperatures recorded are 37.60c and 19.50c respectively. The annual temperature range is 18.10c.

Rainfall is significant climatic element that influences the agricultural economy of the study region annual average rainfall 1475 mm but in 2006 average rainfall was 1728 mm. the rainfall mains received during June to September in the region it decreases from west to east.

1.3 OBJECTIVES

Irrigation is one of the input responsible for agricultural transformation. Hence, the specific objectives of the present study area as under.

a. to know the existing pattern of irrigation and changes therein.
b. to analyze the impact of irrigation on cropping pattern.
c. to investigate the influence of irrigation on agricultural productivity.
d. to identify the negative impact of irrigation on cultivated land.

1.4 HYPOTHESIS

To satisfy above objectives the following hypothesis are formulated.

a. The development of irrigation compels the farmer to take cash crops and motivate to use inputs like fertilizers, High yielding varieties of seeds, pesticides and machineries.
b. Irrigation along with other inputs has brought about the changes in cropping pattern and has increased the crop productivity.
c. Excess use of irrigation and over doses of fertilizers make the cultivated land unproductive or sterile.

1.5 SOURCES OF DATA AND METHODOLGY

To investigate the irrigation and its impact on cultivated area at micro level the main body of the data used in this study were collected from.

i. Primary Sources.

ii. Secondary Sources.

Direct contact and discussion with Class I and Class II officers, tahasil offices. Zilla parishad, Agriculture office of Satara district for collecting data. In addition to the personal discussion with Irrigation engineers. The essential secondary data were collected from published and unpublished report and socio-economic abstracts of Satara district. Such as socio-economic review, census book, agricultural gazetteers, district statistical abstracts, agricultural bulletins by department of agriculture Maharashtra state. The periodicals and unpublished documents by the department of irrigation have also provided lot of information about the present problem.

The collected data and information were analyzed by statically and cartographic techniques. The agricultural productivity was assessed by Bhatia's Methods. The details for the same given in concerned chapter. The extensive field work was under taken for investigation of irrigation and degradation of soils.

There are many positive and negative impacts of irrigation. In the present study positive and negative impact of soil degradation has been considered. The negative impact of irrigation such as social disaster, low form income and water born diseases and increased crime rate omitted.

1.6 THE REVIEW OF LITERATURE

The geographical studies on impact of irrigation are many in India and abroad. It is an interdisciplinary subject being studied by Geographer, Economists, Irrigation Engineers and Agronomist.

Contor (1967) in his book 'A World of Geography of Irrigation has highlighted history and present condition of irrigated agriculture in the world. Michel (1983) in his book 'Irrigation Theory and Practice has covered all areas of irrigation related to agriculture. An attempt has been made by Fukuda (1962) to study the irrigation and drainage of the World. The method of irrigation and Water Management are studied by M. Shaft (1987) and Atkinan (1979),

India's water Wealth: its Problems Facts and basic Principles are highlighted by Rao (1975) , Impact of irrigation studies of canal, well and tank irrigation in Karnataka was attempted by economists such as Kami M.V., Mishra G.P. and Vivekananda. Kamble N.D., Abdul Aziz, C. Charles Nalson, Nageshwar Rao and Rao V.M. Gadgil (1948) studied the economic effects of irrigation. The Regional account of irrigation is studied by Jasbir Singh (1977), Pawar C.T. (1981) and Gurjar R.K. (1987). Some aspects of irrigation have been highlighted by David Friman (1952). The negative effects of irrigation have also been studied by many scholars such as Chawdhary and Reddy (1987), Patil P.B. (1988), Bowonder B. and Ravi C. (1984), Aggarwal R.R. (1957) and Dhawan L.L (1964).

1.7 DESIGN OF THE WORK

The entire study condensed into six chapters.

- In the first chapter, the significance of irrigation, area under study, objectives, hypothesis, sources of data, methodology, review of the literature and design of the work is presented.
- The second chapter includes the physiography, drainage, climate, soil, landuse pattern, agriculture and irrigation, transport and communication, population characteristics of Satara district.
- The subject matter of third chapter is pattern of irrigation.
- The impact of irrigation on cropping pattern is given in chapter fourth.
- The chapter fifth consisting the impact of irrigation on crop productivity.
- Conclusions and suggestions are attempted in sixth chapter.
- The relevant references are given at the end of each chapter, and general Bibliography is listed in the last.

1.8 REFERENCES

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CHAPTER II

PHYSICAL SETTING

2.1 INTRODUCTION

In the south part of Satara there is a village named state. The village nearer to the state are called ‘Sat dare' was borne formally the forte Ajinkyatara was known as Saptarshi. Satara word came into existence. The capital of King Bhojraj was Panhalgarh. It seems that in the northeast side Panhalgarh there must be a village named ‘Satar' and thus the word Satara must have been originated. Inscription as an old 200 BC revel that probably the oldest known place in Satara District is Karad. It also believed that Wai, in Satara District is the Viratnagari were Pandavas leaved in 13 the year of their exile. In 1948 the district Satara comprised of eleven sub - divisions namely Jawali, Karad, Khanapur, Walwa, Wai and Bijapur, sub - division was transferred to Belgum District. Targaon Taluka was transfer to Satara District and Pandharpur was transfer to Solapur District in 1864. A new Phaltan Taluka was formed in 1949. In the same year district was bifurcated into North Satara and South Satara. At the time of 1961 since Satara District comprise 9 Talukas and 2 Mahals. Which among themselves included 1160 inhabited villages and 10 towns. According 2001 census Satara district has 11 Tahsils and 1547 inhabited villages.

The district has been 11 towns for administrative purpose the district is divided into four sub - divisions Koregaon, Satara, Phaltan and Wai. It is situated in river basin of Bhima and Krishna. Satara district lies at the western limit of Deccan table and Southern Maharashtra. But the Point of view of the peninsular drainage the entire land of the district belongs to the larger drainage system of Krishna River.

Recently Satara district is one of the developed district in Maharashtra Mahabaleshwar, Karad, Satara, Wai are the important urban centres in the district. It is an important industrial educational and commercial centre.

2.2 LOCATION AND BOUNDRIES

The Satara district is one of the identical and Historical district places in the Maharashtra state. Satara district lies at

western limit of the Deccan table and southern Maharashtra. The district extends between 1305' to 18011' north latitudes and 730 33' to 740 54' east longitude.

The district has component shape with a west stretch of about 144 kms and south - north 120 kms. It covers an area about 10,480,00 sq. kms. This is 3.4 percent of the Maharashtra State. Among the 35 district of state, Satara ranks 15 in the terms of area. The district consists of eleven talukas.

The district is bordered by Pune district to the east, Sangli district to the south and Ratnagiri district to the west. It has a small boundary of 24 km with Raigarh district in the northwest. Although the boundaries are mainly administrative along several lines these consider with physical Features. (Fig. 2.1)

2.3 PHYSIOGRAPHY

The origin of the name Satara is said to the Form the Satara or seventeen wall towers and grates. Which the Satara Fort was supposed to posses. Residual hill rage and inter medicate valleys, all well developed on tableland surface from the main element of the landscape in the district.

There are two major ranges the Sahyadri and Mahadeo. All along the western boundaries of the district is the Sahyadri range, with its major peaks, usually flat topped and intervening saddles. The Mahadeo range begins an off - shoot of the Sahyadries ranges in the northwestern part of district. It runs eastword as a main range and sends of several minor ranges. Southeastwards a south wards. The Sahyadrian ranges having height more than 900 to 1200 mts. from Mean Sea Level.

The Sahyadries system includes the main range of Sahyadri, which is, though out its entire length of about 96 kms. From north to south to the western boundary of the district. The Sahyadrian crowned by several peaks of which two are major forts namely Pratapgarh (1074 mtrs.) and Makarandgarh (1229 Mtrs.)

Fig No. 2.1

The main line of Sahyadries within Satara limits develops several cols and saddles of which more accessible one have become ghat route. The Ambenali pass, par pass, hatlot pass, amboli pass, north tinara pass, mala pass and kumbharli pass are the important passes. In these passes ambenali and kumbarli passes allow major routes from plateau to Konkan.

Several leading spurs pass east to south the Sahyadri begins from the north. The spurs may be named the Kamalgad, Viratgad, Hatgegad, and Arle - Bamnoli. Gheradategad and Bhairavgad - Kondur, the last two are large ranges.

The Bamnoli Gheradategad range consist of Kamalgad, Viratgad and Hatgegad, Arle spurs and Bhairavgad Kondur consist of Satara, Kevali, Sonapur and Jaluvasantgad spurs.

The second change is Mahadeo range. In the north of district the range emanates from Sahyadrian complex 16 km. North of Mahabaleshwar and starches east and south east across the

whole breadth of district the Mahadeo range has only three forts namely Kelnaja, Thathvada of Santoshgad and Varugad. Besides many small saddles Khambataki, Adraki (Salpe) and Thathvada are the important pasees. From the Mahadeo range three principle spurs stretch south and Chandan Vandan spurs in the west. Which runs about half across the district and the Vardhangad and Mahimangad spurs further east which is stretches right across the district.

The top of main Sahyadries and Mahadeo hills especially in the north western track of Wai Jawli and Patan look likes succession of fortress raised on a series of the plateau pilled one over the other. The whole surrounded by a wall of rock. The north face of Mahadeo range flats sharply in to Nira valley. The distance from the crest of the range to the river being not more than 16 to 20 km. to the south hills falls much more gently to the valleys of Krishna.

There are several notable we known hills and heliports in study region. The major hills in Khandala Wai track are Balegarh, Dhamna, Harli Kamalgad, Kenjalgad, Mahadeo, Panchgani, Pandavgad, and Pipli, Sonjal, Vairatgad and Erali. The main hill features in Jawali - Mahabaleshwar track are Mahabaleshwar (1428 mtrs.), Makarandgad (1229 mtrs.), Pratapgad (1074 mtrs.) And within Satara track. The Satara fort Ajinkyatara (1005 mtrs.), Yawteshwar (1340 mtrs.), Parli fort or Sajjangad (910 mtr.), Ghatin, Pateshwar and shulphuai are the important hill ranges.

The five Koregaon hills Harneshwar, Chavaneshwar, Jarandeshwar, Nandgiri and Chandan varies from 1100 mtrs. to 1200 mtrs. From Mean Sea Level. The slopes are bare and steep and are climbed by difficult Footpaths. The five Patan hills Chandoli, Dategad, Gunvantgad, Bhairavgad and Jungli Jaygad all expect the first five are fortified. The four Karad hills are Agashiv, Pal, Sadashiv and Vasantgad of which Sadashiv and Vasantgad are fortified. The major Man hills are Varugad Kohkada, Shikhar - Shinganapur, Thathwada - Jine pathar, Kulakjai and Mahimangad. The Varugad Thathwada and -Mahimangad are fortified. The Khatav hills consist

of Solaknath, Bhapshah, Vardhangad and Bhushangad. The Vardhangad and Bhushangad are fortified.

Broadly Satara district divided into four physiographical divisions they are as follows.

I. Sahyadri hilly region: -

Sahyadri ranges runs in west side of the district mainly in Wai Patan, Jawali and Mahabaleshwar tahsil.

II. Eastern hilly region: -

In this Khatav and Man Tahsils are included.

III. Region of Krishna river basin: -

Krishna River flowing in the central area of district. Krishna and tributaries extended in Karad, Wai, Satara and Koregaon Tahsil.

IV. Region of Nira river basin: -

The Nire River flows to the northern boundary of Satara district. The Khandala and Phaltan Tahsil are included in this area. (fig. 2.2)

2.4 DRAINAGE PATTERN

In the study region there are four river basins.

i. The Krishna drains the major portion to the South.
ii. The Yerla drains mideast and south region.
iii. The Manganga drains eastern part to join Bhima river out of the
iv. District
v. Nira drains the northern portion of study area

From the point of few of the peninsular drainage the entire district belongs to the larger drainage system of the river Krishna. The Krishna is the third great river in southern India. The Krishna rises on eastern part of mahabaleshwar plateau. It is four miles west of Jor village in extreme east of Jawali Tahsil like Godawari and Kaveri flows across almost entire breadth of peninsular from west to east and implies in the Bay of Bengal. From its source the Krishna

runs east for about 3.2 kms. South of panchwad. As the confluence of the river Krishna and the

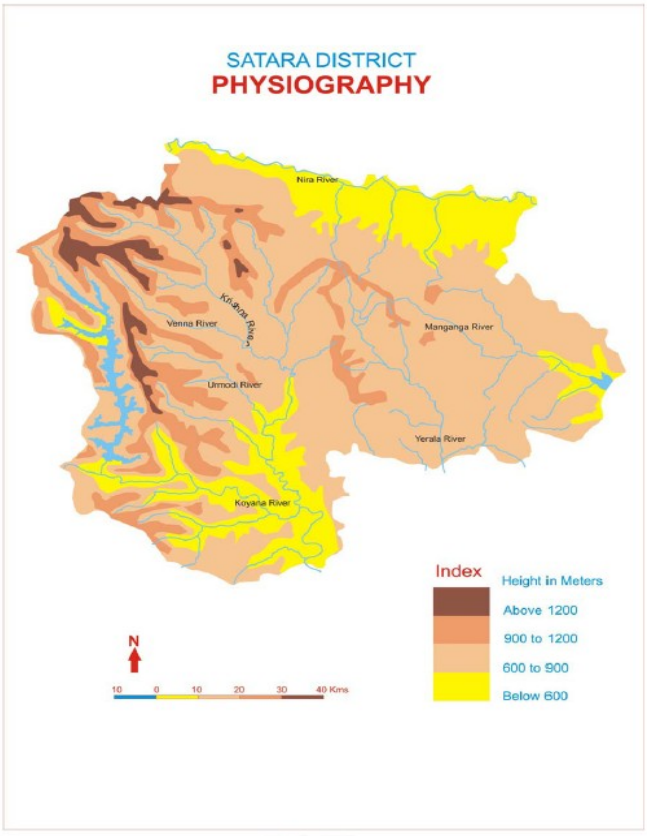

Fig. No. 2.2

river Venna, Mahuli is a sacred spot. In Koregoan Taluka Krishna receives Vasana from left about 1.6 km. east to Mangalapur and it receives Vangana from right. Again it receives two tributaries from right then, Tarali near Umbraj and Koyana near Karad.

The Koyana is largest feeder river of Krishna river. It rises on western side of Mahabaleshwar plateau. The Koyana is the important river in the state on allowed of the hydro - electricity project near Helvak. The perala is largest of the left bank feeder of the river Krishna. It rises Solknath hills in the eastern north of Khatav tahsil.

It flows along with valley flanked by Vardhangad to its right and Mahimangad to its left. It flows generally southward direction and falls into Krishna river. Outside the limits of the district in Sangali district. The Nira tributary of Bhima river rises in Sahydries in Bhor tahsil of Pune district. Nira flows the northern boundy of Satara district. The Manganga is also tributary of river Bhima it rises Tital hills in Man tahsil. It runs southeast direction. In the district Shiva sagar reservoir on Koyana river, Dhom dam on Krishna river, Vir - Bhatgar dam on Nira river (Pune district) are very supportive, extensive and huge network of canals for irrigation. (Fig. 2.2)

2.5 CLIMATE

The climate of Satara district is entirely favorable for agricultural. The year may divide in to four seasons.

i) The Cold season (December. to February.)

ii) The Hot season (March. to May)

iii) The Rainy Season (June to September.)

iv) The Retreating Monsoon season (October. to November.)

The hot season is the period of continuous increase in temperature. The rise in temperature is more marked in the plains than the hills. The maximum temperature is in between 340 to 380C. and minimum temperature is between 10° to 150 C . May is hottest month of year and December is coldest month of the year.

The rainfall varies widely in different parts of the district depending upon their nearness to the Sahyadri. The maximum rainfall receives in the month of June, July, August and September from the southwest wing of monsoon winds. The average rainfall is study region is about 1000 mm. The western part receives heavy rainfall, which decreases to the east. Mahabaleshwar get more than 8000 mm. of rain. The eastern part of study region i.e. Phaltan receives round about 459 mm. of rain. The table No. II-I and fig. no. 2.3 gives the details of average annual rainfall of important places.

TABLE NO. II-II
SATARA DISTRICT
Annual Rainfall (2005 - 20006)

Sr.No.	Place	Annual Rainfall in mm.
1	Satara	1821.5
2	Koregaon	1395.6
3	Wai	1537.1
4	Karad	1184.5
5	Khatav	605.8
6	Man	542.8
7	Mahabaleshwar	8639.5
8	Khandala	778.5
9	Phaltan	459.5
10	Jaoli	2720.0
11	Patan	3289.4

Source: Socio - Economic Abstract of Satara 2006.

The air generally dries particularly in the afternoon except during the monsoon season. The dryness is more marked in the plains that the hills. During the southwest monsoon season the skies are heavily clouded to over cast. With the withdrawal of monsoon cloudiness rapidly decreases and skies are clear to lightly cloud in winter and summer. Winds are generally light to moderate except during southwest monsoon season when they are stronger particularly on the hills. Thunders forms occur in the pre and post monsoon months. Fogs occur occasionally in the valleys in the cold season.

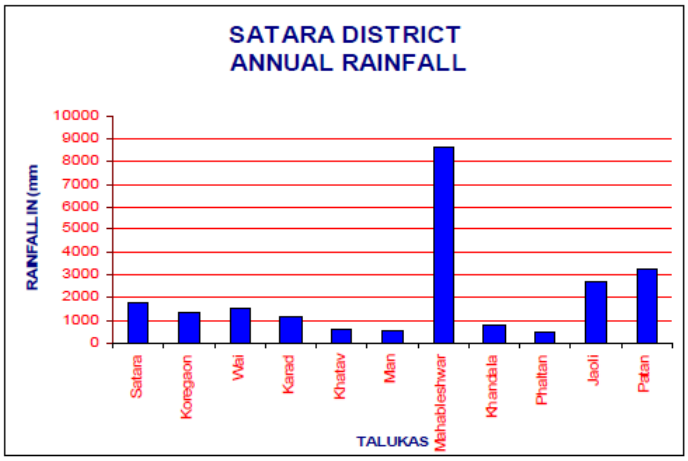

Fig. No. 2.3

2.6 SOILS

The soils of the district are generally fall under the following three main categories.

i) Medium black to deep black soil on the plain lands.

ii) Lighter soils on slopes of eastern part of the district.

iii) Late rite soils in hilly region of western part and small hillocks in the east.

Medium black soils found mainly along the Krishna, the Koyana and Nira rivers. This soil usually characterized by a rich and fertile black soil content high proportion of nitrogen and organic matter.

Light soil locally called as *'Malran'*. These soils are hard, rocky and brown in color. They are rich in line and potash content, but shallow in depth. These soils are deficient in Nitrogen, Organic Carbon and Phosphorus and can yield good produced only if bulky manures and heavy fertilizer are applied and proper irrigation is provided.

Late rite soils are red in colour and are locally known as *'Tambadi Mati'*. They are mainly found in Mahabaleshwar hills and mountain range along the entire Koyana valley. On the top of the hills, were water cannot be confined this soil used for Kumri cultivation or would ash fill age on account of heavy rainfall in this the late rite soils are subjected to heavy leaching and high degree of erosion. The reason for red colour is high proportion of iron oxide in the sesqui- oxides of these soils.

2.7 LAND USE PATTERN

In any region the land under different use has got important in the economy of the region. In the study region, the land under cultivation is about 58.28 percent of the total geographical area. The agricultural activity in the study region is very important because the economy of the region depends upon the land under cultivation or agricultural in the western part of study region the land under forest is more than 24.2 percent but in the eastern part of study region it is very low. Over all the land under forest is 13.00 percent. The eastern

part mostly covered by barrens and follows land wild western part is covered by non - agricultural land and grazing land. The study region is a part of sahydri ranges and covered by Mahadeo hill range so the land under cultivation is less.

2.8 AGRICULTURE AND IRRIGATION

Agricultural is one of the most important occupation of the study region. Nearly 71.3 percent of working population is directly engaged in agricultural activities. The economy of the study region mainly depends on agricultural. The modern agricultural implements, improved or hybrid seeds use of different pesticides insecticides weed sides and fungicides and irrigation facilities have increased agricultural production of the study region. Agriculture is more prosperous in the areas of various river basins i.e. Krishna, Koyana and Nira river basin etc.

The cropping patterned and agrarian economy of the district has changed because of the land under cash crops increased wiled the land under food crops decreased. But the production has increased due to introduction of canal irrigation. In the study region Rice, Jowar and pulses are main food crops in the central part the Jowar and Wheat while in the eastern part Bajra, Jowar and pulses are the main food crops.

In the study region nearly 61.17 percent area is under cereal crops and nearly 11.52 percent area is found under pulses. A sugarcane and oil seeds covers an area about 5.94 percent, 10.31 percent respectively. Now a days the sugarcane production is increased due to irrigation facilities. Irrigation plays an important role in development in any region. In the study region the canal and well irrigation has got prime importance. In the year 2005 - 2006 the land under irrigation was 395645 hector out of which nearly 57.00 percent land was under well irrigation and nearly 43 percent land was under canal irrigation. The canal and lift irrigation facilities have changed the cropping patterned in recent years.(table no. II-III and Fig. No. 2.4)

TABLE NO. II-II
SATARA DISTRICT
AREA UNDER DIFFERENT SOURCE

Sr. No.	Source	Area in Hect.	percent to total
1	Canal, Tank and Other	170230	43
2	Well	225415	57
	Total	395645	100

Source: - Socio economic review and district statically abstract of Satara. 1998 - 1999.

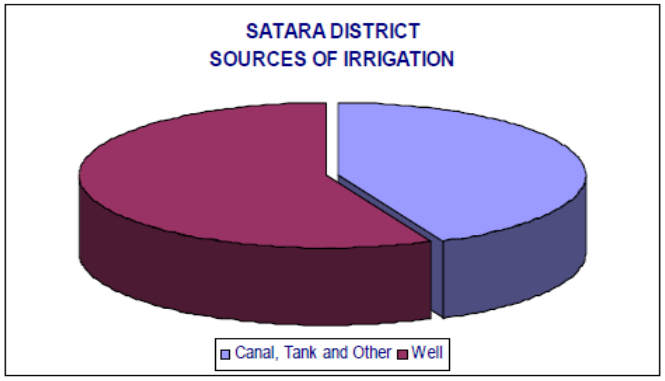

Fig. No. 2.4

2.9 TRANSPORT AND COMMUNICATION

The transport and communication plays very vital role in economic and social development of the region. In the study region road network is well developed. Railway is also playing important role in transportation.

The national highway no. 4 (Pune - Bangalore) stretches from south to north direction about 137 km. parallel to course of Krishna river.

Satara - Pandharpur, Satara - Mahad, Pune - Mahabaleshwar - Mahad, karad - Chiplun and Miraj Phaltan are the state highways accounting 939 kmtr. in length. District road connects the talukas and important places of study region.

From the central part of study region the Pune - Benglore broad gauge railway route stretches north to south about 124 kmrs. On this line Lonand, Wathar, Satara, Koregoan, Rahimatpur, Masur and Karad are the important railway stations.

The Mahabaleshwar - Pandharpur, Phaltan - Miraj and Bijapur - chiplun are the state highways, which accounts 939 kmrs. in length.

The table no. II-III gives clear idea about road and railway network of study area.

TABLE NO. II-III
SATARA DISTRICT
TRANSPORT ROUTE (2001)

Sr. no.	Name of Transport	Length in kms.
1	Broad gauge railway	120
2	National highway no. 4	137
3	State highway	939
4	District highway	1861
5	Other district roads	1751
6	Village roads	4063
7	Others	578
8	Metelled roads	2368
9	Un – Metelled roads	3574
10	Others	3368

Source: - R.T.O. Office, Satara.

The communication system is also developed in the district and links with important places of Maharashtra and Goa state. The post and telegram services providing facilities to the people in the study area.

2.10 AGRO-BASED INDUSTRIES

The agriculture is one of the main occupation in the study region the fertile land, use of fertilizers an manures, hybrid seeds have increased the agricultural productivity. In the western part of study region due to heavy monsoon rain fall the rice cultivation is dominant but in the river basin canal irrigation and private lift

irrigation scheme, the land under irrigation increased. The sugarcane is the major crop along the riverside so the sugar factories are located in the river basin. There are 10 sugar factories in the study area they are situated in Phaltan, Karad Yashwantnagar, Bhuinj, Shendre, Marali (Patan), Sakharwadi, Chimangaon, Songaon and Rethre Budruk etc.

The groundnut and other oil seeds are produced more in the district so some oil meals are located in the study area mainly at tahsil places like Karad, Koregaon, Satara, Phaltan. There are 27 agricultural commodity-processing centers in the district.

The dairy industry is major subsidiary occupation of the people. There are 855 co - operative milk collection centers in the study area and 22 fisheries co - op. societies. Now a days a poultry industries is also growing because of governmental facilities. Many other types of industries are located at Satara, Karad, Phaltan, Shirwal, Wai and other places.

2.11 POPULATION CHARACTERISTICS

It is very important to study population characteristics of the study area for knowing and understanding the economic level of the people. The income and production efficiency of the people from different sources is based on different factors. The development of natural resources and the level of economy development mainly depend on economic use of the environment.

The total population of Satara district according to 2001 census 27,96,906, which is increased by 14.39 percent during 1991 to 2001. The annual growth rate of population nearly 1.5 percent. The density population in the year 1991 is 233 people per square km., which is increased up to 267 persons per sq.kmr. In the year 2001.

RURAL URBAN POPULATION RATIO

According to 2001 census there are 15 urban centers in the study area, out of total population nearly 85.80 percent population was rural and 14.20 percent population was urban. When we compared rural urban population to previous decade i.e. 1991 it is

observed very little change in rural and urban population. The densities of rural urban population have also increased than the year 1991. Density of Satara district is 268 persons per sq.km. High density of population is observed in Karad Taluka i.e. 561 lowest density of population observed in Man Taluka i.e. 138 person's oper sq.km. Out of total urban population, near about 70.45 percent population concentrated in Satara, Karad and Phaltan cities and remaining population concentrated in other cities of Satara district.

The sex ratio of study area is 995 females per 1000 males. There is high sex ratio in Satara district as compared to Maharashtra State and entire country because of males are working outside specially in Mumbai and defense forces rural sex ratio is 1006 and urban sex ratio is 928 females per 1000 males.

2.12 OCCUPATIONAL STRUCTURE

Occupational Structure of any region is more important in economic life. The working class people play an important role in development of the region.

In the study region, it is observed that out of total population 46.61 percent population is engaged in various activities out of total population 48.34 percent engaged in farming activity and 21.55 percent population engaged in agricultural laborer totally 69.89 percent population engaged in agricultural activities. Remaining 30.09 percent population engaged in mining, manufacturing, maintenances construction trade and commerce, transport and other activities.

Female labors are more because most of the male population migrated to Mumbai and other parts of the nation for various activities.

The ratio of literacy is 78.52 percent. 88.45 percent made population is literate out of 14.08 lakh male population and 68.71 percent male population is literate out of 14.01 lakh female population.

2.13 OTHER FACILITIES

Different town exhibits different social economic features and each town has its own identification. There are so many facilities affecting on growth of district. Education facilities have been in the district. There are 22 Senior colleges and many Junior colleges, Medical, B.Ed., D.Ed., agriculture, Polytechnic and Information Technology Colleges found in district. Beside these number of high schools of Marathi and English medium. There are some *Ashram Shala* in the district providing education to backward class and economically backward students. In the district there are number of government and private hospitals, M.I.D.C. units (Satara, Karad, Wai, Shirwal, Koregoan and Satara road).

2.14 REFERENCES

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CHAPTER III

PATTERN OF IRRIGATION

3.1 Evaluation of Irrigation
3.2 Methods of Irrigation
3.3 Sources of Irrigation
3.4 Taluka wise Irrigation Pattern
3.5 Scope for Irrigation Development
3.6 References

The present chapter aims at to highlight the source wise progress of irrigation facilities for the period 1984-85 to 2004-2005. The overall irrigation and changes therein also attempted in this chapter, irrigation is essential for crop cultivation and better yield. The success of agriculture depends upon wise use of irrigation water, irrigation plays very significant role particularly in the areas where rainfall is low and uncertain. Therefore it is one of the significant inputs in the transformation of subsistence to commercial agriculture.

Irrigation being artery and pulsing heart is an absolute, constant as well as a sufficient command over the location of commercial crops important in agricultural production per hectare, showing in the cropping pattern change in the technique in the land use of a region since 1976.

3.1 EVOLUTION OF IRRIGATION

Irrigation is an artificial supply of water to the crops for their proper development. It is as old as civilization, irrigation in India is an old cultural technique and it has been existing from three to four thousand years. In India early development of irrigation took place in valley of Ganga and Indus. The Britishers systematically developed the irrigation to diminish the effects of famines. After independence political stability has stimulated irrigation development which brought green revolution many attempts were made to tap water for irrigation through major, medium and minor irrigation projects or schemes.

In the region under study, irrigation was started in early period of British rule with opening of Krishna canal but actual construction of were started in 1864 which was complicated in 1867. The weir is 60.66 mt. long and 7.1 mt high which is situated across the Krishna near Khodashi in Karad taluka. The canal discharges 160.06 cubic mt water per second in Krishna canal, irrigating 3,079.2 hectors land of cultivable land. Prior to this project the main source of irrigation was most by wells and *mots* and water wheel were used for lifting water. Now a days many more
irrigation projects launch by State and Central Government to bring

maximum area under irrigation by supplying water through canals and other sources of irrigation.

TABLE NO.III-I
SATARA DISTRICT
MAJOR IRRIGATION PROJECTS

Sr. No.	Name of Irrigation Project	Taluka	Irrigated Area		
			Perennial	Seasonal	Total
1	Dhom	Wai	1435	30937	
2	Kanher	Satara	1891	16732	
3	Arphal	Koregaon	2734	7814	
4	Veer	Khandala	2340	24447	

Source - Socio-economic abstract of Satara District 2006

Other Irrigation Projects

- Mhaswad tank (1901, Man)
- Krishna canal (1985, Karad)
- Yerelwadi dam (1998,Khatav)
- Morna project (2009, Patan)
- Andhali project(2005, Man)
- Urmodi project (under Construction, Satara,2012)
- Uttarmand project (under contraction, Satara, 2009)
- Tarali project (2009, Patan)
- Hateghar (2006, Man)
- Nagewadi (2009, Wai)
- Wang project (2009, Patan)
- Dhom Balakwadi (2006, Wai)

Now a days farmers of study area have started using extensively water from wells and rivers. Recently drip, sprinkler and micro sprinkler method of irrigation is practiced, almost all the area of the study region to avoid misuse of water and to get optimum benefits of available water by adopting this methods many farmers

promoting economic use of water especially in eastern and central region of study area.

In Satara district Government policies have encouraged to utilize the surface and ground water resources by providing financial assistance and subsidies, many co-operative societies emerged and formed dense network of lift, drip as well as sprinkler irrigation. Lift irrigation is dominant in Karad taluka in Krishna and Koyana river basins. The topographical obstacle has been surmounted by lift irrigation to some extent further, the sugar factories which has been establish in every taluka during last two decades have developed irrigation facilities by making special effort in command area, apart from this the rapid rural electrification, awareness of the farmers and increasing trend of education have stimulated irrigation development.

The total area under irrigated has increased tremendously. In 1984-1985 the area under irrigation by all sources of irrigation was 145691 hectors its rises to 216149 hectors. The absolute increase in area irrigation was 70458 hectors of cultivated land.

3.2 METHODS OF IRRIGATION

Methods of irrigation are practiced in the study region according to the nature of terrain, soil type and total climatic condition, mostly surface water irrigation are generally practiced everywhere beside that flood irrigation, border furrow and corrugation irrigation, however flood and border irrigation are observed in central part of the region like Wai, Satara, south Koregaon and Karad Taluka. The furrow irrigation in which water is run in furrow is used in eastern and western part of the region. When slopes are moderate and low. By this method water is applied to crops like sugarcane, maize and vegetables. Furrow irrigation is very common because it adoptable to great variety of land slope.

The corrugation irrigation, where water is applied to the ground in rills or small shallow furrows is practiced along the Krishna valley.

The subsurface and overhead irrigation methods are practiced in study area because they are expensive though they are economic to the water. But in future these economic methods of irrigation may be used.

Now a days there is remarkable changes in farmers outlook or approaches. They started to use advanced means of irrigation like drip, sprinkler. Micro sprinkler methods of irrigation to avoid the misuse of irrigation and adopt proper utilization of available water. In the region of draught like Man, Khatav, eastern and north Koregaon, Phaltan etc. Even the this methods of irrigation are costly and expensive, they are enjoining many more government polices which are in the favour of farmers like direct 50 percent subsidies.

3.3 SOURCES OF IRRIGATION

The sources of irrigation in the study region largely affected by the physical features such as topography, water, geology means structure of rocks, soils and presence of ground water etc. presently the region has-

1) Well Irrigation
2) Surface Water Irrigation
3) Other sources of irrigation

The topography of Krishna valley is quite suitable for lift irrigation and very less suitable for tank irrigation. The physical features of Mahabaleshwar Jaoli and Patan taluka are not suitable for lift irrigation. In such taluka well irrigation is flourished and eastern part of study area like Man, Khatav, Phaltan, taluka have canal, tank and well irrigation the geological structure is suitable to construct the dam and store the water for long time and utilize it whenever necessary.

The lift irrigation widely spread in the Krishna river basin mostly in the Karad taluka. Maximum area is under irrigation. The lift irrigation is on cooperative basis, the 52 percent land under lift irrigation.

The well and tank irrigation found in eastern and western part of study area. There are maximum land under well water

irrigation in taluka of Man, Khatav, Phaltan tanks are observed in all three parts of study area mostly move in eastern part canal irrigation observed in only along the lower reaches of river in Karad taluka. Tank irrigation is nil in the same taluka due to an unsuitability of topography. A brief description of major source of irrigation is attempted below.

The term lift irrigation refers to lifting of water from the surface of *nala* river, canal, tank, lakes etc. With mechanical power and supplying near by area through cement or plastic pipes. The sources of lift irrigation schemes depends upon perennial rivers. The obstacle of the slope is eliminated hence as the water is supplied to the fields for a distance ranging from 5 to 25 kms from river banks.

The present lift irrigation is operated in Krishna basin and other area by constricting, Kolhapur type weir, and percolation tanks. Karad taluka is very well known for lift irrigation in the study area.

The industrious nature of the farmer with the spirit of development and progress have formed the co-operative lift irrigation societies. These schemes promote to bring more area under irrigation.

WELL IRRIGATION

Well irrigation is dominant in eastern region of study area. Near about (31.80percent) area is irrigated by well irrigation, Man and Khatav taluka having 10425 hect. and 9852 hect. Land under well irrigation. There is reduction in area under well irrigation in phaltan taluka because of other sources of irrigation like canal in 2004-05.

Western part of study area receiving more rain then also area under well irrigation recorded 32.72percent. 30.78 and 28.19percent. IN this region pattern recorded (32.72percent) Jawali (30.78percent) and Wai (28.19) only. M. Shwar has less area under well irrigation due to rigid & rugged topography, mountainous soil.

In the central part of study are Karad recorded more area under well irrigation i.e. 12453 hect (31.0percent) Satara 10846 hect

(27.06percent) and koregaon has 10296 hect (25.69percent) area under well irrigation. Khandala has comparative less hectors of land under well irrigation in 2004-05.

According to 1984.85 statistics it was more in every region of study region. In some areas it was less but now a day it is increasing. (Table no. III-I and fig. no.3.1 A and B).

TABLE NO. III-II
SATARA DISTRICT
AREA UNDER WELL IRRIGATION

Sr.No	Taluka	1984-85	Percent	2004-05	Percent	Change
	Eastern Part					
i	Man	11177	28	10425	31.80	3.81
ii	Khatav	5595	14	9852	30.10	16.05
iii	Phaltan	23130	58	12477	38.10	19.87
Total		**39902**	**100**	**32754**	100	
	Western Part					
i	Patan	594	11.83	13265	32.72	20.85
ii	Jawali	815	16.23	12478	30.78	14.55
iii	Mahabaleshwar	41	8.81	3325	8.20	7.35
iv	Wai	3571	71.12	11469	28.19	-42.93
	Total	**5021**		**40537**		
	Central Part					
i	Karad	6394	33.61	12453	31.07	-2.54
ii	Satara	1225	6.43	10846	27.06	20.63
iii	Koregaon	6683	35.12	10296	25.69	-9.44
iv	Khandala	4721	24.81	6478	16.16	-8.65
	Total	**19023**		**40073**		

Source: Socio - Economic abstract, Satara district 2006 and 1986

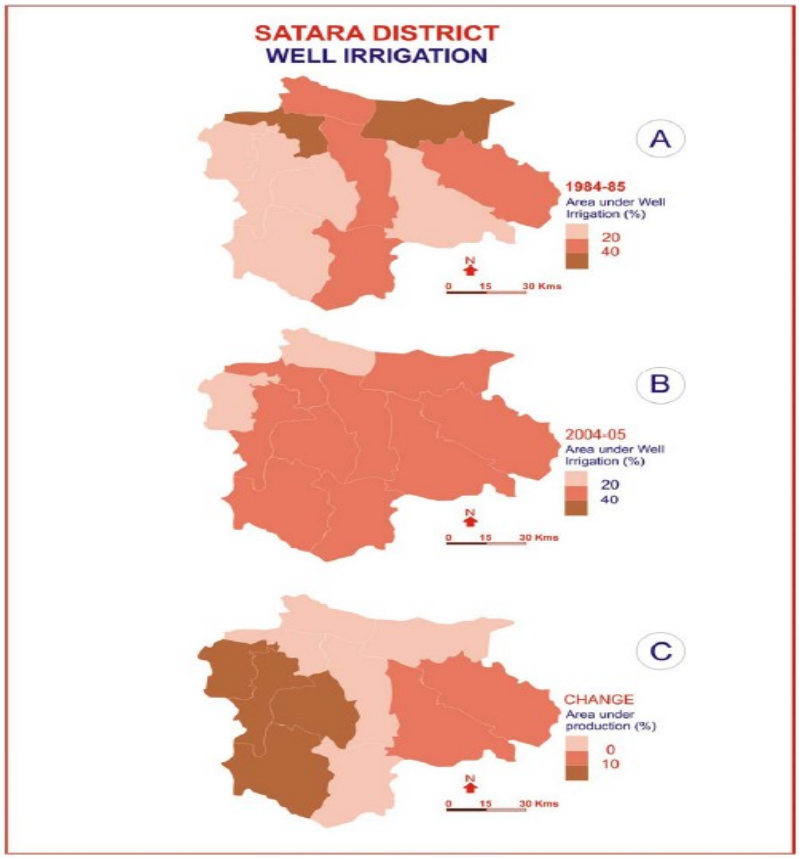

Fig. No.3.1A, B & C

Change in well irrigation

In the eastern region Man, Khatav, phaltan these 3 talukas are included, the area under well irrigation in Man Taluka was 11777 hect (28.00percent) during 1964-85 but now it is 16425 hect (31.80percent) actually it is shows negative change but area under well irrigation in the entire region is changed so it shows positive change.

Area under well irrigation in Khatav taluka is increased from 5595 hect to 9852 hect. i.e. (14.02percent to 16.05percent) only Phaltan taluka shows negative change in well irrigation. i.e. - 19.87. Actually it was 23130 hect land under well irrigation but it decreases upto 12477 hect in 2004-2005.

In the western part of Satara district positive change is observed in Patan, Jawoli M. shwar taluka. There was tremendous change in land under well irrigation form 11.83percent to 32.72percent 16.23percent 30.78percent and 0.81 to 8.20percent in western part. Only Wai taluka has negative change even the hect. under well irrigation increased it show - 42.93 change.

Central part of the study area showing negative changes in Karad taluka (-2.5percent), Koregaon (-9.44) and Khandala (-8.65percent) because in Karad taluka lift irrigation is dominant. Due to presence of Krishna river, sample water for agriculture is available and it is lifted by huge pump set so it shows negative change. Koregaon and Khandala showing negative changes due water is made available by other sources of irrigation during different season. Only in Satara taluka, the land under well irrigation increased form just 1225 (6.43percent) hect to 10846 (7.66percent) hectors of land. (Fig. no. 3.1 C)

SURFACE WATER IRRIGATION

Very less hectare of land under surface water irrigation during 1984-85.There was drastic change in this irrigation pattern in 2004-2005.

In the eastern region Phaltan taluka shows mre land 13625 hect during 1984 hect. (45.38percent). Man and Khatav taluka show increase in land under surface water irrigation. Man, 1010hect. to 5047 hect and Khatav 1899 to 5810 hect.

Western part of study area Patan and Jawali taluka and Wai taluka showing increase in land under surface water irrigation. In Patan taluka it increase from 3946 hect to 8325 hect during 1984-85 it increases up to 3277 hect in 2004-2005.

The Wai and Mahabaleshwar talukas showing decrease in area under surface water irrigation. In Mahabaleshwar and Wai shows decrease. i.e. from 940 to 931 hect and 4526 hect to 3546 hect during 1984-85 to 2004-2005.

Central part of Satara district consisting Karad, Koregaon, Satara and Khandala taluka. Satara, Koregaon and Khandala shows

increase in area under surface water irrigation i.e. - Satara 21.75percent to 26.04percent, Koregaon 10.19percent to 27.51percent and Khandala 4.22percent to 10.92percent to total irrigated area, only in Karad taluka area under surface water irrigation shows little increase but negative change due to improper use of water, illiteracy of the farmer, degradation of land. (Table no. III-II and fig. no. 3.2 A and B)

TABLE NO. III-III
SATARA DISTRICT
SURFACE WATER IRRIGATION

Sr.No	Taluka	1984-85	percent	2004-2005	percent	Change
	Eastern Part					
i	Man	1010	6.10	5097	25.61	19.51
ii	Khatav	1899	11.48	5810	42.76	31.28
iii	Phaltan	13625	82.40	9034	45.38	-37.02
	Total	**16534**		**19901**		
	Western Part					
i	Patan	3946	31.17	8325	51.62	20.45
ii	Jawali	1495	13.70	3277	20.32	6.62
iii	Mahabaleshwar	940	8.61	931	5.77	-2.84
iv	Wai	4526	41.49	3596	22.30	-19.19
	Total	**10907**		**16125**		
	Central Part					
i	Karad	9537	63.82	10352	35.47	-28.35
ii	Satara	3250	21.75	7608	26.04	4.25
iii	Koregaon	1524	10.19	8029	27.51	4.29
iv	Khanadala	631	4.22	3189	1092	6.07
	Total	**14942**		**29178**		

Source - Socio-economic abstract of Satara District, 1986, 2006.

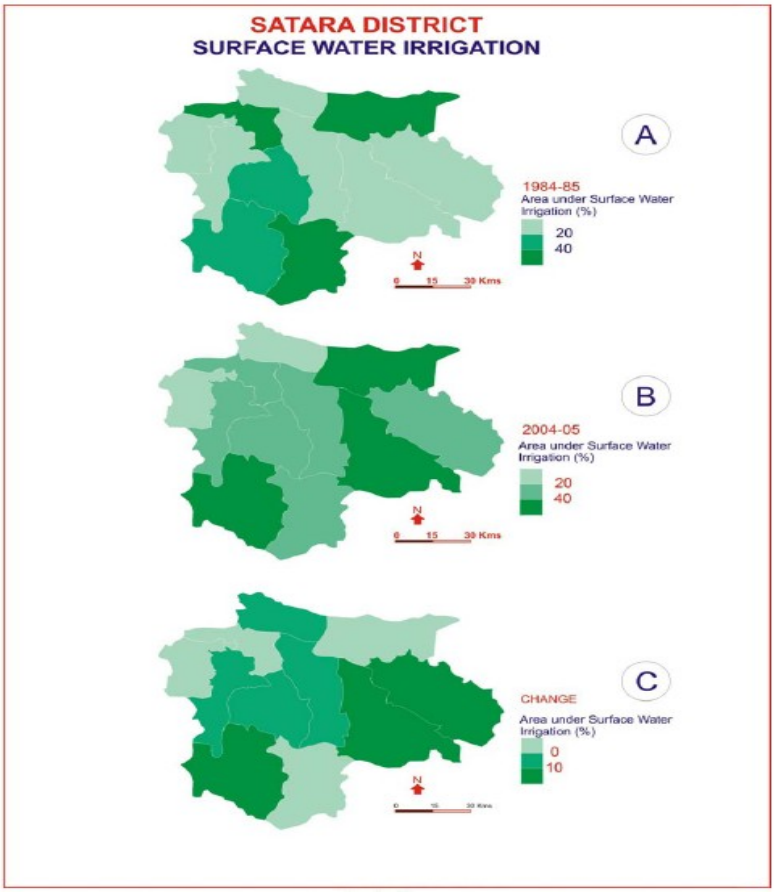

Fig. No.3.2 A, B & C

Change in Surface water irrigation

Positive change observed in Man to Khatav taluka it is from 1010 hect to 5097 hect. in percentage (6.10percent to 25.6percent) and 1899 hect to 5810 hect in percentage (11.48percent to 42.76percent) and negative change in Phaltan tahsil from 82.40percent to 45.38 i.e. - 3702percent due to undulating surface, rugged topography, seasonal rivers and less amount of rain in eastern part.

Negative changes found in Mahabaleshwar and Wai taluka of the district. In Wai remarkable decrease in land under surface water irrigation it was 4526 hector in 1984-85 it decreases upto 3596 in 2004-2005 so it shows negative change (i.e.-19.19percent)

due to baran land, availability of water, less storage of water in reservoirs. Positive changes observed in Patan and Jawali taluka. It is from (Patan 31.17percent) to 51.62percent) Jawali 13.76percent to 20.32percent in the span of 20 year i.e. 1984-85 to 2004-05.

In central part of study region Karad taluka shows negative change in land under surface water irrigation even though there is actual increase in hectorage under surface water irrigation i.e. 9537 hector in 1984-85 it increase 10352 hectors in 2004-05 because land turn to saline soil due to water logging & saturation of water, over irrigation. Negative change (28.35percent) it was 63.82percent during 1984.85 and 35.47percent during 2004-05. (Fig. no. 2.3 C)

OTHER SOURCES OF IRRIGATION

Other sources of irrigation consist rainfall and moisture in the air where there is no chance to get water from canal or lift irrigation, even though well is not possible in such area rain is one and only one source of irrigation in the study area. These area can be bring under lift irrigation.

Eastern part of the study area Khatav and Phaltan shows of irrigation in Khatav 6076 hect. land was under other sources of irrigation during 1984-85 it is changed into 6658 hect. in 2004-2005 and Phaltan had 5468 hect during 1984-85 changed into 9136 hect i.e. 27.10 percent to 42.18 percent during span of 20 years. In many taluka land under surface water irrigation decreases from 42.86 percent to 27.06 percent.

Western region of Satara district well known for rain but in recent year there is also less percent of rain but land under other sources of irrigation increased from 1135 hect (1984-85) to 3166 (2004-05). In Jawali taluka 440 hect increased upto 2846 hect (2084-05) in percentage 13.83percent to 24.11percent during this span. Mahabaleshwar show very little increase in land under other sources irrigation. Wai also shows increase in land under other sources of irrigation.

Central part of study area included Karad, Satara, Koregaon and Khandala taluka. There is maximum use of other sources of irrigation in Khandala and Karad.

4742 hect land under other sources of irrigation during 1984-85 it changed into 6333 hect in 2004-05.

Satara and Koregaon shows decrease in land under other sources of irrigation in Satara it was 6287 hect. in 1984-85 and it decrease upto 3683 hect in 2004-2005 . In Koregaon taluka it was 2689 hect. it decreases upto 3140 hect Khandala taluka has 2157 hect it changed in 6654 hect land under other sources of irrigation. (Table no. III-III and fig. no. 3.3 A and B)

TABLE NO. III-IV
SATARA DISTRICT
OTHER SOURCES OF IRRIGATION

Sr.No	Taluka	1984-85	percent	2004-05	percent	Change
	Eastern Part					
i	Man	8626	42.86	5862	27.06	-15.8
ii	Khatav	6076	3012	6658	30.74	0.62
iii	Phaltan	5468	27.10	9136	42.18	15.06
	Total	**20170**		**21656**		
	Western Part					
i	Phaltan	1135	36.93	3166	28.83	-8.11
ii	Jawali	440	13.83	2846	24.11	10.28
iii	Mahabaleshwar	124	3.89	455	3.85	-0.04
iv	Wai	1482	40.30	5233	21.46	-18.84
	Total	**3181**		**11800**		
	Central Part					
i	Karad	4742	29.87	6333	31.96	2.09
ii	Satara	6287	39.60	3683	18.71	-20.89
iii	Koregaon	2689	16.93	3140	15.85	-1.08
iii	Khandala	2157	13.58	6654	33.58	20
	Total	**15875**		**19810**		

Source: Socio - Economic abstract, Satara district 2006 and 1986

Changes in other sources of irrigation

There are negative changes in of parts of study area.

In the eastern part Man taluka shows negative change i.e. (-15.8percent) actually it was 42.86percent land under other sources of irrigation but is decreased upto 27.06percent.

In western zone Patan, M. shwar & Wai taluka shows negative changed because amount of rainfall is less so the people diverted to other sooner of irrigation Patan (-8.1percent) M. Shwar (-0.04percent) Wai (-18.84percent)

Central part of study area showing positive and negative changes in other sources of irrigation. Khandala and Karad taluka Jawali positive changes i.e. 20 & 2.04percent respective and Satara & Koregaon shows negative changes i.e. - 20.89percent -0.08percent people find out other sources irrigation to irrigate the crop. (Fig. no. 3.3 C)

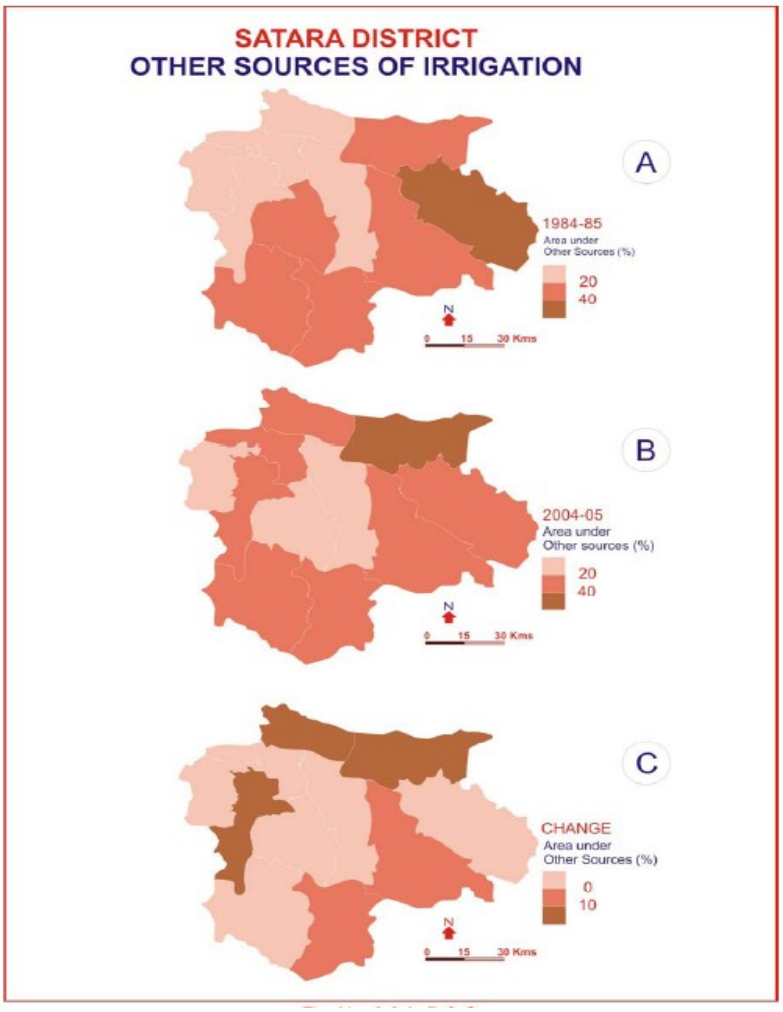

Fig. No.3.3 A, B & C

3.4 TALUKA WISE IRRIGATION PATTERN

MAHABALESHWAR

In Mahabaleshwar taluka of the district irrigation facilities are not much developed during 1984-85. The area under well irrigation was just 41 hectors. And area under surface water irrigation was 790 hect. Net irrigated area was 1105 hect and total area under irrigation oct of 22700 hector. Total geographical area. But during 2004-2005 the area under irrigation changed tremendously.

790 hectors by surface water irrigation and 2156 hect under well irrigation and total irrigated changes into 3303 hect. oct of 22190 hectors because of awareness of the people in this span of two year there wend rustic change in irrigation Govt forcing people to bring maximum land under irrigation for that Govt made available so many facilities like finance, capital , loans. Etc.

WAI

The situation of irrigation in Wai, surface water irrigations sources irrigated 4526 hect. area Dhile 3571 hact. Area irrigated by well total area under irrigation was 9579 act of 61,600 sq.km area during 1984-1985, But in last 20 years there is tremendous change in irrigation pattern and irrigation sources. Form beginning the maximum area was under irrigation but there was not proper order of utilization of water but due to some minor and kanor projects of, irrigation. The area under irrigation is changed during 2004-05 into area under surface water irrigation 3222 hect. and by well 8283 hect. and total irrigated area was 16894 hects. There was remarkable change in irrigation i.e. from 9579 hect. to 16894 hects. Due to availability of lift irrigation Krishna river, canals connected to Dhom project and financial support by Govt to doing well in the own forms.

TABLE NO. III-V
SATARA DISTRICT
CHANGES IN IRRIGATION PATTERN (Area in the hector)
(1984-85 to 2004-05)

Sr. No.	Taluka	Total Area Under Irrigation		Total Area Under Irrigation		Change in irrigation	
		2004 - 2005	Percent	1984 – 1985	Percent	Change	Percent
1)	Mahabaleshwar	3303	1.52	1105	0.75	2198	0.77
2)	Wai	1689	7.81	9579	6.58	7315	1.23
3)	Khandala	19875	9.19	7509	5.15	12366	4.04
4)	Phaltan	54027	24.99	2223	29.00	1804	-4.01
5)	Man	20402	9.4	20813	14.29	411	-4.89
6)	Khatav	21020	9.7	13570	9.32	7450	-0.38
7)	Koregaon	18011	8.3	10892	7.48	7119	6.4
8)	Satara	24900	11.51	10762	7.39	14138	4.12
9)	Jaoli	9509	4.3	2750	1.40	6759	2.9
10)	Patan	12715	5.8	7675	3.89	7040	1.91
11)	Karad	15493	7.16	20673	14.20	5180	-7.04
Total		200944	99.68	107551	99.45	71780	

Source - Socio-economic abstract of Satara District 1986 and 2006

KHANDALA

The situation of irrigation was very poor in Khandala taluka of Satara district during 1984-1985. The area under irrigation by surface water irrigation and well irrigation was 631 hect and 4721 hects respectively and total area under irrigation was 7509 hect. out of 54300 hects total geographical area. There was change in irrigation during 2004-05. The surface water irrigation, irrigated 3984 hects and well irrigation irrigated 8266 hect. and total area under irrigation 19875 hects out of 53608 hects. 12366 hects. area under irrigation is the change in irrigation and this is identical one, due to diversertion of people towards agriculture, the Dhom dam awareness of the people, change in peoples attitude and financial support by various institution of finance and non-institutional sources of finance. Like many lender, friends relatives and co-operative societies, Banks, sugar factories.

PHALTAN

Phaltan is the 4th largest taluka in Satara district according to area. That is 1,19,029 hects. Near about 50percent area was

under irrigation from beginning i.e 42,223 hect. in brief 13625 hects by surface water irrigation and 23130 hects area by well irrigation and remaining by other minor sources like rain. The condition of irrigation changed in the last 20 years. The area under surface water irrigation was 11534 hect and 33248 hects by well irrigation and the total area irrigated by all sources of irrigates was 54027 hectors.

The change in irrigation pattern. 11804 hectors in the span of 20 years this is remarkable change due to change in farmer's attitude and Govt. facilities some minor & major irrigation projects.

MAN

This taluka of the district is always in drought conditions it receive very less rainfall throughout act the year but irrigation condition during 1984-85 1010 hect area irrigated by surface water irrigation and 11177 hector area irrigated by well irrigation and area irrigated by all sources of irrigation was 20813 hect. and condition during 2004-2005 was area irrigated by surface water irrigation 4375 hect. and by well 10025 hect. with 20402 total hectors of irrigated area there was no any identical/remarkable change in area under irrigation, even the Govt. is providing all the necessities to the farmer, due to unfavorable condition of climate and physiographic condition.

KHATAV

In Khatav taluka we can observe. Some what improved condition in case of irrigation means within the period of 20 years just 7450 land brought under irrigation.

During 1984-85 the area under irrigation by surface water and well irrigation 1899 hect, 5595 hect. respectively and total area under irrigation was 13750 hect. During 2004-2005 the situation was 4715 hect. and 9521 hects under surface water irrigation and well irrigation respectively and total area and under irrigation was 21020 hects.

In this taluka some minor and medium project are there like Near dam, Dingh tank canal irrigation but they are getting dry up due severe summers and frequents dxoght condition.

KOREGAON

In the Koregaon taluka the area along with Krishan river and Vasana & Vangana river the develops well some part receive water left and right canal of Dhom and Kanher dam, so total area irrigated 14798 hectors and by well 10296 hect & by surface water irrigation 4502 hect.

In 1984-05 the situation was weak means the area under surface water irrigation 1524 hect and area under well irrigate 6683 hect and total area irrigated was 10892 hect.

SATARA

Western part of Satra taluka not develop in irrigation but eastern part somewhat developed due to the river Krishna Venna, and their tributaries, the level of well water is always medium level due to availability of water in dams and canal so the farmer can bring was maximun land irrigation.

During 1984-85 the area under surface water irrigation was 3250 hect and by well irrigation 1225 hect is irrigated. And the total area irrigated 91.000 hect. In the span of years means during 2004-2005 the area under irrigation by surface water changed into 6807 hect. and area under well irrigation changed into 14348 hect. Then was tremendous change in area under irrigation in Satara taluka.

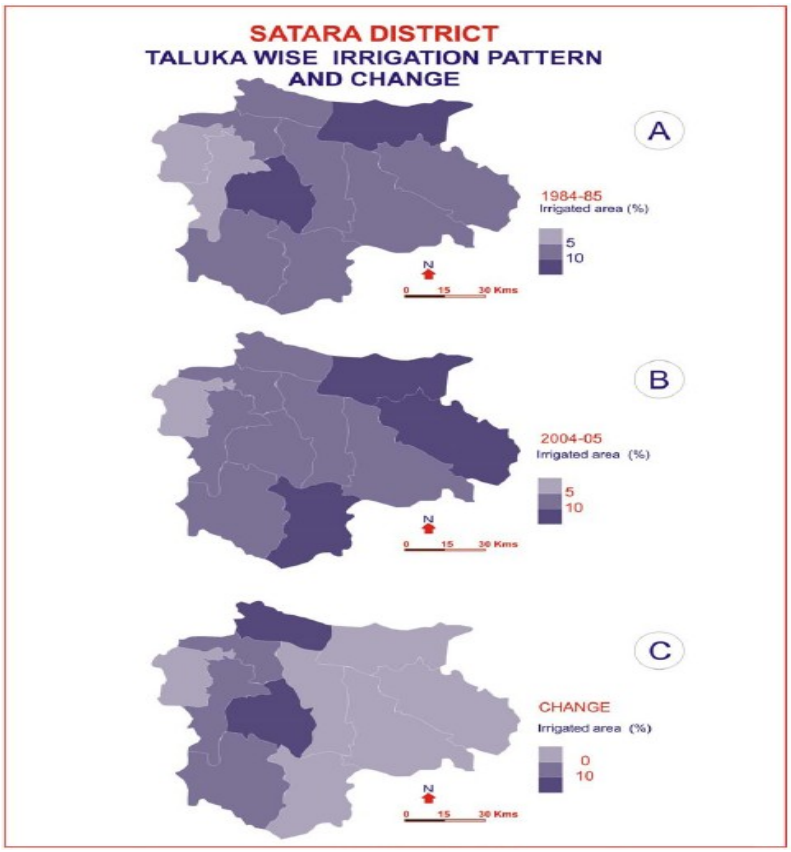

Fig. No.3.4 A, B & C

JAWALI

This taluka of Satara on district is in the western part of the district the topography is not condusive There is heavy in but rain water is not arrested at many places so there is very less use of rainfall water

During 1984-85 the area under surface irrigation was 1495 hect and under well irrigation just 815 hect and total area under irrigation 2750 hect. During 2004-05 the 1938 hect and 4615 hect area irrigated by surface water irrigation and well irrigation and total irrigated area was 9509 hects.

There is improvement in irrigation during those days total 6754 hect land brought under irrigation.

PATAN

Patan taluka is in extreme western side and ranges of Sahyadri due to rugged topography and forest area very less land under irrigation even the this takka has a boon of dam and Koyana river.

The irrigation situation of Patan taluka during 1984-85 was area under surface water irrigation 3946 hect and just 594 hect by well irrigation the total area under irrigation was 5675 hects. in last 20 years the area under surface water irrigation changing to 3664 hect. By well irrigation changed into 8073 hect. the total brought under irrigation 7050 hect by using various schemes of Govt.

KARAD

Only this talaku of Satara district is showing negative change in irrigation, because, farmers illiteracy in irrigation, over dosage of water, extensive use of fertilizer, urbanization, formation of saline and alkaline soil. Soil selling for break making. Instead increase in area under irrigation there was decrease in area under irrigation that is from 2067 hect to 15493 i.e. - 5180 hect.

3.5 SCOPE FOR IRRIGATION DEVELOPMENT

Irrigation is one of the significant input for development of the agriculture .The success of agriculture depends to large extent on how successfully water requirements of can we met (Arora 1976) Availability of water in the region present the scope for development of irrigation.

Presently many schemes on Krishna and koyana and urmodi are under construction which would create large potential and may head lead toan extension of commercial crop in future .The more and more lift irrigation schemes will be developed by improving rural electrification and financial assistance.

The rain water can also be tapped in the east by constructing a chain of water percolating tanks .There is however, need to harness streams and other possible sites. In general lift irrigation in the west and central parts and well and tank irrigation in the east have better future in the entire region.

3.6 REFERENCES

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CHAPTER IV

IRRIGATION AND CROPPING PATTERN

4.1 General Land Use Pattern

4.2 Area Under Different Crops

4.3 References

In the earlier chapter an attempt has been made to investigate the spatio- temporal pattern of irrigation facilities during the period under review. This chapter deals with an analysis of general land use, cropping pattern and irrigated cropping patter and changes therein.

4.1 GENERAL LAND USE PATTERN

Land is basic source of human society and land use is the surface utilization of developing and vacant land it is use made of the land by man in a series of recognized category. land use is an important economic activity of man it is function of four variables viz. land, water, air, and Man certain proportion of its available for cultivation , which the best base for the agricultural production land use changes occur to meet the variables demands of the society in its new way of life .

The primary use of land for crops forest, pasture, mining, transportation, gardening, residential, recreational, industrial, commercial, cultivable waste, barren and fallow land.

The land use study in its spatial context is essential to understand the regionalization of the areas of optimum land use degraded area etc.

The change in the land use pattern of Satara district depict the interaction among all these elements. To study these changes the total area has been studied under two heads viz.-

i) Non cultivable

ii) Cultivable land

TABLE NO. IV-I
SATARA DISTRICT
LAND USE PATTERN

Sr.No.	Land use categary	Area in hector 2004- 05	percent	Area in hector 1984 - 85	percent	Change
I)	Non cultivable land					
	1) Forest	137572	12.99	145800	13.78	-0.79
	2) Area not available for cultivation	121212	11.45	115100	10.87	+0.58
	a) land under non agriculture	28151	2.66	22800	2.15	-0.57
	b) Barren and uncultivated land	93061	8.7	86300	8.15	-0.55
II)	Cultivable land					
	3) Net area sown	551911	52.15	589700	55.72	-3.57
	4) Fallow land	124559	11.76	71400	6.74	5.02
	a) Current fallow	53881	5.09	16300	1.54	3.55
	b) Other fallow	70678	6.67	55100	5.20	1.47
	5) Other uncultivated land	122989	1.62	136300	12.87	-1.25
Total		1058243	99.97	1058300	99.98	

Source: Socio - Economic abstract, Satara district 1986and 2006

4.1.1 NON CULTIVABLE LAND

The non-cultivable land comprises forest land and area not available for cultivation. Forest occupies 12.99percent of the total geographical area in 2004¬2005 which was about 13.78percent in 1984-85. The forest area is in the western part of the study area which coincides with the rainfall distribution and topography. Area not available for cultivation is about 11.45percent (121212 hect) of the total study area. It includes land which cannot be brought under cultivation unless at very heavy cost and rugged and barren topography. The land put to non-agricultural use is 2.66 percent (28151 hect.) and barren and uncultivated land is 8.7 percent (93061 hect) of the total area of Satara district shows the regional distribution of area not available for cultivation. Its proportion is high in eastern, western, North western part of study area. (Fig. no. 4.1 A and B)

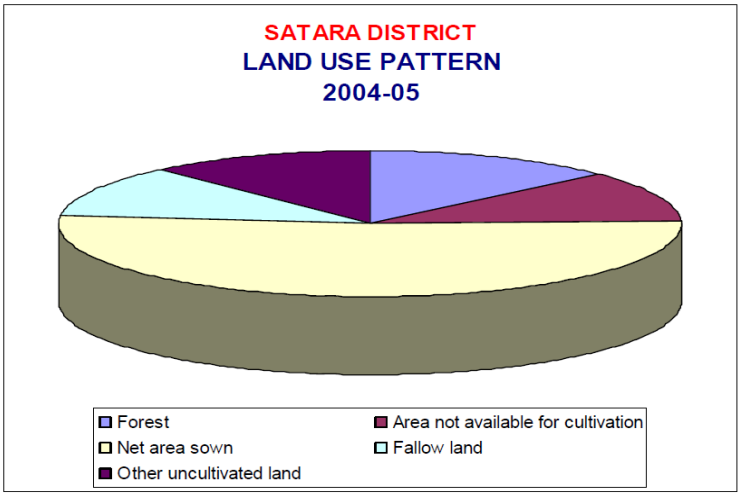

Fig. no. 4.1 A

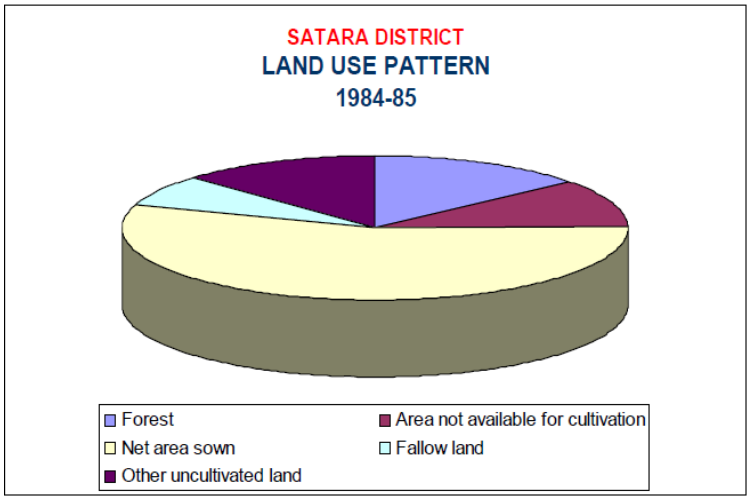

Fig. no. 4.1 B

4.1.2 CULTIVABLE LAND

The cultivable land which includes the net area sown and follow land shares about 52.15 percent of the geographical area in the present study the same meaning is taken for analyzing the impact of irrigation generally in central , northern, southern, part of such area has high percentage (over 75 percent). Generally high proportion of net sown is due to level land. The northern eastern

and south central have moderate (70 to 75) area under this category.

The low (60 to 70 percent) intensity of net area sowed lies in eastern and western part study area. Moreover very low net area sown observed in western and eastern part of study area. Here the land is highly undulating mountainous of rugged topography.

The land which remains vacant for 6 to 10 seasons comes under fallow land class. The total fallow land accounts to 11.76 percent (fig. no. 4.1 A and B)

4.2 AREA UNDER DIFFERENT CROPS JOWAR

Jowar is the crop produced in both Kharip and Rabi season. In eastern zone of Satara district it is more i.e. in Phaltan taluka during 1984-85 total cultivation was 58856 hect. It is decreased upto 26691 hect. in 2004-5. It is followed (28.50percent) by man and Khatav taluka, Patan and Wai taluka are leading in area under Jawar production i.e. 11434 hect. (33.36percent) and 13619 hect (39.74percent) in 1984-1985. There is somewhat incrase in area under jowar in Patan, Jawali i.e. 18333 hect (36.21percent) 170501 hect (33.75percent) and in Mahabaleshwar 4591 hect (9.13percent) it was just 285 hect during 1984.85.

Central part of the district was dominant in Area under jowar production like Karad, Koregaon, Satara and Khandala. The area under jowar cultivation was 27331 hect (27.46percent) 21216 hect (21.44percent) respectively. There is decrease in area under jowar crop. During 2004-05 Karad 17519 heact (26.46percent) Satara 17062 hect (25.77percent) Koregaon 16830 (28.14percent) and Khandala 12985 hect (19.61percent) during 2004-05 because most of the farmer cultivating wheat and other irrigated crops due to availability of irrigation facilities.

The positive change shows by Man and Khatav taluka i.e. 11.87percent and 11.48percent. Phaltan shows negative change i.e. -23.35percent due to source of irrigation facilities area under jowar crops increased. Even amount of rain is less in eastern part of the district.

Negative change found in Wai taluka i.e. -27.71percent, Jawali - 7.7percent and Mahabaleshawr -8.3percent in western part of the district.

Karad, Koregaon and Khandala taluka of central part shows negative changes because land under other crops increased only Satara taluka shows positive change in case of jowar crop. (Table no. IV-II and Fig. no.4.2 A, B, C.)

TABLE NO. IV-II
SATARA DISTRICT
AREA UNDER JOWAR

Sr.No.	Taluka	1884 - 85	percent	2004 - 05	percent	Change
	Eastern Part					
I	Man	21049	18.54	28478	30.41	11.87
Ii	Khatav	33588	29.59	38454	41.07	11.48
Iii	Phaltan	58856	51.85	26691	28.5	-23.35
	Total	**113493**		**93623**		
	Western Part					
I	Patan	11434	33.36	18333	36.21	2.85
Ii	Jawali	8929	26.05	17050	33.75	-7.7
Iii	Mahabaleshwar	285	0.83	4591	9.13	-8.3
Iv	Wai	13619	39.74	10648	21.03	-27.71
	Total	**34267**		**50622**		
	Central Part					
I	Karad	27331	27.46	17519	26.46	-1
Ii	Satara	21263	21.36	17062	25.77	4.41
Iii	Koregaon	29585	29.72	18630	28.14	-1.58
Iv	Khandala	21345	21.44	12985	19.61	-1.84
	Total	**99524**		**66196**		

Source: Socio - Economic abstract, Satara district 1986 and 2006

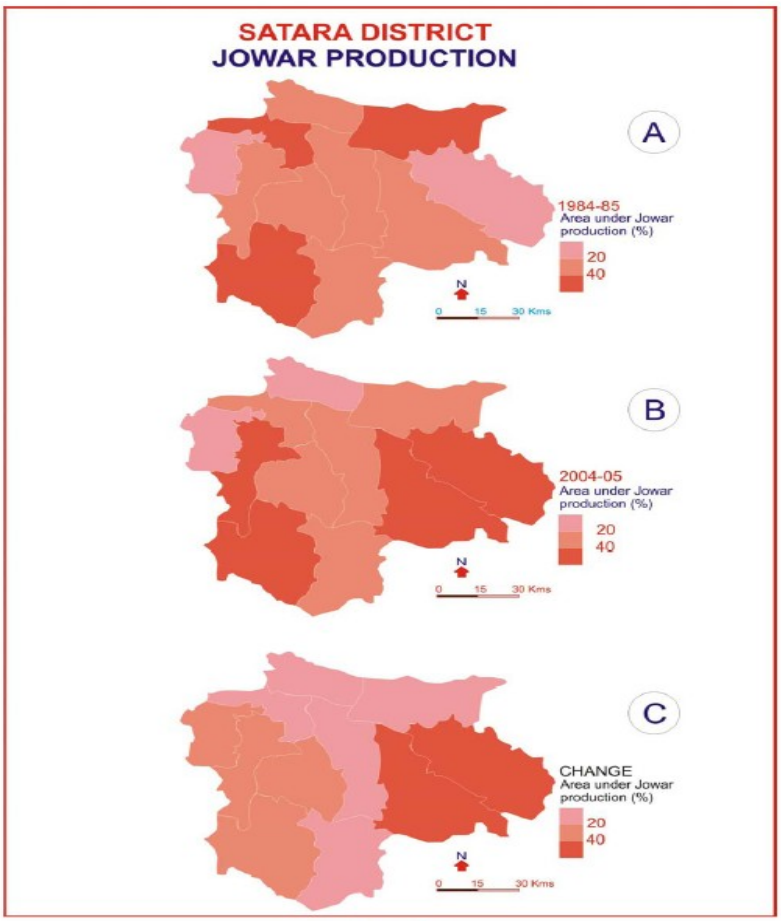

Fig. No.4.2 A, B & C

WHEAT

Wheat is the most significant crop grown during the winter season. It requires a cool climate with moderate rainfall less than 50cm and irrigation. As such in the study region the post monsoon rainfall is not sufficient for optimum production. Therefore it is the irrigation which determines it's a real extent wheat occupies maximum are in eastern part of the district i.e 9413 hect. other two part central and western occupies 7255 hect and 3944 hect respectively during 1984-85. The area under wheat crop in eastern, western and central part of the district increased during 2004-05 into 12026 hect, 7988 hect and 10984 hect talukawise there was more land under wheat crop in Khatav, Phaltan, Patan and Karad and it is followed by Man, Satara, Koregaon. In the central part,

Karad was leading taluka having more area under wheat crop i.e. 4748 hect (43.54percent), eastern part Khatav 5114 hect (34.37percent) and Paltan 4060 hect (27.28percent). The little increase in area under wheat is recorded in Wai, Jawali and Mahabaleshwar taluka.

The positive change in area under wheat is recorded in Man (6.36percent) Khatav (7.79percent) Patan (34.94percent) Karad (9.35percent) Satara (2.79percent) Koregaon (6.9percent) Khandala (15.93percent).

Negative change is observed in Phatan (-33.33percent) Wai (-0.31percent) taluka of the district.

Compare to other cereal crops there is remarkable change in area under wheat crop. (Table no. IV-III and Fig. no.4.3 A, B, C.)

TABLE NO. IV-III
SATARA DISTRICT
AREA UNDER WHEAT

Sr.No.	Taluka	1884 - 85	percent	2004 - 05	percent	Change
	Eastern Part					
I	Man	1205	12.8	2852	19.16	6.36
Ii	Khatav	2502	26.58	5114	34.37	7.79
Iii	Phaltan	5706	60.61	4060	27.28	-33.33
	Total	**9413**		**12026**		
	Western Part					
I	Patan	939	23.27	4650	58.21	34.94
Ii	Jawali	1452	38.22	467	5.84	-32.38
Iii	Mahabaleshwar	194	4.8	205	2.56	-2.24
Iv	Wai	1359	33.68	2666	33.37	-0.31
	Total	**3944**		**7988**		
	Central Part					
I	Karad	2481	34.19	4748	43.54	9.35
Ii	Satara	1776	24.47	2364	21.68	2.79
Iii	Koregaon	1427	19.66	2897	26.56	6.9
Iv	Khandala	1571	24.13	895	8.2	15.93
	Total	**7255**		**10904**		

Source: Socio - Economic abstract, Satara district 1986and 2006

RICE

Among the cereals rice crop is more important requiring high temperature and rainfall. Western and central part of the district occupies more land under rice cultivation. There is variation

in rice cultivation in different taluka Patan 12453 hect. Jawali 5645hect, Karad 6850 hect and Satara 5124 hect area under rice crop during 1984-85.

The area under rice cultivation has increased in all talukas of the district region wise it is increased upto to 12265 hect in eastern region 19497 hect in western region there is little decrease in central part i.e. 13121 hect. during 2004¬2005.

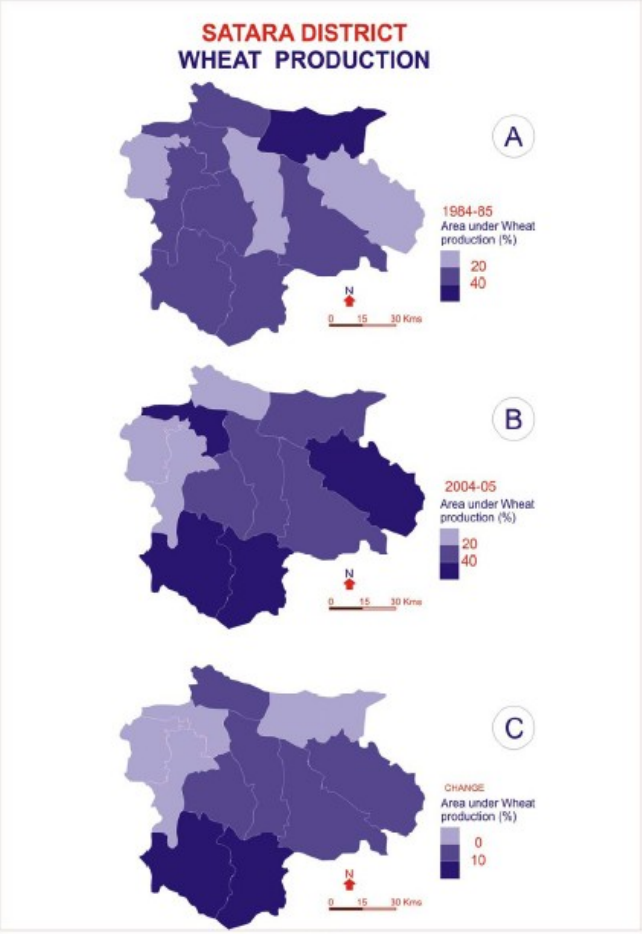

Fig. No.4.3 A, B & C

The significant increase in area under rice crop has been found in eastern part i.e. form 1073 hect to 12265 hect. there is decrease in central part i.e. from 13571 hect to 13121 hect and decrease also found in western part i.e. from 22044 hect to 19497 hect during the span of 20 years.

Positive change observed in Man (3.48percent) Wai (4.39percent) Karad (3.67percent) Koregaon (7.33percent) Khandala (1.75percent) Jawali (1.77percent) Introduction of high yielding varieties irrigation facilities and attentive provides seem to have encouraged rice cultivation. Attraction to the farmers and it has made rapid strides particularly in the irrigated tracts of the Krishna valley in recent year. Its uneven Spatical distribution in Karad taluka is concerned with spatial distribution the soil fertility and irrigation facilities sugarcane cultivation is largely confined to the central and western part of study area. (Table no. IV-IV and Fig. no.4.4 A,B,C.)

TABLE NO. IV-IV
SATARA DISTRICT
AREA UNDER RICE

Sr.No.	Taluka	1884 - 85	percent	2004 - 05	percent	Change
	Eastern Part					
I	Man	238	22.18	3148	25.66	3.48
Ii	Khatav	592	55.17	5102	41.59	-13.58
Iii	Phaltan	243	22.64	3015	24.58	1.94
	Total	1073		11265		
	Western Part					
I	Patan	12452	56.48	9644	49.46	-6.82
Ii	Jawali	5645	25.6	5337	27.37	1.77
Iii	Mahabaleshwar	707	3.2	795	4.07	0.87
Iv	Wai	3240	14.6	3721	19.08	4.39
	Total	22044		19497		
	Central Part					
I	Karad	6850	50.47	7111	54.14	3.67
Ii	Satara	5124	37.75	3354	25.56	-12.19
Iii	Koregaon	967	7.12	1896	14.45	7.33
Iv	Khandala	630	4.64	760	5.79	1.15
	Total	13571		13121		

Source: Socio - Economic abstract, Satara district 1986and 2006

SUGARCANE

Sugarcane comprises about 8717 hect in eastern part, 3612 hect in western zone and 16264 hect in the central part of Satara district during 1984-85. Negative change i.e. below 0percent tot eh respective part of study region observed in Khandala, Phaltan, Karad, Patan and Wai taluka.

Positive change found above 40percent found in Khatav and Koregaon taluka due to availability of irrigation facilities and special efforts of Govt. to bring more land under irrigation through various irrigation schemes.

The significant positive change observed in Man, Khatav, Jawali, Satara and Koregaon taluka. The confluence of Krishna and Venna at Sangam Mahuli, Krishan and Koyana at Karad made it possible to increase in land under irrigation with irrigation facilities and special efforts made by co-operative sugar factories. Increase in sugarcane production is proportionate to increase in irrigated area. The negative change below 0 percent in area under cane noted in Karad, Wai, Phaltan taluka. It may be due to change in farmers attitude. They are performing other cash crops like fruit garden, other crops. And somewhere land become saline and Alkaline due to over irrigation and some people selling upper layer of soil for brick making, the land under sugarcane due to social encroachment.

Karad (14127) hect. Koregan (6610 hect) Patan (8081 hect) Wai (5443 hect) Phaltan (4025 hect) area under this crop during 2004-05. This is the area where irrigation facilities are comparatively more developed. The moderate area under this crop observed in Man, Khatav, Satara taluka and low area under sugarcane crop observed in Jawali and Khandala taluka due to rugged topography and mountainous region with low rainfall and less irrigation facilities.

There is no any single piece of land under sugarcane cultivation in Mahabaleshwar taluka because unfavorable condition. The fertile soil better irrigation facilities and other agro climatic conditions are responsible for concentration of cane cultivation in Krishna river basin in Karad, Koregaon, Satara and Wai taluka.

The period under investigation has withnessed phenomenal growth in area under cane. Which rose form 28293 hect to 47015 hector. In the span of 20 years. (Table no. IV-V and Fig. no. 4.5 A, B, C.)

TABLE NO. IV-VI
SATARA DISTRICT
AREA UNDER SUGARCANE

Sr.No.	Taluka	1884 - 85	percent	2004 - 05	percent	Change
	Eastern Part					
i	Man	714	8.19	1259	17.76	9.57
ii	Khatav	925	10.61	1802	25.43	14.82
iii	Phaltan	7078	81.19	4025	56.8	-24.39
	Total	**8717**		**7086**		
	Western Part					
i	Patan	2050	56.75	8081	55.81	-0.94
ii	Jawali	75	2.07	955	6.59	4.52
iii	Mahabaleshwar	0	0	0	0	0
iv	Wai	1487	41.16	5443	37.59	-3.57
	Total	**3612**		**14479**		
	Central Part					
i	Karad	12792	78.65	14127	55.5	-23.15
ii	Satara	1635	10.05	3965	15.57	5.52
iii	Koregaon	1244	7.64	6610	25.97	18.33
iv	Khandala	593	3.64	748	2.93	-0.71
	Total	**16264**		**25450**		

Source: Socio - Economic abstract, Satara district 1986and 2006

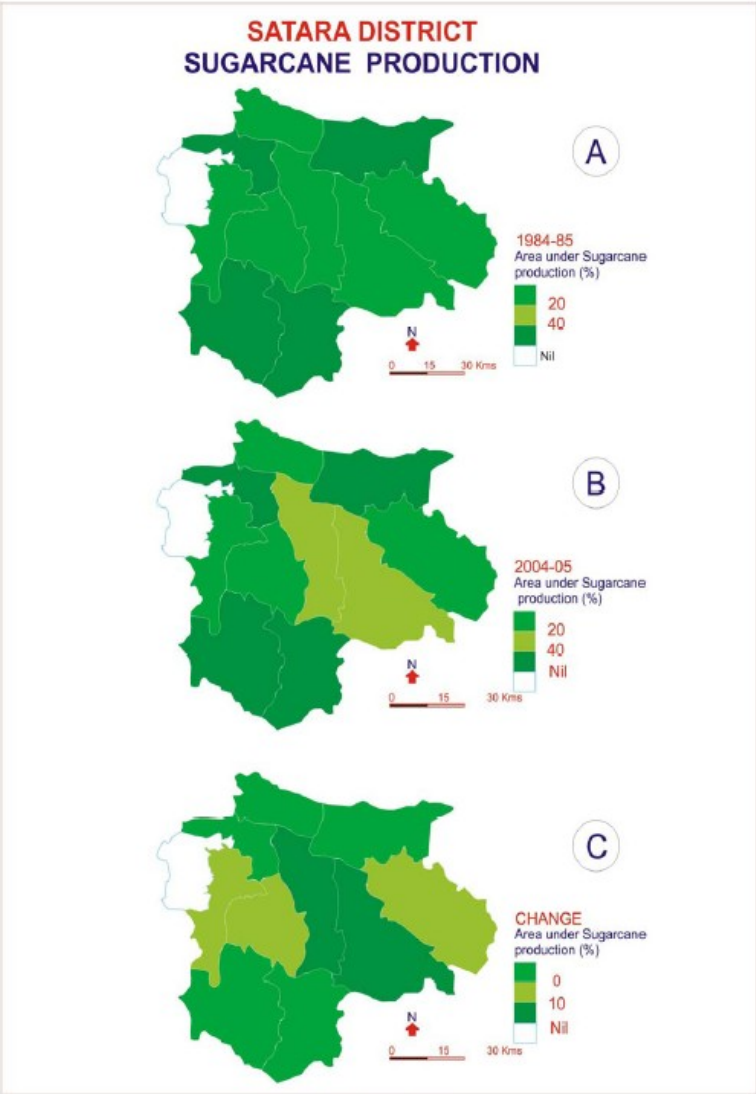

Fig. No.4.5 A, B & C

GROUNDNUT

Groundnut is a leguminous crop and can synthesize atmospheric nitrogen and thereby increase fertility, sandy loans loams and well drained black soil which allow enough of root turning are suitable for groundnut cultivation. It cannot stand for severe drought and water stagnation groundnut is cultivated in Kharip and Rabi season it can grow both as an irrigated and rain fed corp.

The area under groundnut it observed more it. Above 40percent in Khatav, Patan, Karad taluka of the Satara district. During 1984-85, and in 2004-2005 the maximum land that is above 40percent found under groundnut cultivation in Khatav (94.64percent) Satara (40.65percent) moderate land underground cultivation observed in Wai (22.07percent) Karad (34.50percent) and low area observed in Khandala (2.36percent) Jawali (16.54percent) Phaltan (2.56percent) Man (2.78percent) taluka to the total percentage of their respective division or part. (Table no. IV-VI and Fig. no. 4.6 A, B, C.)

TABLE NO. IV-VI
SATARA DISTRICT
AREA UNDER GROUNDNUT

Sr.No.	Taluka	1884 - 85	percent	2004 - 05	percent	Change
	Eastern Part					
I	Man	350	19.29	399	2.78	15.51
Ii	Khatav	958	50.07	13536	94.64	44.57
Iii	Phaltan	605	31.62	367	2.56	-29.06
	Total	**1913**		**14302**		
	Western Part					
I	Patan	11031	62.89	7965	30.68	-32.21
Ii	Jawali	2537	14.46	4294	16.54	2.06
Iii	Mahabaleshwar	3	0.01	0	0	0.01
Iv	Wai	3969	22.62	5730	22.07	-0.55
	Total	**17540**		**17989**		
	Central Part					
I	Karad	13469	40.45	10682	34.5	-5.95
Ii	Satara	13302	39.95	14146	46.65	6.7
Iii	Koregaon	5534	16.62	5402	17.44	0.82
Iv	Khandala	990	2.97	731	2.36	-0.61
	Total	**33295**		**30961**		

Source: Socio - Economic abstract, Satara district 1986and 2006

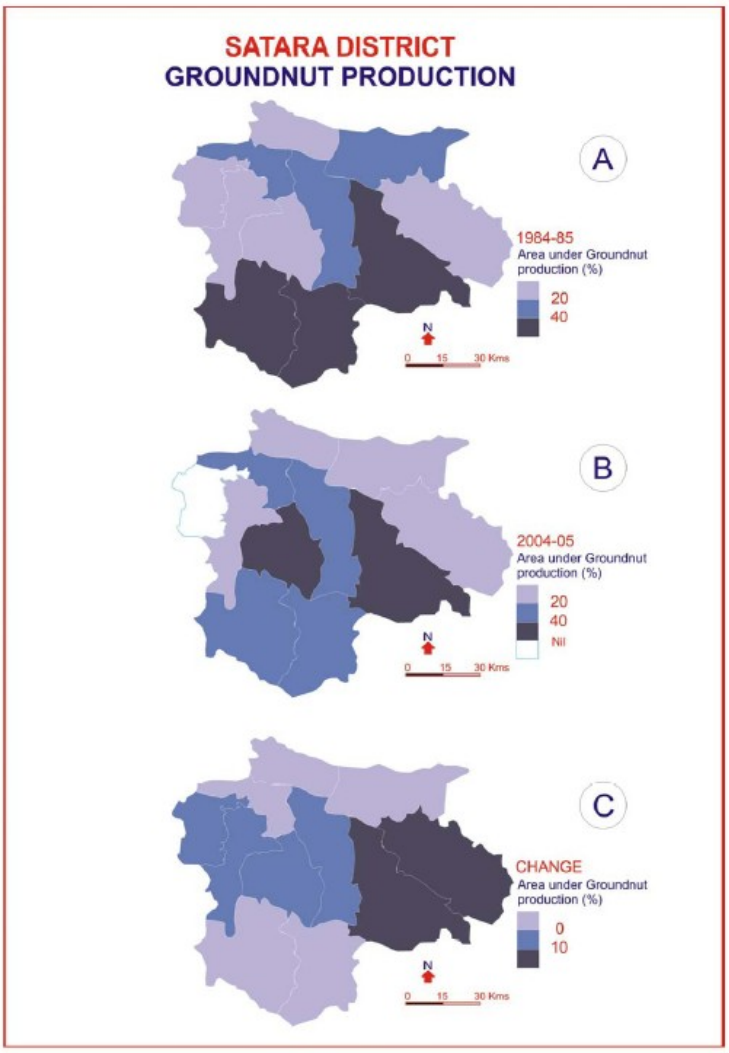

Fig. No.4.6 A, B & C

GRAM

Gram is one of the important pulses grown in Rabi season along with wheat or some time separately. In the eastern part of study area Khatav taluka recorded 311 hect. (76.36 percent) land under gram production. In Wai taluka 1136 hect. (60.04 percent) land under gram production. Mahabaleshwar recorded just 5 hect. land under gram production in 1984-85.

Khatav, Phaltan and Man taluka recorded 4906 hect. (48.13 percent), 2900 hect. (28.45 percent) and 2687 hect. (26.36 percent) land under gram production respectively. There was tremendous increase in land under gram in the western part of study area. Patan 4850 hect. (45 percent), Jawali 2784 hect. (25.83 percent) and Wai 3120 hect. (28.95 percent) land under gram. Mahabaleshwar recorded 22 hect. land under gram in 2004-05.

Positive changes noted in the taluka like Man, Khatav, Phaltan, Patan and Khandala taluka of study area. Negative changes found in Mahabaleshwar (-0.08 percent), Wai (-31.05 percent), Karad (-7.02 percent) and Koregaon (-7.31 percent) because the attention of the farmer diverted to cultivate other cash crops due to availability of irrigation sources. (Table no. IV-VII and Fig. no. 4.7 A, B, C.)

TABLE NO. IV-VII
SATARA DISTRICT
AREA UNDER GRAM

Sr.No.	Taluka	1884 - 85	percent	2004 - 05	percent	Change
	Eastern Part					
i	Man	491	12.05	2687	26.36	14.31
ii	Khatav	3111	76.36	4906	48.13	28.23
iii	Phaltan	472	11.58	2900	28.45	16.87
	Total	**4074**		**10493**		
	Western Part					
i	Patan	268	14.16	4850	45	30.84
ii	Jawali	483	25.52	2784	25.83	0.31
iii	Mahabaleshwar	5	0.26	22	0.2	-0.08
iv	Wai	1136	60.04	3120	28.95	-31.05
	Total	**1892**		**10776**		
	Central Part					
i	Karad	1135	34.97	4590	27.95	-7.02
ii	Satara	493	15.19	4750	28.92	13.73
iii	Koregaon	1526	47.02	6521	39.71	-7.31
iv	Khandala	91	2.8	560	3.41	0.61
	Total	**3245**		**16421**		

Source: Socio - Economic abstract, Satara district 1986and 2006

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CHAPTER V

IRRIGATION AND AGRICULTURAL PRODUCTIVITY

5.1 INTRODUCTION
5.2 INPUTS USED
5.3 METHODOLOGY
5.4 BHATIA'S METHOD
5.5 CROP PRODUCTIVITY AND CHANGES
5.6 REFERENCES

5.1 INTRODUCTION

The previous chapter is devoted to the study cropping pattern and changes there in the present chapter aims to and lyses, how far irrigation has changed the agricultural productivity.

The term agricultural productivity is both a dynamic relative concept it is used to express the efficiency of agriculture agricultural productivity is the level of existing performance of a unit of land which differentiates from one area to another agricultural productive of an area is influenced number of physical social, institutional and organizational factors, beside these their productivity also depends on availability of labour supply of capital and encouragement by the govt. Thus it is the result of combined interplay of physical and human factor.

5.2 INPUTS USED

Mechanical biological and chemical inputs are playing important role in transformation of agricultural crop yield in the study region. It is noted in field observation that the adoption of form technology is increasing found in the irrigated areas. The improved iron plough, tractors, electric pumps, seedlings spray pumps, duster, sugarcane crusher are the modern machinery.

Wooden plough is traditional implement largely used in un irrigated hilly parts of the Satara on taluka. Iron plough is used for deep ploughing as compare to wooden plough. The formers are showing progressive trend in the use mechanical inputs. The mechanization is not possible in western and eastern hills areas. However the farmers in the level land of irrigated areas. Responding positively for the modernization of agriculture. The level of land is always suitable for mechanized farming provided other conditions are favorable sigh.

The adoption of chemical inputs such as HYV seeds has increases as they, respond more rapidly of the fertilizers and water input. There are significant centers in Karad taluka and many more centers in Satara district. Moreover, Satara Zilla Parishad, every

Panchayat Samitee 11 taluka Kharedri-vikri society of every taluka and private traders related to agricultural inputs provides.

a) High yielding verities of seeds.

b) Fertilizers

c) Crop protection materials

1. Fungicide
2. Weedicide
3. Insecticide

d) Organic manures etc.

All these institutional sources of finance provide loan and financial assistance to the farmer to purchase bio-chemical inputs. The green manure is also used to maintain the fertility of the soil. Moreover the protection of sensitive crop. All the types of chemicals in both form i.e. powder and liquid are used (pesticide) to increase the productivity of land.

TABLE NO. V-I
SATARA DISTRICT
AGRICULTURAL INPUTS

Sr.No.	Agricaltural implements	2004 - 2005	1984 - 1985
1	Total No. of plough i) Wooden ii) Steel	55502 27077 28425	88292 46302 41990
2	Total No. of Bollocks Carts	28056	33012
3	Sugarcan Crushers i) Power driver ii) Bullock driver	641 471 170	615 560 55
4	No of pumps for irrigation i) Electric pumps ii) Disel Engine	39246 30292 8954	34694 21498 13196
5	No of Tractors	6524	2445

Source: Socio-Economic abstract 1986 and 2006

5.3 METHODOLOGY

Experts in Agricultural Geography have developed many techniques suitable for the measurement of agricultural productivity. The assessment of agricultural productivity in terms of grain equivalent per head of population was first employed by Back (1937) in his study of land utilization. The need to determine the spatial variations in agricultural productivity statistically was realized by Kendall (1939) who devised for it a method called ranking co-efficient. L.D. Stamp (1943) determined agricultural productivity by Kendall's method by selecting number of countries and some major crops. However the method was found to be inaccurate as it did not take note of the areal strength of the individual crops.

Sapre and Deshpande (1964) tried to eliminate this defect by weighting the ranks of the individual crop by their proportion in the total cropped area in the region. The areal units were graded in ranking order according to their output per unit area and ranking coefficients were derived.

Singh, Jasbir (1972) has attempted to measure the agricultural efficiency of Haryana in terms of nutrition per unit area. Singh Jasbir et. al. (1982) recently applied a technique known as the crop yield and concentration indices ranking coefficient.

Bhatia (1967) used the index suggested by Sapre and Deshpande with slight modification. He used Yield Index of crops, instead of yield ranking of individual crops.

P. Sen Gupta (1968) also used the same index as prepared by Bhatia for stubbing agricultural efficiency in India.

Sinha (1972) has developed the standard deviation and standard core method to determine the agricultural productivity in India at the district level.

Shinde, Jadhav and Pawar (1978) measured agricultural productivity of Maharashtra plateaue by money value co-efficient method.

In the present study first individual crop productivity is assessed to show the variations in agricultural productivity by

location quotient. Talukas are chosen as the basic areal unit and the span study period covers 20 years from 1984-85 to 2004-05.

5.4 BHATIA'S METHOD

The crop productivity is determined by Bhatia's yield index method, he suggest that contribution of each crop agricultural efficiency is in relation to its proportionate share to crop land. Bhataia's formula of agricultural efficiency is read thus.

$$Iya = \frac{Yc}{Yr} \times 100$$

Where,

Iya = yield Index of crop 'a'

Yc = is the hectare yield of crop 'a' in the component areal unit

Yr = is the hectare yield of crop 'a' in the entire region.

$$Ei = \frac{Iya \times ca + Iyb \times cb + ... + Iyn + cn}{Ca + Cb + Cc + ... + Cn.}$$

Where,

Ei is the agricultural efficiency index Ca, Cb……Cn are the percentage of crop land under different crops. With this technique the value are computed and depicted.

5.5 CROP PRODUCTIVITY AND CHANGES

In the study of agricultural productivity it is of interest to know the general areas where different crops dominate and their contribution in agricultural productivity for this purpose viz. Jowar, Wheat, Rice, Groundnut, Sugarcane, Gram, have been considered. These crops are grown in various part of the district I different combination and they contribute significantly total agricultural productivity.

5.5.1 JOWAR

The distribution of Jowar productivity is plotted in fig no. 5.1 A and B. The high (above 200percent index) productivity of Jowar mainly in central and southern part of study area covering Khatav, Koregaon, Satara, Jawali, Karad and Wai taluka more than 300percent index. The area under high productivity covers. 85percent area of the district in 2004-05. The northern and western taluka like Khandala, Phaltan and Wai have recorded moderate Productivity Index (100 to 2005percent) of Jowar, it contribute 10 percent area of the total cropped area. Whereas the area under low productivity has been recorded by Mahabaleshwar taluka. Major taluka of the Satara district producing Jowar crop on large scale in both season i.e. Kharip and Rabi. Jowar crop is dominant crop due to all conducive condition.

5.5.2 RICE

The fig. no. 5.2 A and B reveals the spatial pattern of productivity of rice in study area. The high (above 200percent index) productivity of rice is not found all over the district, because of the unfavorable condition of atmosphere like, rainfall, soil. But only one taluka has record the moderate productivity i.. (100 to 200percent index) by Koregaon taluka i.e. 119.19percent index. Jowali, Karad, Patan and Wai taluka have the index to the moderate index i.e. Jawali. 91.70percent near index Karad- 97.29percent and Wai. 84.99percent index. It covers 100percent area to total cropped are due to high intensity of irrigation, deep and fertile soils, in 2004-05.

Low productivity (below 100percent index) have been recorded in Mahabaleshwar, Khandala, Satara and Patan taluka. Even the M.shwar, Satara Patan taluka have favorable climatic condition they have law productivity due to backwardness, illiteracy, ignorance, awareness about the crop among the people.

Some taluka recorded no production of rice like Phaltan, Man and Khatav, these areas are always under drought condition.

5.5.3 WHEAT

The spatial pattern of wheat productivity is depicted in fig - reveals the high productivity of wheat (above 200percent index) not confined by any taluka of the study area.

The moderate productivity (100 to 200percent index of wheat is observed in Phaltan (143percent index) and Karad taluka (124.5percent index) 10percent area of the total cropped area covered by moderate productivity. The taluka like Khandal, Wai M.shawr, Jawli, Satra, Pant, Koregaon, Man have recorded low (below 100percent index) productivity of wheat crop, it covers maximum area to total cropped area in 2004-05. The moderate productivity has been increased due to use of fertilizers and HYV seeds.

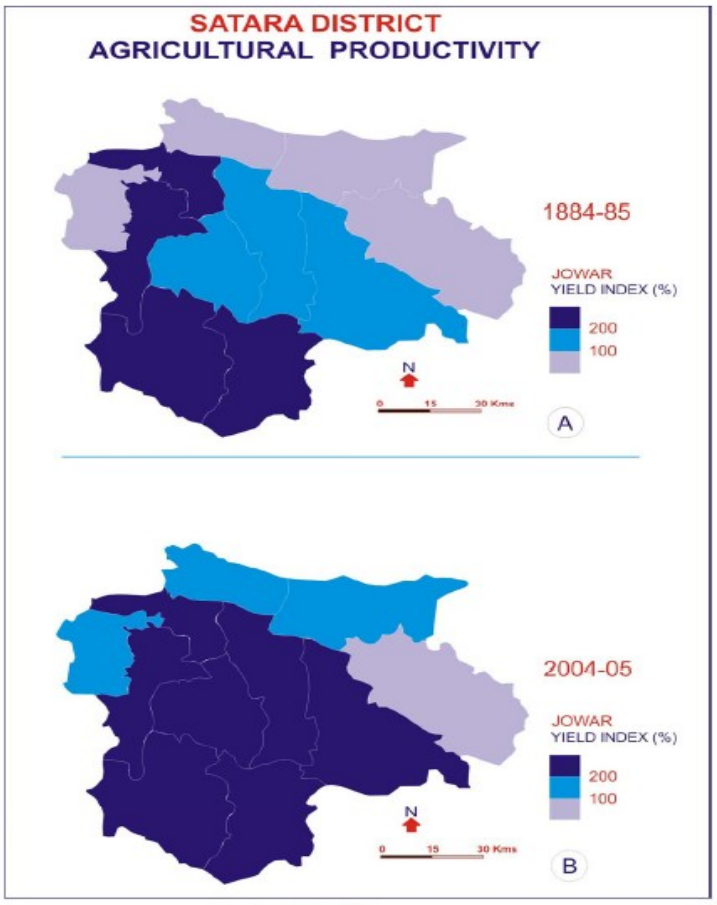

Fig. No.5.1 A & B

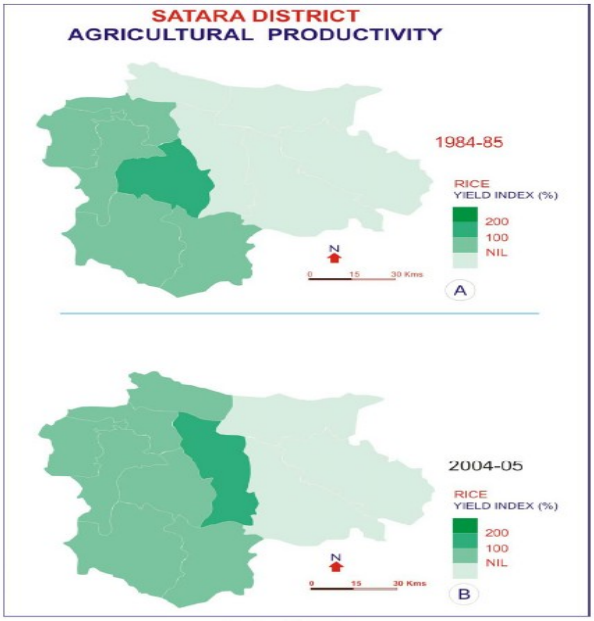

Fig. No.5.2 A & B

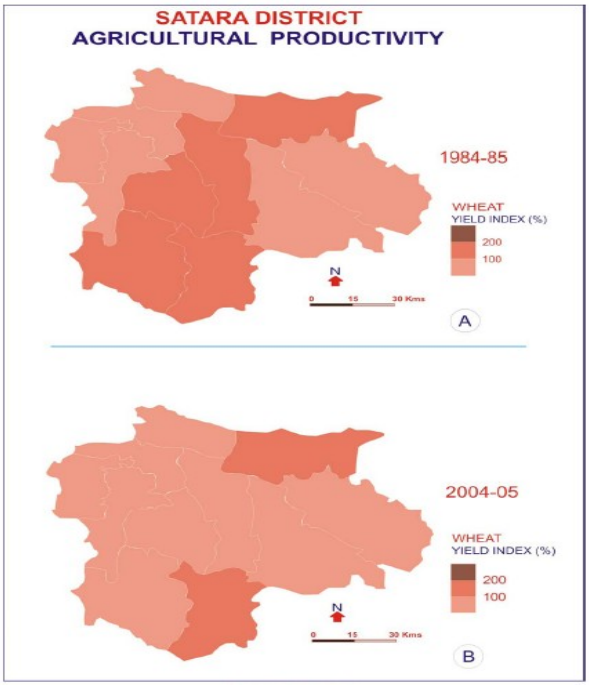

Fig. No. 5.3 A & B

5.5.4 SUGARCANE

The soil, climate and irrigation are the important factors which affects the productivity of sugarcane. The productivity of sugarcane is the manifestation of the integrated impact of factors like physical social economic and institutional (Jadhav' 1984) The distribution pattern of productivity of sugarcane plotted in fig. - The high (above 200percent index) productivity of sugarcane is noted in any taluka of the district.

The moderate productivity (100 to 200percent) of sugarcane is noted in Wai, Phaltan, Koregaon, Jawali and Karad due to irrigation facilities made by government, deep balck soil and techniques adopted by farmer, Wai taluka noted 113percent yield index which is top most productivity of sugarcane in district. Even in Karad taluka the productivity of sugarcane was more in previous days but it is declined due to over use of irrigation, ignorance and illiteracy of farmers the most of the land and sugarcane become Kharland, saline land or sterile land so the it resulted into moderate productivity, moderate productivity contributes near about 45.45percent area out of total cropped area in 2004-05.

The low productivity of sugarcane is observed in Jawali, Patan and Satara taluka. This may be attributed to various factors such as poor soil, finance condition of the farmer and intensity of irrigation.

There is increase in 60percent increase in area under moderate productivity during the period under study. There is no any modification of moderate productivity at high productivity. TH low productivity of sugarcane has noted significant change during the period under study.

There is no land under sugarcane production in Mahabaleswer, Khatav and Man taluka due to lack of irrigation facilities and rigid topography.

5.5.5 GROUNDNUT

The fig - reveals the spatial pattern of productivity of groundnut in the study region. The major area of high (above

200percent Yield index) of productivity of groundnut is confined to the country, Northern eastern and south eastern part of study region i.e. in Wai, Khangal, Phaltan, Koregaon Man, Khatav, Karad, Satara taluka Phaltan taluka noted high productivity i.e. 689.3percent index and followed by Khatav (363.25percent) yield index, Koregaon (306.14percent) Wai (325.54percent) Karad (303.73percent). In this taluka shallow to medium deep black soil nad favorable climatic conditions are responsible and the area under high productivity of groundnut is about 75percent to the total cropped area in 2004-05. The moderate productivity is noted in any taluka of study, region int 2004-05. The Nil productivity of groundnut noted I Mahabaleshwar, Jawali and Patan, Soil and climatic conditions are not suitable.

5.5.6 GRAM

The fig - reveals the spatial pattern of Gram in the study region. The major area of high (Above 220percent yield index) productivity noted in Wai and Karad taluka due to required conditions are available there. The area under high productivity covers 18percent area to total cropped area in 2004-05.

The moderate productivity (100to 200) of Gram is noted in Phaltan, Man, Koregaon and Satara taluka. It covers near 36percent area to total cropped area. In the study region. The low productivity below 100percent yield is noted in Khatav, Khandala, Mahabaleshwar and Jawali taluka of study area. Agricultural productivity and changes.

The agricultural productivity is measured by applying Bhatia's method in order to study regional difference in levels of agricultural productivity which helps to delimit the weaker area from the point of view of agricultural production.

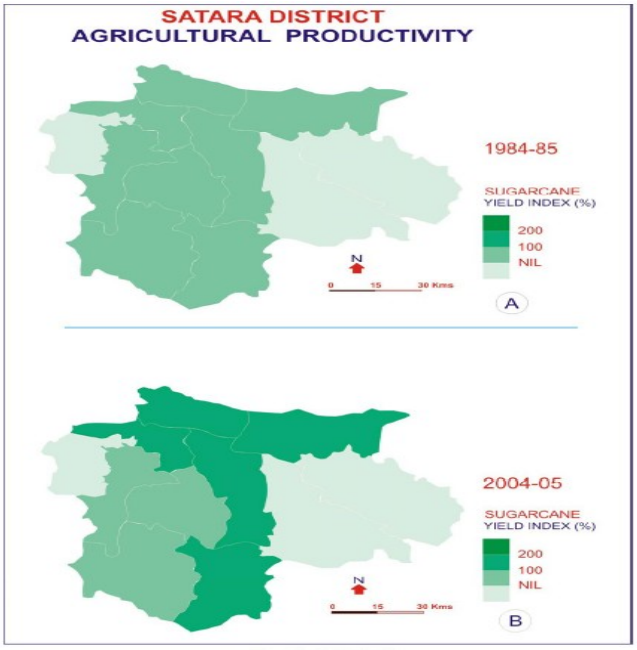

Fig. No. 5.4 A & B 80

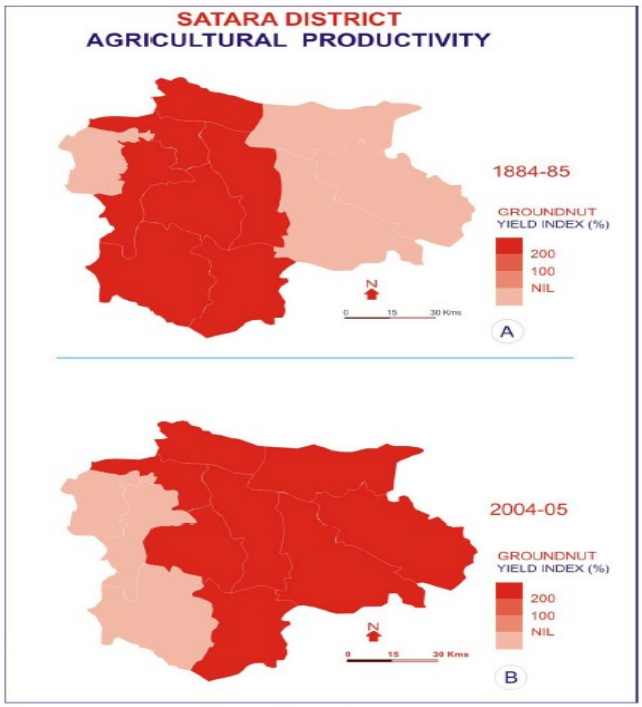

Fig. No. 5.5 A & B 80

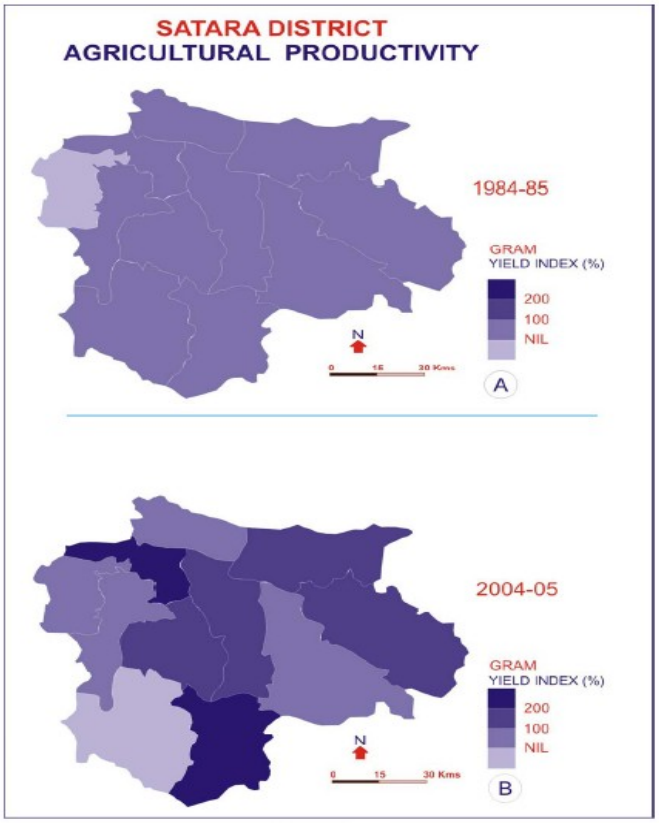

Fig. No. 5.6 A & B

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CHAPTER VI

CONCLUSION

The region is characterized by different physical features which have affected the methods and development of irrigation. As the study of irrigation conducted in the Satara district reveals spatio-temporal pattern of irrigation. It is observed that the percentage of area under irrigation has increased about hect. During last 20 years.

This mainly because of development in lift irrigation and various major and minor irrigation project of the Govt. The two main river basin are suitable for canal and lift irrigation. Whereas eastern, western and some part of central region in the favour of well irrigation. However eastern, western and some portion of central part is cultivated have scarcity of irrigation.

The whole study region depends for its water need on southwest monsoon which is irregular both in space and time. Hence irrigation is essential for the growth of crops in dry months. An evidence suggest that well irrigation is dominant source of irrigation. Constituting 48.51 percent of total irrigated area of the region. This followed by surface water irrigation consisting canal and lift irrigation. Canal irrigation is important in central as well as southern and eastern part of the district lift irrigation is dominant in Karad taluka and adjoining area, western part of Satara district is influenced by local sources of irrigation like rainfall well and tube well. The terrain and soil types have dominated the methods of

irrigation. It is found that the well, tube well, canal, and tank irrigation is practiced in eastern central and western part of the study area. Moreover drip, sprinkler and micro sprinkler methods are recently adopted by the farmers from the areas where deficiency of water to utilize every drop water. This method adopted by rich farmer, middle class and also poor farmer due subsidies offered by Government such type of irrigation needs more investment and technical know-how.

The present research work is designed to test validity of several hypotheses in context with irrigation and cultivated land.

The first important hypothesis of the present work is to test the association of irrigation development and the use of other inputs in agricultural activities. It is also observed that, the use of mechanical and biological inputs has increased in irrigated area. Wooden ploughs replaced by iron ploughs oil engines by electric pumps. Moreover use of tractor, harvesting machines is also increased. The use of chemical fertilizer and HYV seeds, organic manures and bio-techniques such as greenhouse and white house or poly house is also confined in the study regions. The use of above mentioned agricultural inputs is in all parts of study area.

The second significance hypothesis of the present work is to test the association of irrigation and inputs with cropping pattern and crop productivity. It is observed that irrigaition played a dominant role in changing the cropping pattern. It is seen that more irrigated land is used for the crop like sugarcane, wheat and rice cultivation, percentage of area under gram, bajara, wheat, rice increased. The area under sugarcane particularly in Karad taluka and adjoining area decreased. The crop diversity is high through act the region the intensity of cropping pattern is height in hilly region and low in river basin.

The proportion of cultivated land is increased with development of irrigation facilities. As some cultivated waste land brought under cultivation. Karad, Satara, Koregaon, Khandala, Wai, Phaltan have high percentage of cultivated land. It is observed that positive increase in sugarcane, wheat, rice, jowar groundnut with

increase in irrigation facilities. There is increase in area under different crops in the study area.

The analysis of level of agricultural productivity shows that there is direct relationship between the irrigation and per hect. yield and production of different crops in the reigon. The yield of sugarcane rice, jowar, wheat, bajra, groundnut and gram have increased with the development of irrigation facilities. The relationship between yields and irrigated area under selected of crops stands positive throughout the region. It also, observed from present study there are regional disparities in the level of productivity which is related to agricultural inputs used. Central part have high productivity than western and eastern part so far as the temporal changes are concerned there is tremendous changes in the productivity Mahabaleshwar, Man and Khatav noted low productivity due to shortage of water, mountainous soil, and low grade soil respectively, High productivity noted in the Karad, Satara, Wai, Phaltan, Koregaon, Patan taluka due to fertile soil and irrigation facilities. Central part noted high productivity eastern part recorded moderate productivity and west part having low productivity.

The weaker areas characterized by relatively inadequate irrigation facilities unfavorable topography and poor soil, therefore, it has been concluded that the development of agriculture in the region is commensurate with development of irrigation.

The third hypothesis of present work is to test negative influence of irrigation on cultivated area. It is observed that due to improper use of irrigation water and unsuitable soil management and the problem of soil salinity, alkalinity water logging etc. have seriously emerged in canal irrigated tracks of central, mostly in Karad taluka. The more fertile sugarcane land has gone out of cultivation by the abuse of irrigation. The excess use of irrigation, inadequate drainage and heavy doses of chemical fertilizers have resulted such problems in the region, if this land degradation is not kept under control cultivated fertile land would rapidly decrease which is known as incurable cancer of soil, for solving these

problems the government and private sector have made an attempts to bring the problematic land under cultivation.

In this context some suggestions for improving irrigated farming and agricultural productivity have been made. They are as follows:

i. The farmers in canal irrigated area use excess water for crops. If the farmers in these areas guided properly and convinced them significances of judicious use of water, the problems would be controlled to some extend.

ii. The farmers make use of traditional methods of irrigation such as flood, border methods in which water is wasted; therefore they should be trained to use scientific methods of irrigation, viz. drip, sprinkler and micro sprinkler etc. to save water which would help to irrigate additional land.

iii. The percentage of degraded land is greater in the ill drained taluka. Therefore it is essential to improve vertical and horizontal drainage system in order to check the extension of the waste land.

iv. The surplus water should be diverted to the rivers.

v. The application of over doses of fertilizers is also another reason of soil degradation; therefore chemical fertilizers should be used according to the need of soils.

vi. Land in the lower reaches of valley remains uncultivated nothing to the presence of salt in the soil. Hence as a first measure salt to learnt crops should be grown and a detailed chemical analysis of soil and drainage survey of the area should be undertaken.

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