SPATIO-TEMPORAL ANALYSIS OF DAIRY FARMING OF AHMEDNAGAR DISTRICT

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By

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November - 2017

CERTIFICATE

This is to certify that the dissertation entitled **"SPATIO-TEMPORAL ANALYSIS OF DAIRY FARMING OF AHMEDNAGAR DISTRICT"** is being submitted herewith for the Degree of Vidyavachaspati (Ph.D.) in Geography of Tilak Maharashtra Vidyapeeth, Pune is the result of original research work completed by **Shri. Sanjay Dhondiba Aghav** under my supervision and guidance. To the best of my knowledge and belief the work incorporated in this thesis has not formed the basis for the award of any degree or similar title of this or any other university or examining body.

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Date: 09/11/2017

DECLARATION

I hereby declare that the thesis entitled **SPATIO-TEMPORAL ANALYSIS OF DAIRY FARMING OF AHMEDNAGAR DISTRICT** completed and written by me has not previously formed the basis for the award of any degree or other similar title of this or any other University or examining body.

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Abstract

SPATIO-TEMPORAL ANALYSIS OF DAIRY FARMING OF AHMEDNAGAR DISTRICT

Dairy farming is an important activity of the farmers of rural India. It has remained an important source of food and raw material of various industries. In the world, maximum number of countries farmers' practice dairy farming and it's an important source of their income .In developing countries dairy farming provides significant employment opportunities and overall socio-economic growth.

This study is concerned with the spatial and temporal analysis of dairy farming of Ahmednagar district. The study region is located in the middle part of Maharashtra and to the lee ward side of Sahyadri Mountain. (i.e.Western Ghat).It has remarkably moderate or low rainfall, which affects the agricultural land use and help to develop livestock activities on large scale. Distribution of dairy farming is totally uneven in the district.

Some tehsils support dairy farming positively and farmers of these tehsils practice dairy farming on commercial scale e.g. Sangmner, Rahata and Rahuri tehsils. There is high difference found in physiography and type's soils, though their effect on dairy farming is a matter of research.

Dairy farming is the leading occupation of the people living in Ahmednagar district of Maharashtra. The district covers an area of 5.7 per cent of the state and lies in between 18°20'N and 19°59'N latitudes and 73°40'E and 75°20'E longitudes. The entire district is divided into 14 tehsils. The population of the district is 45, 43,083 .Nearly 80 percent population of the district is in rural area. An average density of population is 267 persons per sq. km (census, 2011).

There are spatio-temporal changes in dairy farming in Ahmednagar district, because of various factors such as irrigation facilities, fodder crops, and dairy animals.

The objectives of the present study are-

1. To identify and study the spatial pattern of dairy farming development in Ahmednagar district.

2. To analyze the temporal development of dairy farming over a period of two decades.

3. To assess the physical and socio- economic background of the region in order to study the influence of these factors, i.e. Relief, climate, drainage, soil, vegetation cover, population, transport, irrigation etc., over dairy farming.

4. To assess the relationship between irrigation and dairy development.

5. To suggest measures for development of dairy farming activity in the study area.

Hypothesis of the study

1. Dairy farming is economically beneficial for farmers in the study area.

2. Spatial development of dairy farming is guided by geographical factors.

3. Dairy farming is affected by social and economic conditions of the farmers.

The present work is based on primary and secondary data sources. The primary data collected through personal interviews of farmers, questionnaires, field observations and group discussion with farmers. The secondary data has been obtained from various sources, namely, Socio-economic abstract of Ahmednagar district, District land record office, District Dairy development department of each tehsil, Agriculture department of Maharashtra state, Pune, District census, Cattle census, Department of irrigation, Indian Metrology department, Pune. The collected data studied and analyzed by applying different cartographical and statistical techniques and is presented through tables and figures. The spatio-temporal changes in dairy farming are explained with the help of Time series analyses.

Correlation coefficient technique and Regression analysis was applied to find out the correlation between milk production and selected variables, like dairy animals, irrigated land, area under fodder crops etc. With the help of data analysis and subjective information, the following major conclusions were arrived at-

1. All tehsils of Ahmednagar district practice commercial dairy farming.

2. There has been a continuous rise in the number of dairies since 1991 to 2014.

3. Government as well as Private dairies are functional in the district.

4. Native as well as hybrid animals are used for milk production. The number of hybrid animals is increasing.

5. In all tehsils, milk production is a profitable activity. In some regions, the output ratio is as high as three times the input.

6. There is no specific spatial pattern of development of dairy farming.

7. Role of Geographical factors like rainfall and soil type is insignificant in deciding development of dairy farming.

8. The major controlling factors which influence dairy activity and milk production are the hybrid animals, availability of irrigation and cultivation of fodder.

9. Thus, dairy development in Ahmednagar is more dependent on socio-cultural factors, than geographical factors.

The present research has been arranged into seven chapters. Chapter one deals with introduction, objectives, hypothesis, methodology and review of literature. The chapter two presents the profile of the study region with respect to location, physiography,climate, and drainage pattern, types of soil, minerals and natural vegetation. Chapter three deals with population distribution, density of population, irrigation and transportation facilities, occupational structure etc. which are influenced the dairy farming. Chapter four explains factors affecting dairy farming such as irrigated land, fodder crops and dairy animals and spatial variation of dairy animals. The chapter five deal with theGrowth and development of dairy farming, structure of dairy farming, milk collection and distribution system, and seasonal variation in milk production and spatio-temporal variation in dairy farming:

The chapter six is related to the analysis of the data with the help of quantitative analysis technique such as co-efficient of correlation, Regression analysis, Time series analysis, and finally cost benefit analysis calculated with the help of quantitative data, and it is found that dairy farming is profitable to the farmers of Ahmednagar district.

The last chapter concludes results of the study and it findings, testing of hypothesis, conclusions and gives possible suggestions for planning and development. During the period

of two decades, milk production has increased continually. The results of correlation coefficient technique shows that there is a significant positive correlation of milk production with various variables such as irrigated land, dairy animals ,fodder crops. It means that increase the irrigated land increases the milk production. This situation suggests growth of dairy farming of Ahmednagar district.

Present study may help to provide important information for future studies, planning and development of dairy farming in rural area of Maharashtra.

CHAPTER-I

INTRODUCTION

1.1 General Introduction

1.2 Concept of dairy farming

1.3 Development of dairy in India

1.4 Dairy development in Maharashtra

1.5 The study Area –Ahmednagar district

1.6 Objective of the study

1.7 Hypothesis of the study

1.8 Review of literature

1.9 Methodology

1.10 Scheme of chapters

1.11 Limitations of study

1.12 References

1.1 General Introduction

The development of dairy farming in India has been acknowledged in the world, as one of the most successful developed dairy activities. Domestication of cattle is practiced since primitive times till today, everywhere in the world. In fact the cow was so important to the early people of central Asia that wealth was measured in terms of number of cattle. Later, the cow was treated as a sacred animal and is still so considered by a major part of the Hindu population of India. The cow was also worshipped in Babylonia and Egypt about 2000 BC. From these early days to the present, the cow has continued to help man and her help as a source of food has not diminished by the thousands of years which have passed.

India is a country of rural people and villages; therefore, the focus of planning should have been on development of this large rural component. India holds a leading position in her cattle population. It is nearly one fifth of the total cattle population of the world. The cattle play a very important role in development of rural economy; the economic importance of cattle in India is based on the production of milk and other milk products. However, the role of cattle and dairy farming in an economy is assessed on the basis of contribution of cattle production to total agricultural production. Apart from milk, cow dung and urine of cow are good sources of medicines and organic manure, useful for making soil fertile. Generally, cows and buffaloes live on plants and vegetable feeds which man cannot eat or digest. They convert their rough feeds to products useful to man like milk and meat.

A number of studies have supported the fact that the practice of mixed farming increases the earning than practicing only arable farming or only dairy farming. Also, a number of studies have pointed out the possibility of using dairy development activities to bring about social and economic change in the rural areas.

Milk is the very important constituent of human diet, as a perfect food. It contains almost all the material that the human body needs and in the most suitable proportion. Cow’s milk contains on average 87 % water and 13% solids, consisting of proteins, facts, sugar and a variety of mineral substances and vitamins. All these substances are in such form that they can be easily utilized in building and repairing body tissues and bones and maintaining health and normal growth. Milk is used as food from ancient period. In the

Vedic period (2000 to 1500 B.C) boiled milk of cows formed one of the principal items of food for the upper classes. The nutritional expert group of the Indian council of medical research has recommended 300 grams of milk for pre-school children in the age group of 7-12 years and boys and girls in the age group of 13 – 18 years and 200 grams for adult men & women and additional 125 grams for expected mothers per day in the case of vegetarian. For non-vegetarian the recommended requirement ranges from 200 grams for children and 160 grams for adults. The minimum nutritional requirement recommended per head per day is about 200 grams of milk. Thus, importance of milk in the diet is widely recognized.

1.2. Concept of Dairy farming

Dairy farming is considered as one of the oldest economic activities. In ancient time man, tamed sheep and goats because of limited demand for dairy products. With growth in population, however cows become the major instrument for the supply of these products. In Asia dairying emerged coincident with early civilizations of the Indo-Gangetic plains and the Tigris-Euphrates valleys as evidenced by fossil remains and, recorded history. However, for a long time it remained as an activity subsidiary to crop cultivation (Azam A.M.1981). This is the most common form of dairying practiced in the western countries where milk animals are breed with a view to breeding cattle for better strain and most of the fodder is grown on the dairy land. This type of dairying is mainly found in rural areas of our country where most of feed and fodder is grown on the other farm.

Dairying should be one of the most important and profitable agricultural enterprise in India as the demand for quality milk products is increasing. More than half of the India's population is vegetarian, most of which uses milk. After independence, this type of dairy farming has been well developed in India.

1.3. Development of dairy in India:

In spite of rapid development of industries, India still remains to be predominantly agricultural country on account of its vast population in villages depending on agriculture. Most of those who depend on agriculture are either small and marginal land holders or landless agriculture labourers. Because of uneconomic land holding and non-availability of

infrastructural facilities, the small and marginal farmers can hardly subsist on agriculture. This situation compels them to augment other sources of income through subsidiary occupations allied to agriculture like dairying fishery, poultry, sheep and goat rearing etc. Those who take up subsidiary occupation are facing the problem of marketing since the villages cannot absorb their produce. The private middleman who entered the field are bound to exploit both the producers and the consumers. Since the Indian government is constitutionally committed to usher in socialistic pattern of a society, it is playing the role of middleman of providing marketing facilities to the rural producers and also taking the obligation of assuring the regular supply of such products to urban consumers on no profit no loss basis. The field of dairying is no exception on this.

Since independence ,the Government of India have planned a number of dairy development programmes viz. Cattle Breeding programme with foreign collaboration, Progeny Testing Scheme, Fodder development projects and Operation flood programme-I,II and III .Besides, the government has established Central Cattle Breeding and Artificial Insemination Centers for producing better cattle breeds (Sule,1981).However, due to poor allocations of funds to plans, dairying is not improved to the level of expectations.

As the collection and distribution of milk business was looked after by emerging milk producers, co-operatives, the consumer's co-operative could not be developed in this field. In 1946, Kheda District Co-operative milk federation of milk produces was established in Gujarat state, this federation undertook expansion activity and established AMUL dairy in 1955.There are four types of milk producer's co-operative societies adopted by AMUL.

I - Primary milk producer's society.

II-District co-operative milk federation or Taluka co-operative union.

III- State level co-operative milk federation

IV- National Co-operative Dairy Board.

Two streams have been observed in the co-operative dairies. One is clearly known as Anand pattern and other one is co-operative but not strictly Anand type. The operation flood

schemes cover only Anand pattern dairies .The organization of milk production, processing and marketing as an integrated activity on the Anand pattern.

The Anand pattern known after the Amul dairy complex at Anand in the Kheda District of Gujarat, adopted a three-tier organization and set up of interrelated functions. Milk producers at village level are organized into a co-operative society. The village societies in turn are organized into a district co-operative milk producers' union. Such unions in a given milk shed area are combined to form a marketing federation whose activities are directed mainly towards consumers in urban centers.

The producer member of a village co-operative is obliged to supply his milk to the union, which in turn is obliged to put his milk at a fixed price. The milk is transported, processed and marketed by union with the help of federation.

Co-operative linkage in the dairy industry is like this National Co-operative Dairy Federation of India-Sate co-operative Dairy federations –District co-operative milk federation or Taluka co-operative Unions-Primary milk producer's societies –milk producer.

After the independence to progressive self-reliance, Indian dairying has crossed a long way. The launching Operation Flood in 1970 appeared one of the most promising events in the field of rural development in recent years. It has been claimed by the promoters of the programme that the new "White Revolution", unlike "Green Revolution "one would be a more effective in improving the lot of the poor and in reducing economic disparities in rural areas. Milk production has of course become an integral part of traditional rural economy of India.

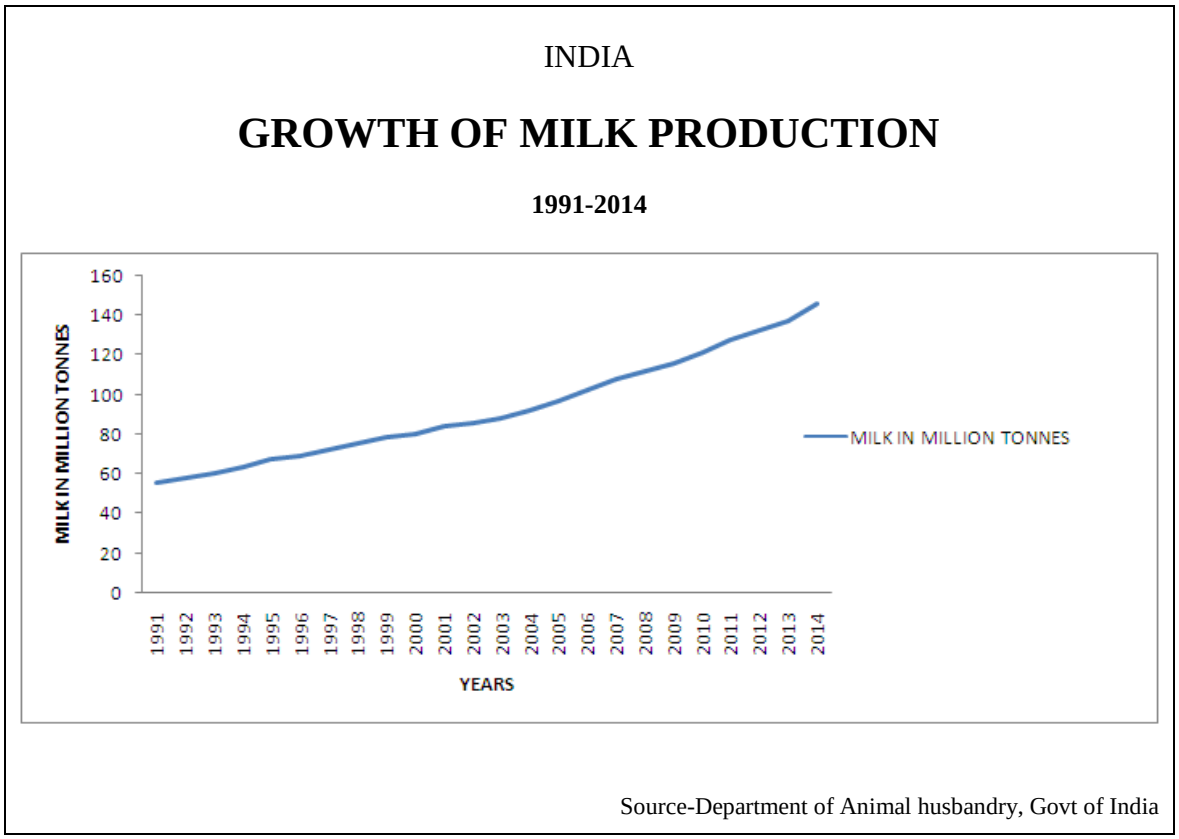


Fig 1.1- Growth of milk production in India.

In 1950-51 the milk production in India was very low as 17 million tons by 1991-92 it reached a level of 56 million tones and in 2014 it was146 million tones. There has been a considerable rise in the dairy farming activity from 2004 onwards, which may be attributed to the rising co-operative movements across the country and constant efforts taken at the local government level. Till the period of data collection, India ranked first position in the world, possessing more than 276 million bovines (Cattle & Buffaloes), had more than one lakh co-operative milk societies. Uttar Pradesh, Haryana, Punjab, Bihar and Gujarat are among the leading states contributing to the total milk production of the nation.

1.4. Dairy Development in Maharashtra

In the rural economy of Maharashtra state, animal husbandry mostly provides subsidiary means of livelihood to the agriculturists and livestock raising has become an integral part of agriculture.

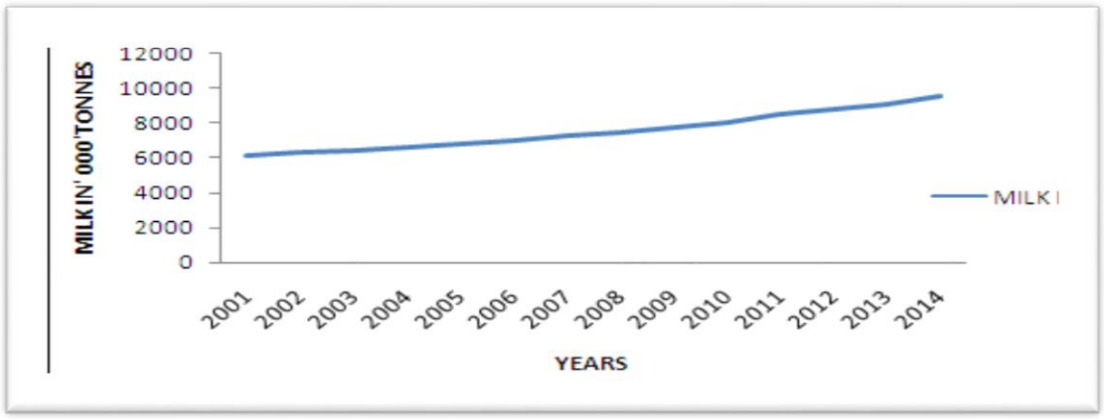
The Government of Maharashtra has taken positive steps in initiating the dairy development programme in the state. The milk collection processing and distribution scheme was first started in Pune in 1950. Thereafter, the activity of procurement of milk from producers in rural areas had been extended to 20 centers. Since farmers are spread out in the villages, the government made arrangements for collection of milk and distribution of it to consumers in the important cities of the state and provided an assured market capable of giving reasonable returns to the milk producers.

The expansion of dairy industry has the twin objectives of serving the rural based producers and urban consumers through its intricate network of organization spreading from the apex body at the state level to the field units in the districts and tehsils.

In achieving the objectives of dairy development, the efficient management of resources coupled with the infrastructural facilities plays an important role. The plan allocations and the budgetary provisions reveal the degree of commitment of the government for dairy development. The formation of Maharashtra State Co-operative Marketing federation in 1967 ushered in a new era of development in dairy industry in the state.

In recognition of Dairy Development Department of Maharashtra state, expanded the activities in talukas and districts level with the objective to expand the milk production in rural areas and secure market for milk to develop the co-operative milk societies at village level and district levels, to fix milk price on cost of production basis and give remunerative price for milk and to provide subsidiary occupation for weaker sections of the rural society. The state government has been promoting the development of dairy industry by way of extending credit facilities to milk producers and establishing chilling plants, ice factories, dairy plants for milk and milk products.

Presently Maharashtra state set up the infrastructure for dairy development includes better collection system, more than 3000 village co-operatives milk societies develop and help for dairy development.



Source-Dept. of Animal husbandry, Govt of India.

Fig 1.2.Growth of milk production in Maharashtra.

Maharashtra state has achieved a spectacular success in dairy development activity through the establishment of government milk scheme and co-operative milk collecting societies. Moreover, dairying as subsidiary occupation has become an important business activity and additional source of employment and income in the rural areas of the state. The milk production is the seasonal. There is a lot of milk production during the flush season and considerably less during the lean season. Dairy plants have begun facing the problems of utilizing flush season surplus milk in useful way.

The average annual milk yield of the crossbred cow is reported 2-3 times more than native cattle. There has been a rapid increase in the number of highly productive crossbred cattle and improved buffaloes in the country as well as in the state of Maharashtra .This was due to the adoption of many strategies by the government which includes genetic improvement of important cattle breeds by selective breeding in the home tracts and upgrading in other selective areas, crossbreeding in no –descript cattle on extensive scale with recognized exotic breeds to develop crossbreed by using frozen semen technology ,progressive genetic improvement of buffaloes in their home tracts by selecting breeding and upgrading of no-descript buffaloes, development of feed and fodder resources ,organization of effective animal health services to support the production programme and control the

diseases. Moreover, the various technologies are adopted properly which help to increases the level of milk production in Maharashtra state.

1.5. The Study Area- Ahmednagar District

The present study area, Ahmednagar, is the biggest district of Maharashtra in terms of area. The total geographical area of the district is 17.41 lakh ha. The net cropped area is 12, 56,500 ha, out of which an area of 3, 30,000 ha. (26.27 %) is under canal (84,000 ha) and good irrigation. About 9, 26,500ha. (73.73 %) area is rain fed. A multiple cropping system is followed on 1, 10,500 ha. area. A total of 8.73 per cent area of the district is under forest.

Geographically, Ahmednagar falls into the “Rain shadow region” of Maharashtra, lying to the west of the Sahyadris. It is characterized by a hot and dry climate for most part of the year. Annual average rainfall rarely exceeds 70 cms. In such harsh conditions, several restrictions are imposed on farming activity. Lack of irrigation limits agricultural growth, though fertile black soil is available near the river valleys of Pravara and Mula. Most crops grown in the district are the dry and rainfaed crops such as Bajra, Jowar and pulses. As 73% area of the district is rained, only Kharif crops can sustain. Only the areas having some source of irrigation, can practice rabi cropping.

In such conditions, there is a limited dependability on farming, wherein farmers would need an additional economic activity to sustain themselves. Animal rearing and dairy farming would provide an ideal source of extra and permanent income to farmers in Ahmednagar district. Being the largest district in Maharashtra, availability of pastures, or need of open spaces can be easily solved. Moreover, such open areas can be used for fodder cultivation as well. Thus, in terms of physical factors, Ahmednagar district provides a good scope of developing dairy farming activity as an effective alternative to agriculture.

The study area also has a varied physical base i.e., the river plain region, the dry plateau area and low lying hills. Thus, it is possible to evaluate the influence of various physical elements upon the dairy farming. The study area has all types of land, which can help to anyalise development of dairy farming. The study area is combination of irrigated,

un-irrigated and semi-irrigated land, which helps to anyalize relationship between irrigated land and Dairy farming. The Study area has a combination of irrigated, non-irrigated& semi irrigated area which can clearly highlight the disparity between irrigated and non-irrigated area in terms of dairy product output. All these considerations have led to the choice of Ahmednagar district as the region for this study in order to understand the dairy development of region.

1.6. Objectives of the study

This study is concerned with the spatio-temporal analysis of dairy farming in Ahmednagar District from 1991 to 2014. The study aims at identifying the spatial pattern of dairy farming development in the district, as well as its temporal variations across different parts. The purpose of the undertaken study is also to evaluate the influence of physical environment as well socio- economic factors on dairy activities in the Ahmednagar District of Maharashtra.

The Main Objectives are given below:

1. To identify and study the spatial pattern of dairy farming development in Ahmednagar district.

2. To analyze the temporal development of dairy farming over a period of two decades.

3. To assess the physical and socio- economic background of the region in order to study the influence of these factors, i.e. Relief, climate, drainage, soil, vegetation cover, population, transport, irrigation etc., over dairy farming.

4. To assess the relationship between irrigation and dairy development.

5. To suggest measures for development of dairy farming activity in the study area.

1.7. Hypothesis of the study

1. Dairy farming is economically beneficial for farmers in the study area.
2. Spatial development of dairy farming is guided by geographical factors.
3. Dairy farming is affected by social and economic conditions of the farmers.

1.8. Review of Literature

Several researchers have studied the feasibility of dairy farming and its development in different parts of India as well as Maharashtra.

One of the earliest studies which identified the rural-urban interaction with reference to dairy farming, was Godbole G.S. (1966). In his study of milk supply in Maharashtra pointed out that it was possible to increase supply of milk by encouraging milk production in rural areas and marketing it in the cities: According to him this would help in building dairy industry on sound footing.

Alagh C.D. (1975) through national sample survey showed that 62 percent of the households owing cow in milk production produced less than one liters of milk per day. This presented a rather dismal picture of Indian dairy farming activity, which was confined to an unorganized and undeveloped status.

Thakur D.S. (1975), in his empirical study, pointed out that the milk producers sell their milk directly to the co-operative societies located in villages twice a day and receive payments every day or as decided by them. The village (rural) societies provide the facilities like artificial insemination, veterinary services, cattle feeds and loan for purchasing the milch animals as well as for constructing the stables. Thus, the role of co-operative Societies was significant for the dairy development in rural areas of our country.

In one of the early studies in Ahmednagar, Ahire (1979) in his study, found that the distributional pattern of milk was affected by large size families rather than the small size of

families in villages around Mahatma Phule, Krushi Vidyapeeth, Rahuri. This was a typical Pro-Natalistic approach towards dairy farming where the development was directly related to the number of people available for work.

B.K.Ganguly and S.Gopal (1979) worked on Indian milk in their research study. They found that 41.0% of the milk producers were landless while 22.9% have land below one hector. Nearly ⅔of the dairy farmers had no land or very small land for growing the feed and fodder for dairy animals. It was found that 13.9% of dairy farmers had operational land of 1 and 2 hector while 22% had land holding of 2 hectares and above. This paper underlines the fact that while most land was utilised for cultivation, a very small proportion was actually devoted to dairy activity.

Banger (1982), studied the problems of dairy farmers in Pune district, and identified the following problems faced by the dairy farmers-

1. Dairy farmers face problems of capital for purchasing milch animals & constructing the stable.
2. Price of milk is low compared to cost of production.
3. No knowledge of scientific feedings.
4. Because of the high rate of illiteracy among the dairy farmers, they are ignorant about advantages and disadvantages of various financing agencies.
5. Non-availability of veterinary facilities to the milk co-operative societies members,
6. Management of milk co-operatives societies is not efficient.
7. Irregularity in payment by village milk co-operatives societies negatively affects the dairy development in rural areas.

According to Vithal C.P. (1986) In India, dairying has been a part of the agricultural system since times immemorial. Dairying has been very popular with all sections of India's

rural people and is especially suited to the weaker sections with small land base and abundant labour force. The National Commission on Agriculture has rightly observed that "as cattle and buffalo rearing involves intensive use of labour usually on the part of the members of the family, more than many other enterprises, it offers very significant employment and income opportunities to small and marginal farmers and agricultural labourers. A large proportion of female labourers find scope for fuller utilization in several operations connected with cattle and buffalo rearing.

Patel (1987) studied the impact made by dairy co-operatives in Gujarat and found out that Cooperative movement has played an important factor responsible for dairy development in Gujarat.

George (1990) opined that livestock plays an important role in the socio- economic life of India. It is a rich source of high quality foods such as milk, meat and eggs and a source for income and employment to millions of rural farmers, particularly women. With a large human population and about 250 million economically strong potential consumers, the domestic demand for these food products are increasing rapidly, the demand often exceeding the supply.

A similar conclusion was presented by Yeshwanth.T.S.(1990), who studied livestock enterprises in Kerala. He suggested that livestock plays an important role in improving the socio-economic living conditions of the rural population. This study examines the impact of livestock enterprises on the integrated development of the state of Kerala, India.

Dhas .K.S (1990) reported that the production of milk would be attractive to the farmers if the parity between the prices paid for inputs and they received from the sale of milk remain favorable to them.

Thombare B.M. and Pawar B. B. (1993) made an effort to study the profile of crossbred cattle owners in Maharashtra. They identified the problems and made suggestions for crossbred cattle owners. Dysfunction of milk producer co-operative societies was the major problem followed by more expenditure on ration and lack of green fodder.

Suggestions were given as milk producers co- operative societies should not be de-functioning and optimum price of milk should be given.

Ashok A. Devikar (1997) opined that most of the required facilities are available in irrigated areas for dairy activity, which help dairy development and substantial milk production. The dairy operations use the potential of irrigated areas resulting in the gradual increase in milk production. Most of the required facilities except space for stable are available in urban areas. But this is the most important limitation for further dairy development in cities. The production of milk in the non-irrigated areas is decided by the amount of rainfall.

Patil C. D (1999) observed the major constraints of Tembhurni chilling centre. He stated that high procurement cost, reception of below grade milk, defective co-operative set-up, no correct testing of milk, no properly cleaned cans, and facilities at milk collection centers. he also studied the problems of producers and reported that the problems like low price of milk, high cost of cattle feeds, improper testing of milk society, fluctuation in price of milk ,lack of veterinary aids were faced by the producers.

M.D. Shamshad Alam. (2012) commented upon India's large domestic market. H stated that though India is home to the world's largest dairy herd, but the country still faces a production shortfall due to massive demand from growing population and also low productivity of Indian cows. In spite of India's position as highest producer of milk, productivity per animal is very poor.

Azam A .M, Khan MKI and Das A. (2012) worked on "Adaptability and Survivability of Different Crossbreds cattle under Commercial Dairy Farming Conditions in Chittagong area". The study was undertaken to investigate the adaptability and survivability of different crossbred dairy cows under commercial farming conditions in Chittagong, Bangladesh. Different cattle genotypes (Holstein Local, Sahiwal, Holstein and Jersey) were found in the studied farms. The percentages of Holstein was (58.94%) higher than other genotype. The survivability of Holstein, Sahiwal, Holstein and Jersey calves were 84.0±3.90, 100, 97.1±5.48 and 100 percent, respectively. The survivability of calves and cows were significantly different.

1.9. Methodology

Methodology adopted for the present work was divided in five stages. These were-

1. Literature Survey
2. Pre-field surveys
3. Designing the questionnaire
4. Field work and primary data collection
5. Secondary data collection
6. Data Analysis and results
7. Conclusion and findings

Literature survey was used to get an idea of the quantum of work done in the field of dairy development in India, Maharashtra and in Ahmednagar district in particular. This would not only help knowing the methodology adopted for such works, but also would indicate the research gaps, if any. At the end of the literature survey, a tentative methodology was finalised to carry out the further research.

Ahmednagar district, as mentioned earlier, is the largest district in Maharashtra. In order to cover the entire district for survey, a pre-field survey was conducted to finalise the number and location of the sample survey sites. Ahmednagar district has 14 tehsils, and from each tehsil, 30 respondent farmers were chosen on random basis. These respondents were from different villages in the tehsils. Thus, the total number of respondents were 420.

These respondents were to administer a survey questionnaire, in order to record their responses. The questionnaire was designed, which had 27 questions in all. These were related to various physical as well as economic aspects of dairy farming. The animal breeds, types of feed & fodder used, daily milk production, family labour, cost of production etc. were generated through personal interviews of the dairy farmers. During

the actual field survey, the researcher travelled to all 14 tehsils and collected the data by personally obtaining the responses to the questionnaire. This exhaustive field survey took about 3 years of time.

In the meantime, secondary data and published material was also collected from various administrative and government agencies. The data was also obtained from the census and socio-economic review of district, statistical abstracts of Ahmednagar district. The data regarding village land use was collected from the Talathi office. District census handbook (2001 – 2011) of Ahmednagar district compiled by the Maharashtra census office, Mumbai, were the other important sources of data on village level population, occupational classes and general land utilization. Data on some aspects of agriculture, irrigation and transport was collected from agricultural department of Ahmednagar district. District level data about total milk collection and dairy census, was collected from the District Dairy Officer, Ahmednagar. Village level data regarding local milk collection and veterinary services was collected from village Panchayats. Annual reports of various Co-Operative dairies operating within the study area were also collected. These secondary sources gave a macro-level, generalized picture of milk production and collection, their spatial and temporal patterns. Information about various other aspects number of cattle, area under fodder crops, milk production, daily collection etc. was obtained from the secondary sources.

The data collected through primary and secondary sources was subjected to data analysis. Various statistical tools and techniques were used to extract meaningful information from the raw data. A multiple correlation analysis was used to ascertain the inter-dependence of variables. These variables were geographical as well as social and economic. Their interaction with, and effect over dairy farming activity was analyzed using the correlation analysis. In order to study the temporal changes in the dairy farming activity, time series analysis was done for a period of 24 years (1991-2014). In order to ascertain the economic viability of dairy farming, a cost-benefit analysis was calculated for each of the tehsil, using averaged values. The price offered to the milk was ascertained from the co-operative dairies and from the farmers. Information about the average milking period per year for animals, was obtained from veterinary practitioners and farmers.

1.10. Scheme of Chapters

The thesis is divided into seven chapters. The first chapter deals with the introduction of the entire research work. It describes the conceptual framework and various approaches to the measurement of Dairy farming, the problem, choice of the research topic and the region. It also presents the objectives and hypothesis of research work. Methods of data collection. It also deals with the methodology to analyses the database. A detailed review of Literature of the previous research work related to the dairy and dairy farming and limitation of study has been presented in the chapter.

Second chapter is the Geographical setting of the region. It includes location, site, Geology, minerals Physiographical divisions of Ahmednagar district, climatic characteristics, drainage pattern, types of soil and natural vegetation of the study region.

Chapter three deals with spatio-temporal pattern and volume of change in nonphysical determinates such as irrigation, traditional and modern farm implements, livestock population, demographic factors i.e. literacy, population density i.e. crude density of population, physiogical density of population and agricultural density of population, high yielding varieties of seeds, chemical fertilizers, Market centers, agricultural credit and Government policies related to agriculture.

Chapter four includes the study of various geographical variables that influence the dairy farming activity in the study area.

Chapter five deals with the observations and patterns which have emerged from the analysis of data obtained from secondary sources. This chapter also covers the subjective aspects of dairy farming which cannot be effectively shown through statistical analysis.

Sixth chapter includes the quantitative analysis of the data collected through primary and secondary sources. The results of the data analysis shall yield results related to spatial and temporal development of the dairy activity in the district.

The last chapter includes the summary of the observations and conclusions. It also includes the testing of the hypotheses, leading to either acceptance or rejection of the same.

The last chapter also includes suggestions to spread and develop dairy activity in the study area.

1.11. Limitations of Study

The present research work is spatio-temporal analysis of dairy farming in Ahmednagar district of Maharashtra. There are some limitations to the present study. Since Rahata tehsil was created in 1997, some variables before 1997 are not available for Rahata Tehsil. Many of farmers lack the knowledge of cattle breed and their milking capacity. Farmers randomly answer the questions which may cause noise in the statistical information. Thirty respondents in each tehsil may appear a small sample size. However, considering the fact that the researcher had to cover all the 14 tehsils of Ahmednagar, the number of questionnaires was limited to thirty per tehsil.

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CHAPTER - II

A PROFILE OF THE REGION

2.1. General Introduction

2.2. Location, Site and Situation

2.3. Geology and minerals

2.4. Physiographic division

2.5. Soil Types

2.6. Drainage

2.7. Climate

2.7.1. Rainfall

2.7.2. Temperature

2.7.3. Humidity

2.7.4. Wind

2.7.5. Clouds

2.8. Natural Vegetation

Resume

References

2.1. General Introduction

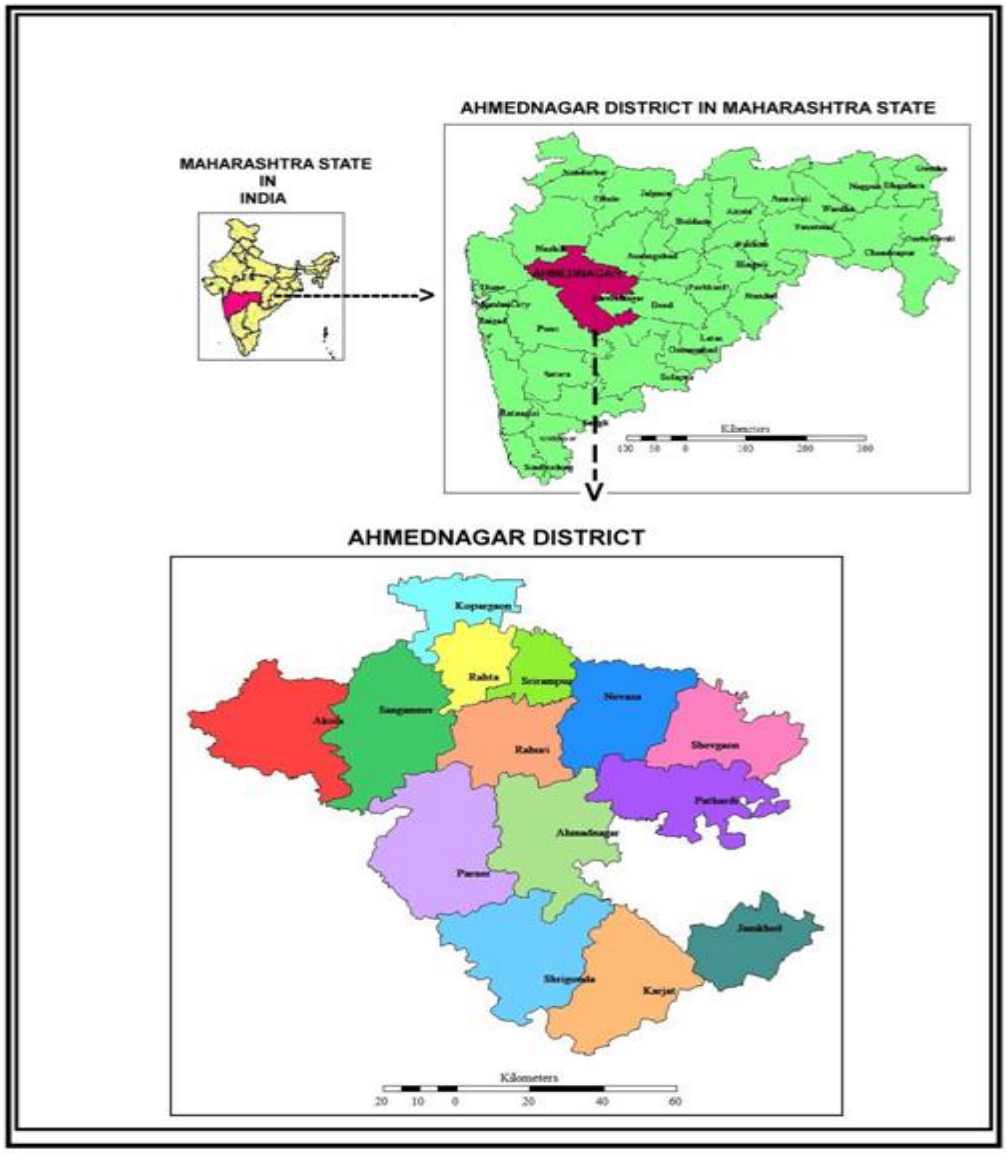
The development of the human societies depends upon the geographical factors as well as activities of human being. Activities of human being are directly or indirectly related to geographical factors such as location, geology, physiography, soils, climate, vegetation, rainfall, and drainage. Water provides different area with variety of possibilities of development (Hettner 1947). Therefore, it is necessary to study about above geographical, geological and physical factors of the region namely location, geology and minerals, physiography, climate, natural drainage, soils, natural vegetation etc. of Ahmednagar district of Maharashtra.

2.2 Location

Ahmednagar district is situated partly in the upper Godavari basin and partly in the Bhima basin occupying somewhat central position in the Maharashtra state. The Fig no.2.1 shows the location of study area. The Ahmednagar district is located in Maharashtra. It extends between $18^0$2' and $19^0$9' north latitude and $73^0$9' and $75^0$5'east longitudes. The district is irregular in shape and resembles a slanting cross with a length of 200 km and breadth of 210km. The Ahmednagar district is bounded by Nasik district to the north, Aurangabad district to the north east, Beed district to the east and Osmanabad, Solapur districts to the south, Pune District to the west and Thane district to the northwest.

LOCATION MAP

AHMEDNAGAR DISTRICT



Source - Topo -sheet published by Survey of India.

Fig.no.2.1. Location map of Ahmednagar district.

Ahmednagar District recognized by the name of Ahmed, founder at the Nizam Shah in A.D.1494. After the end of Peshwa rule in A.D. 1818 Ahmednagar District was established. Ahmednagar is the largest district of Maharashtra State with geographical area of 17048.00 sq. km., which is 5.66% of area of Maharashtra State.

Ahmednagar District ranks Ist in term of area. Out of total area 391.5 sq. km. is urban area and remaining 16,656.5 k.m^2, is rural area. Ahmednagar is centrally located in western Maharashtra. The Ahmednagar District is the biggest district of Maharashtra and it is divided into 14 Tehsils.

2.3 Geology and minerals

The entire district is occupied by basaltic lava flow, which is popularly known as the "Deccan Traps". These lava flows are sometimes associated with inter trappen beds such as lime stones, sand stones, clay shales, red bole beds, porous thin mantle of black cotton soil present almost everywhere on the basaltic area. Except for building stone, there are no minerals in the district.

2.4 Physiographic divisions of Ahmednagar District

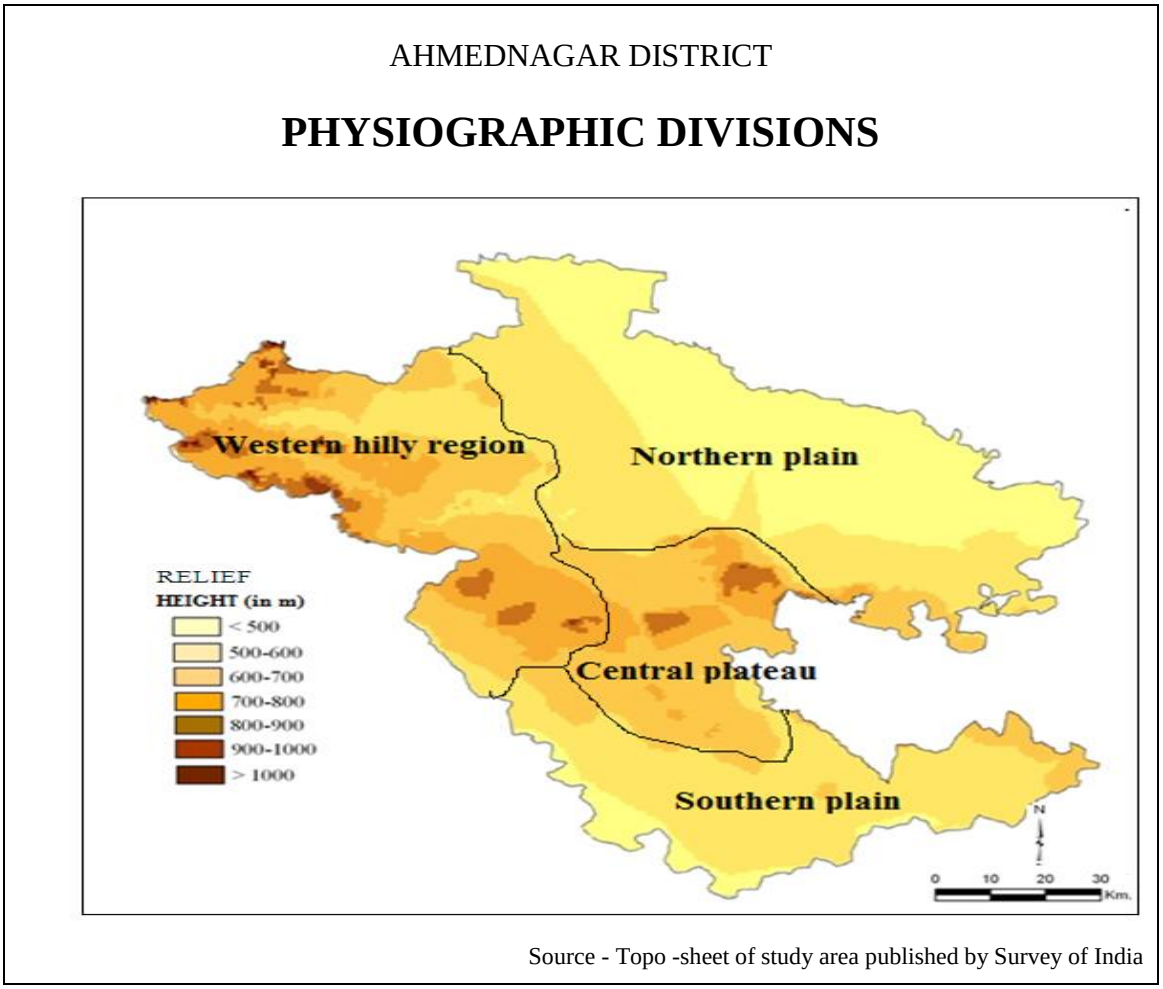


Fig.2.2, Physiographic divisions of Ahmednagar district.

The district as whole is an elevated tableland with number of plateaus at various levels, there are various land forms founds in Ahmednagar district. These different types of land forms in the region constitute its physical set-up. Topographically Ahmednagar district can be divided into following divisions

1) **Western hilly region**-The main Sahyadri range touches Akole tehsil in the north-west area of Ahmednagar and its three eastward offshoots namely the Kalsubai-Adula range in the north, the Baleshwar range in the middle and Harishchandragad ranges in the south. Kalsubai with a height of 1646 meters is the highest peak in the state.

2) **Central plateau region**- Parner, Ahmadnagar Tehsil and parts of Sangamner, Jamkhed, Shrigoda and Karjat tehsils are included in this region. The plateaus in general have an elevation of over 600 meters

3) **Northern regions**- It includes northern Koperagaon, Rahata, Shrirampur, Rahuri, Newasa, Shevgaon and Pathardi tehsils. This is the region of the Godavari and the Pravara river basins.

4) **Southern plain regions-** Parts of the southern tehsils of Shrigoda, Karjat and Jamkhed are also included in this physical division. This region covers basins of the Ghod, Bhima and the Sina rivers.

2.5. Soils

The soils in the district can generally be classified into three groups, viz., black or kali, Medium black soil, Coarse (Murum) soil and red or tambat, and the gray of inferior quality locally known as barad including white or pandhari of these, barad soils are very poor in fertility. The plains in Kopargaon and Shrirampur talukas have comparatively a good depth of soil. Near the Pravara and Godavari rivers white tracts of deep rich lands are found. Two especially barren tracts may be noticed, one on the borders of Karjat and Shrigonda and the other north of a line drawn east to west through Takli-Dhakeshvar, ten miles north of Parner, and as far north as the slopes down to the Mula. The second waste is of great extent and is mostly un-arable being little better than bare basalt, unfit for anything except sheep-grazing. Near the range of the hills that runs south-east down the centre of the Shrigonda and Karjat

sub-divisions, the land is very poor with occasional patches of good light soil near Karjat, Koregaon and other places. In the hilly areas to the west of Akola, red soil, deeper on the slopes than on the levels, is found. Thus, a major area of the district comes under scarcity zone.

The types of soil Zones are given in the following statement:

Types of soil Zones

Main category of soil	Type of soil	Description
High level shallow soils	H	low lime, shallow, reddish brown, loams locally called "Murum"
	G	moderate lime, brown to dark brown clay loams
	F	low lime, brown, loams
Intermediate medium deep soils	A	black clay loams with reddish tinge
	D	calcareous brown clay loams with lime band below
Low level deep soils	B	Low lying high lime, deep brown-black clays.
	B	Eroded phase.
	C	low lying deep, black compact clays
.		Source - Topo -sheet of study area published by Survey of India.

Table.2.1. Types of soil Zones.

Besides, the soils in the district can be divided into following agro-climatic zones encountered from east to west: —

Ghat zone: This zone covers hilly terrain including Sahyadri hill tops and the western sloping hilly land with variable altitude between 500 and 1,500 meters. The main soil types

found in this region are high level, red to reddish brown lateritic soils and light brown to dark brown shallow gravelly loams.

High rainfall zone with non-lateritic soils: This zone includes the narrow strip of land west to the ghat zone and receives rainfall of 2,000 to 3,000 mm. The major soil group, viz., non-lateritic red to reddish brown loams includes two types of soils—high level, red to reddish brown, shallow light textured soils and brown to dark brown, medium deep loams to clay loams locally known as manat.

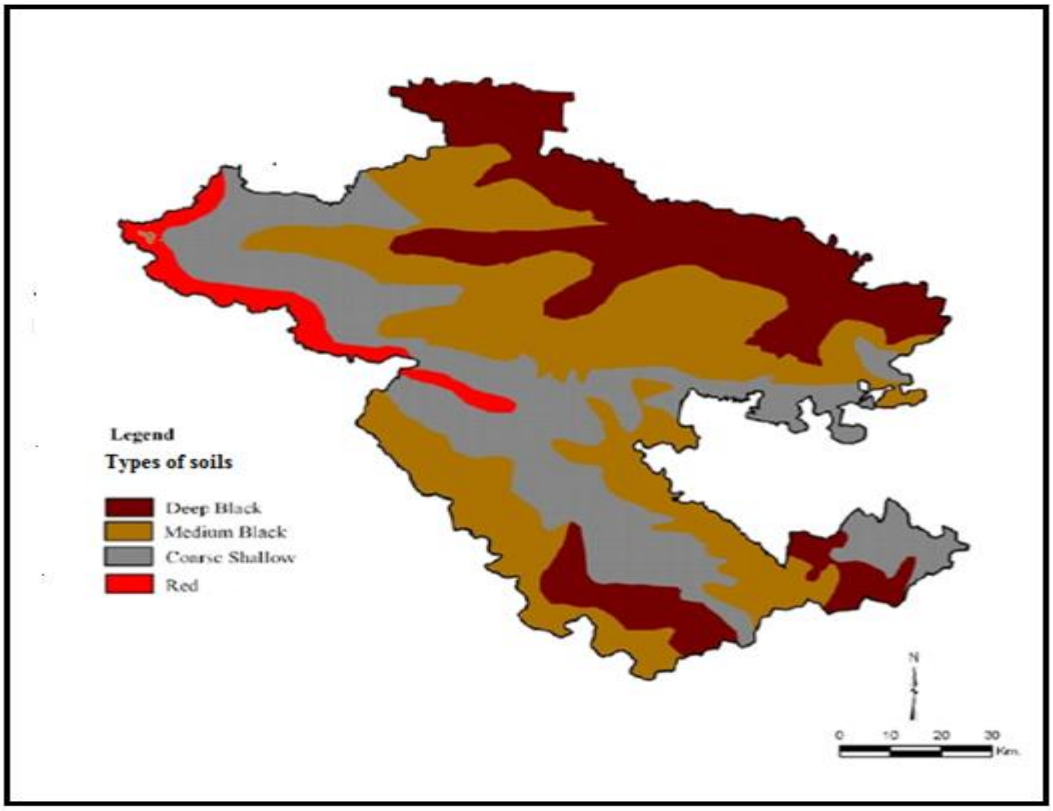
Transition Zone I: Area on the western side of the high rainfall zone with non-lateritic soils comes under this zone. This zone receives rainfall of about 1,250 mm. to 2,500 mm. The soil group consists of soils of red to reddish brown color with varied depth and texture.

Transition Zone II: Western part of Akola taluka and the limited area from south-east portion of Sangamner taluka is covered by this zone. This part of the district receives rainfall of about 700 mm. to 1,250 mm. The major soil group of this zone is brown to dark brown of varying depths and comprises three types of soils, *viz.*, high level, low lime, shallow, reddish brown loams; intermediate, medium deep brown black clay loams; and low level, deep low lime, brown black clays.

In the study region has mainly black soil in irrigated area. Alluvial soils and Red soils in partly irrigated area and Red and laterite soils are found in plateau area or non-irrigated area. Water holding capacity of the deep black soils is very high. Numbers of saline soil patches are also observed in the irrigated tract of the Ahmednagar district, due to excessive use of water. This saline soil is not suitable for the growth of crops.

AHMEDNAGAR DISTRICT

DISTRIBUTION OF SOIL



Source-Topo -sheet of study area published by Survey of India.

Fig. 2.3.Distribution of soil of Ahmednagar district.

Dairy activities are the result of interrelationship among number of growth factors and fertility is an essential prerequisite for its daring purpose. Soil productivity is the capacity of the soil to produce plants under specified programme of management. Fertility is defined as the potential of soil for supplying nutrient elements in amounts, forms and proportions required for ideal plant growth.

2.6. Drainage system of Ahmednagar district

The district is drained by two major rivers, the Godavari in the north and the Bhima in the south, a tributary of the Krishna. The Godavari is the most celebrated river of the whole of peninsular India. It rises in the Sahyadri ranges near Trimbakeshawar in Nasik district and

enters the district as a considerable stream near village Wadgaon in Kopergaon tehsil flows in a south-east direction thought the rich alluvial plains and forms an almost continuous boundary between Ahmednagar and Aurangabad districts. The river has a length of about 200 kms within the district. The Water-shed line is the great spur of the Sahyadri which branches off at Harichandragad and stretches completely across the district from west to east. The important rivers flowing through the district are Paravara, Mula, Sina and Dhora. Pravara is tributary of the river Godavari. Waters of the river Pravara fall from a great height, creating the Randha Falls.

The Godavari, which drains by far the larger part of the district, including the tehsils of Kopargaon, Sangamner, Akole, Rahuri, Newasa,Shevgaon the northern half of Parner and parts of Nagar and Jamkhed ,rises near Trimbak in Nashik on the eastern slope of the Sahyadri. After passing the town of Nashik it receives the Banganga and the Kadva from the north and Darna from the south and is already a considerable stream, when, after course of about 97 km, it enters north-west corner of the Kopargaon tehsil. It then flows south-east through rich alluvial plain past Kopargaon to the town of Puntamba,which is situated on the Nizam's frontier ,where it receives from the south the combined water of Kat and Khara rivers. From Puntamba to a point beyond Paithan,a distance of 97 kms ,the Godavari forms almost continuously the boundary between Ahmednagar and the Nizam's dominions. At the village to Toka it receives on its right bank the combined waters of the Pravara and the Mula.A few miles below ,the Shiva and Ganda join it from the left and the Dhora from the right. Two miles east of Mungi the river enters the Nizam's dominions, and hence, flowing across the peninsula, it empties itself into the Bay of Bengal after the total course of 900 miles.

The river Pravara rises on the eastern slopes of the Sahayadris between Kulang and Ratangad. After the sinuous course of 32 km in an easterly direction, near the village Ranada, it falls into rocky chasm 200 feet deep, and then winds for eight miles through a deep narrow glen which opens wider Valley east of and below the central plateau on which the town of Rajur stands. Total Length of river Pravara is 194 kms. The Dam Bhandardara is constructed across the river at Bhandardara, nearby are the Randha falls.

The Adhula rises in north of Akole on the Slopes of Patta and Mahakali.It flows for fifteen miles in an easterly direction between two ranges of hills which encloses the Samsherpur valley, then falling into the rocky chasm some 150 feet deep it winds between rugged and precipitous hill-sides for couple of kms, when debauching in to the plain of Sangamner, it turns south and falls into the Pravara river five kms west of the town of Sangamner.

The river Mahalungi rises on the southern and eastern slopes of Patta and Aundha. After the course of three miles it passes east into the Sinnar subdivision of Nashik. It reenters Ahmednagar after taking bend to the south.

The Mula rises on the eastern slopes of the Sahaydris between Ratangad and Harichandragad for first twenty miles it flows parallel to Pravara draining the southernmost or Kotul valley of Akole subdivision. Passing the town of Kotul it takes a bend to Baleshvar.It then crosses through Sangamner, Parner. The Dam Mulais constructed across the river at Bargaonnandur.

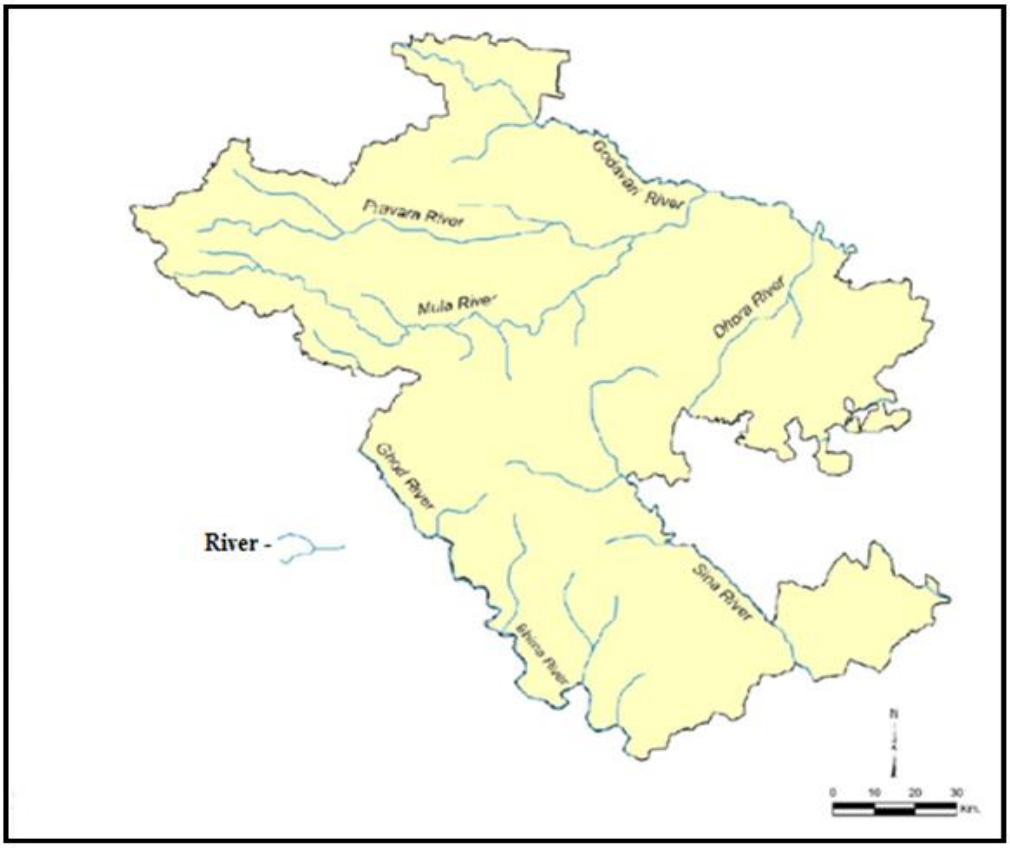
The Dhora rises on the slopes of the hills east of the town of Ahmednagar. It flows north-easterly, draining Shevgaon and part of Nevasa.

The Bhima River drains the whole of the southern portion of the district, comprising the greater part of the Parner and Nagar subdivisions, the whole Shrigonda and Karjat and nearly the whole of Jamkhed.

The Sina has two chief sources, one near Jamgaon fourteen miles west of the town of Ahmadnagar, near, Jeur ten miles to the north-east. The town of Ahmadnagar is built on left bank of the river, which there takes south-easterly course. Leaving the district boundary it enters Solapur and ultimately falls into the Bhima. The southern part of the district consisting of Parner, Ahmednagar, Pathardi, Shrigonda and Karjattahsils constitute the Bhima basin with the tributaries of Kukadi and Ghod.

AHMEDNAGAR DISTRICT

DRAINAGE SYSTEM



. Source -Topo -sheet of study area published by Survey of India.

Fig. 2.4.Drainage system of Ahmednagar district.

2.7 Climate –

The climate of the district is characterized by a hot summer and general dryness during major part of the year except during south-west monsoon season, Year can be divided into four seasons. The cold season from December to February is followed by the hot season from March to the first week of June .The south –west monsoon season is form the second week of June till the end of September while October and November constitute the post monsoon or retreating monsoon season. When the relative humidity is between 60% and 80% thereafter it

decreases. Ahmednagar gets rain mainly from south-west monsoon but the distribution is mostly uneven.

The climate is also a noteworthy constitution exerting influence on crops and dairying activities in Ahmednagar district. The study region receives maximum rainfall in monsoon season.

1. Temperature

There is a meteorological observatory in the region at Ahmednagar. The records of this observatory may be taken as fairly representative of the meteorological conditions in the study area by the middle of November and continues till the end of February, December is the coolest month of the year. The hot summer starts from March and continues till May. In the summer the average temperature is 28^0C .March is the hottest month of the study region. The mean Maximum temperature is 29^0C and the mean minimum temperature is 19.4^0C. The average annual temperature of the region is shown in table no.2.2 given below

Temperature of Ahmednagar district in^{o}c. (2011)

Months	**Maximum**	**Minimum**	**Months**	**Maximum**	**Minimum**
January	30.5	12.4	July	30.1	21.6
February	33.2	14.3	August	29.3	20.8
March	36.6	18.1	September	30.8	20.2
April	39.1	21.9	October	32.5	19.1
May	39.4	22.9	November	30.9	15.4
June	34.1	22.3	December	30.0	11.7

(Source – IMD Pune, Ahmednagar Station)

Table 2.2.Temperature of Ahmednagar district in ^{o}c. (2011)

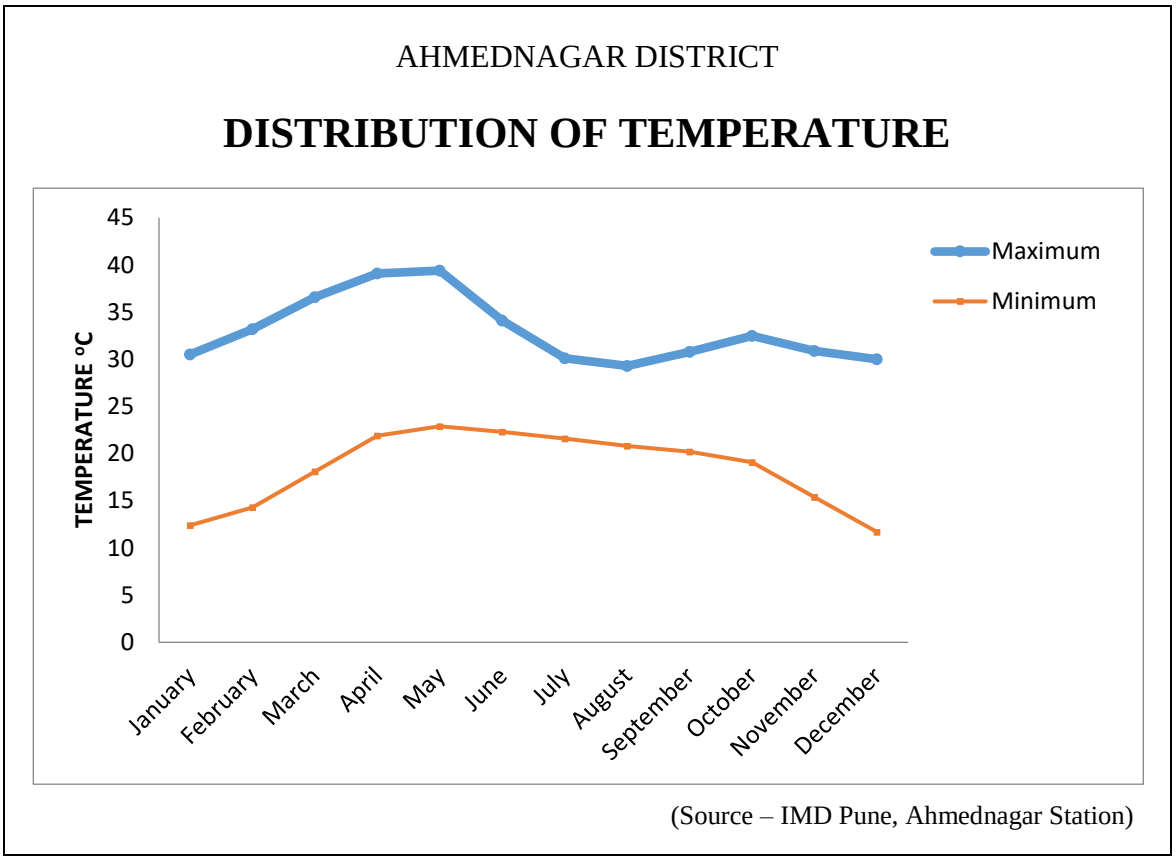


Fig. 2.5. Distribution of temperature of Ahmednagar district

2. Rainfalls.

The average annual rainfall in district is 578.8 mm. The distribution of rainfall is very uneven. The western part of Akole tehsil gets good rainfall and the rainfall decreases as one proceeds towards east. The district mostly lies in the rain shadow to the east of the Sahyadries. It should be noted that nearly 80 to 90 percentage of the rainfall is received during the southwest monsoon period .Generally Ahmednagar district received rainfall during the June to September. The variation in rainfall from year to year is large. Sometime region receives rainfall in November due to return of monsoon wind.

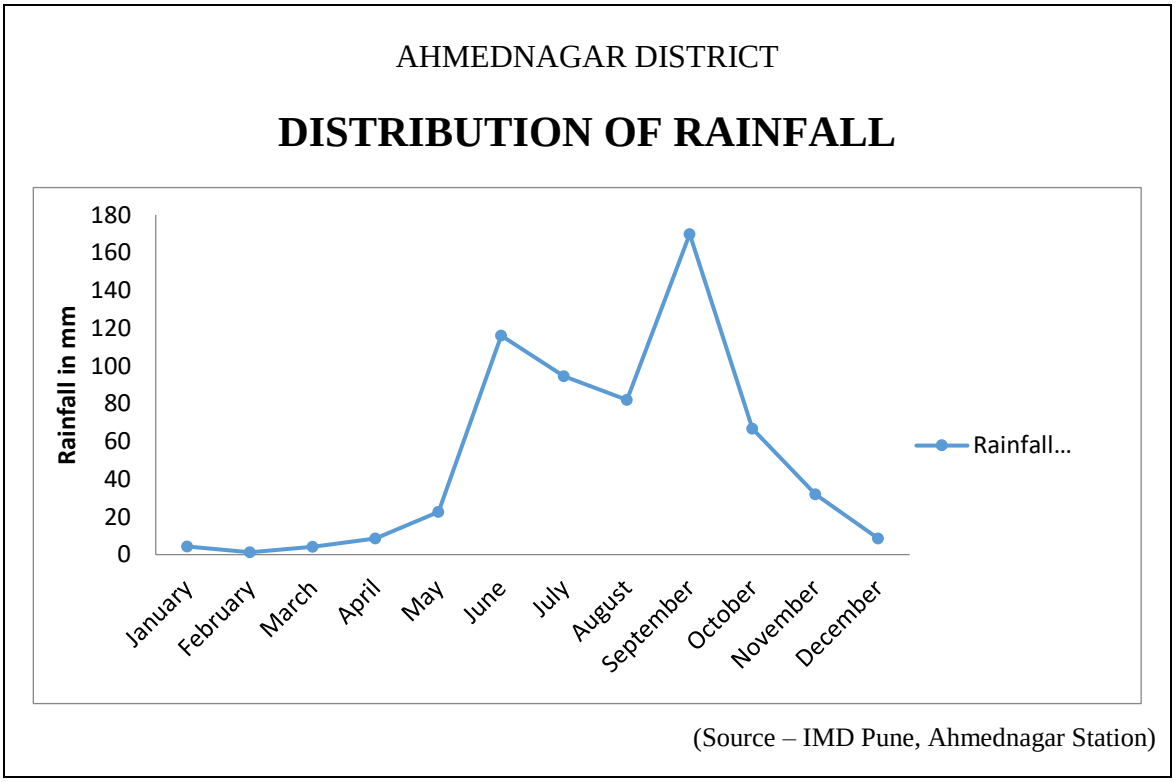
The annual rainfall of region is shown in the table no.2.3 given below

Table-2.3 . Average Annual Rainfall of Ahmednagar district.

Months	Rainfall in mm		Months	Rainfall in mm
January	**4.28**		**July**	**94.45**
February	**1.24**		**August**	**82.02**
March	**4.16**		**September**	**169.83**
April	**8.6**		**October**	**66.74**
May	**22.54**		**November**	**31.88**
June	**116.07**		**December**	**8.48**

(Source – IMD Pune, Ahmednagar Station)

Table-2.3. Average Annual Rainfall of Ahmednagar.

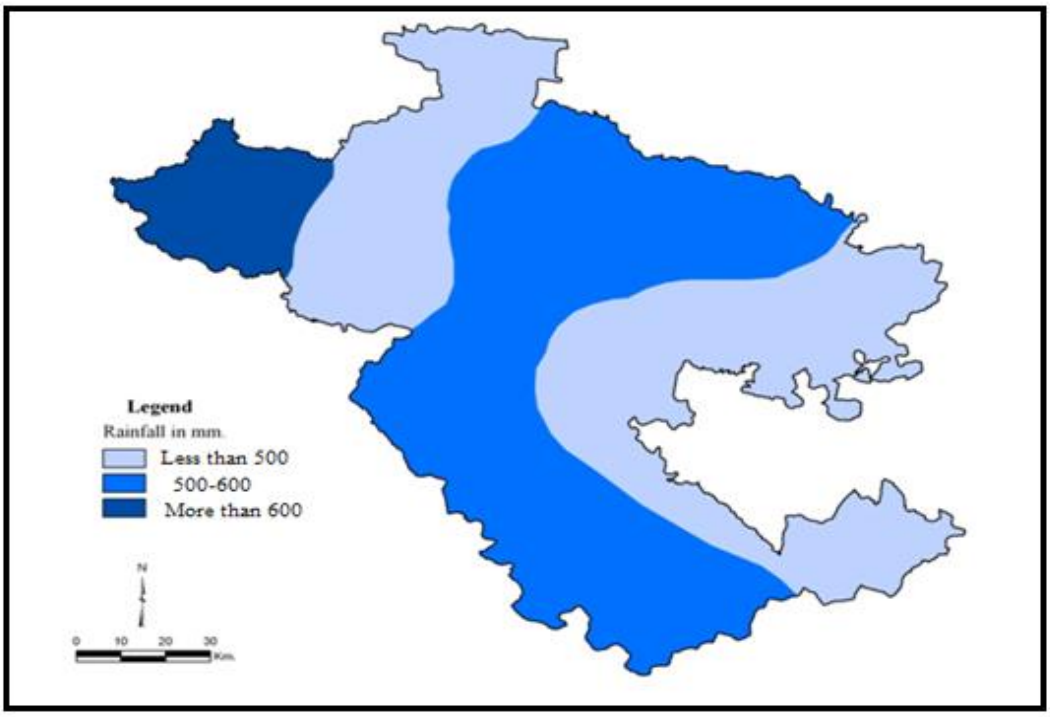


(Source – IMD Pune, Ahmednagar Station)

Fig. 2.6. Distribution of rainfall.

AHMEDNAGAR DISTRICT

DISTRIBUTION OF AVERAGE ANNUAL RAINFALL



(Source – IMD Pune, Ahmednagar Station)

Fig. 2.7. Distribution of average annual rainfall .

3. Humidity

The air is generally dry during the summer season (Feb to May). In summer the humidity is about 20% on an average. The relative humidity during the south –west monsoon period is between 60 to 80 %. For most of the period in the year, humidity of the region is less as it is a dry region.

4. Cloudiness.

During the southwest monsoon season the sky is covered with clouds (overcast). In the rest of the year sky is clear or they could cover is very less. Thunder storms occur during the months of March to June and in September and October.

In association with the monsoon depressions that form in the Bay of Bengal and move across the central parts of the country, the district experiences cloudy to overcast skies and wide spread heavy rain.

2.8. Natural Vegetation

The total area of forests in the district is about 160074.69 hectares (8.73 per cent area of the district is under forest). Among the 14 tehsils of the district, Akole tehsil accounts for 25.75% of the total forest area of the district. The forest produce is divided into two main classes, major and minor. Major forests of the western hilly part of Ahmednagar district produce Teak, Babul, Dhavada, Haldu and Neem and Fruit trees like Mango, Tamrind, Amala, Bor are also found in the district. Minor forests produce are bamboo, grass, grazing, tendu leaves and gum. The forests in Ahmednagar district are one of the valuable and well-preserved forests in Maharashtra. . Most of the villages have some land covered by forest as defined by the forest department (District Census Handbook 2001). The hilly and plateau area of the study area is covered by forest, mostly having the Tropical Deciduous type of vegetation.

2.9. Resume:

The present chapter deals with the profile of physical aspects of study region namely relief, (physiographic), drainage, soils, climate and vegetation cover. The study area has the homogeneous character with plateau and moderate slope towards the south and north of the study area. The climate in the region has small amount of temperature variation as well as rainfall variation. May is the hottest month with average monthly temperature of 29^0C. Region receive maximum rainfall from the southwest monsoon with the onset of the monsoon. Generally in the month of June, July, and August area received heavy rainfall.

References:

Gazetteers of Maharashtra District Series 1984, Ahmednagar District

Government of Maharashtra, Socio Economic Abstract for 1991 to 1998, Ahmednagar District.

IMD Pune, Ahmednagar station Weather report 2013-14.
Topo-sheet of study area published by Survey of India.

CHAPTER -III

SOCIO-ECONOMIC CHARACTERISTICS OF AHMEDNAGAR DISTRICT

3.1. General Introduction

3.2. Population

3.2.1. Rural - Urban Population of Ahmednagar District

3.2.2. Literacy of Ahmednagar District

3.2.3. Spatial distribution of population density

I. Crude Density of Population

ii. Physiological Density of Population

iii. Agricultural Density of Population

3.2.4. Sex ratio of Ahmednagar district

3.3. Occupational structure

3.4. The variation in occupational structure

3.4.1. Percentage of cultivators to farm workers

3.4.2. The agriculture labourers to farm workers.

3.4.3. Percentage of farm workers to total workers

3.5. Land holding of Ahmednagar district

3.6. Irrigation

3.6.1. Irrigation Projects in District

3.6.2. Sources of Irrigation

i. Surface Irrigation

ii. Underground Irrigation

iii. Net Irrigated Area

3.7. Transport Facilities

Resume

References

3.1 General Introduction

After unfolding the background of Geographical setting of the Ahmednagar district in earlier charter pertaining to climate, soils and relief structure, it would be relevant to understand the role of Socio-economic aspects in shaping dairy activities in Ahmednagar district. Jasbir Singh and S. Dhillon (1987) have rightly stressed the necessity of the evaluation of Socio-economic variables in terms of inputs involved in agriculture sector. These variables ultimately affect the farming, land use pattern and yield per hectare. The present study therefore is significant in this respect.

Socio-economic background of the region includes population, occupational structure, and irrigation, and transportation, impact on landuse pattern and dairy farming on the area under study. The data related to population in 1991 and 2001 have been collected from Ahmednagar district census handbook. Area under irrigation has been obtained from land records of tehsil. The elaboration of land holding is entirely based on sample surveys during the fieldwork.

3.2. Population

Population is also known as human resource. It plays very important role in overall development of any region. It is not only the beneficiary of the entire process of resource development and utilization but also is the most potent and dynamic agent of the production (Zimmerman, 1951). Human resource and agricultural development of any particular region are primarily based on the socio-economic facilities with their location at appropriate places serve the people and play an important role in the development of particular geographical area (Singh and Singh, 1987).

Because of the above statement, researcher focuses on distribution of rural urban population, literacy, sex ratio, density of population and especially on the crude density, physiological and agricultural densities. The above population factors are examined to know the impact of human resource on the development of dairy farming in Ahmednagar district.

3.2.1. Rural - Urban Population of Ahmednagar District

The development of dairy activities of any region is based on combination of rural urban population.

AHMEDNAGAR DISTRICT **RURAL-URBAN POPULATION (Values in %)**						
Tehsils	Rural Population		Decrease/increase	Urban Population		Decrease/increase
	1991	2011		1991	2011	
Ahmednagar	54.01	37.3	-16.63	45.99	62.6	16.63
Akole	100	96.5	-3.44	0	3.44	3.44
Jamkhed	100	78.5	-21.45	0	21.4	21.45
Karjat	100	95.0	-4.95	0	4.95	4.95
Kopargaon	73.81	78.4	4.61	26.19	21.5	-4.61
Nevasa	100	100	0	0	0	0
Parner	100	100	0	0	0	0
Pathardi	89.49	89.4	-0.05	10.51	10.5	0.05
Rahata	--	81.7	--	--	18.2	--
Rahuri	78.73	78.3	-0.39	21.27	21.6	0.39
Sangamner	86.17	82.0	-4.15	13.83	17.9	4.15
Shevgaon	100	100	0	0	0	0
Shrigonda	90.82	90.1	-0.68	9.18	9.86	0.68
Shrirampur	76.77	68.96	-7.81	23.23	31.00	7.81
District	81.18	79.9	-1.28	18.82	20.1	1.28
Source: Census, Ahmednagar district (1991 and 2011)						

Table 3.1. Rural-urban population.

Mainly the urban population is customer of milk and milk products and rural population is the customer as well as producer of milk and milk products throughout the dairy farming. Percentages of rural and urban population of tehsils and district are shown in table 3.1 and fig. 3.1 A&B.

In Ahmednagar district, maximum population is in the rural area. According to 1991 census 81.18 % population was residing in the rural area while 18.82 % was residing in urban area. Table 3.1 and fig. 3.1.A reveal that 100 % rural population found in the tehsils of Nevasa, Shevgaon, Jamkhed, Karjat, Parner and Akole. Tehsil Ahmednagar recorded lowest (54.01 %) rural population while rest of the tehsils marked more than 75 percent population living in rural area. It means population is highly dependent on rural activities like agriculture and its related activities like Dairy farming.

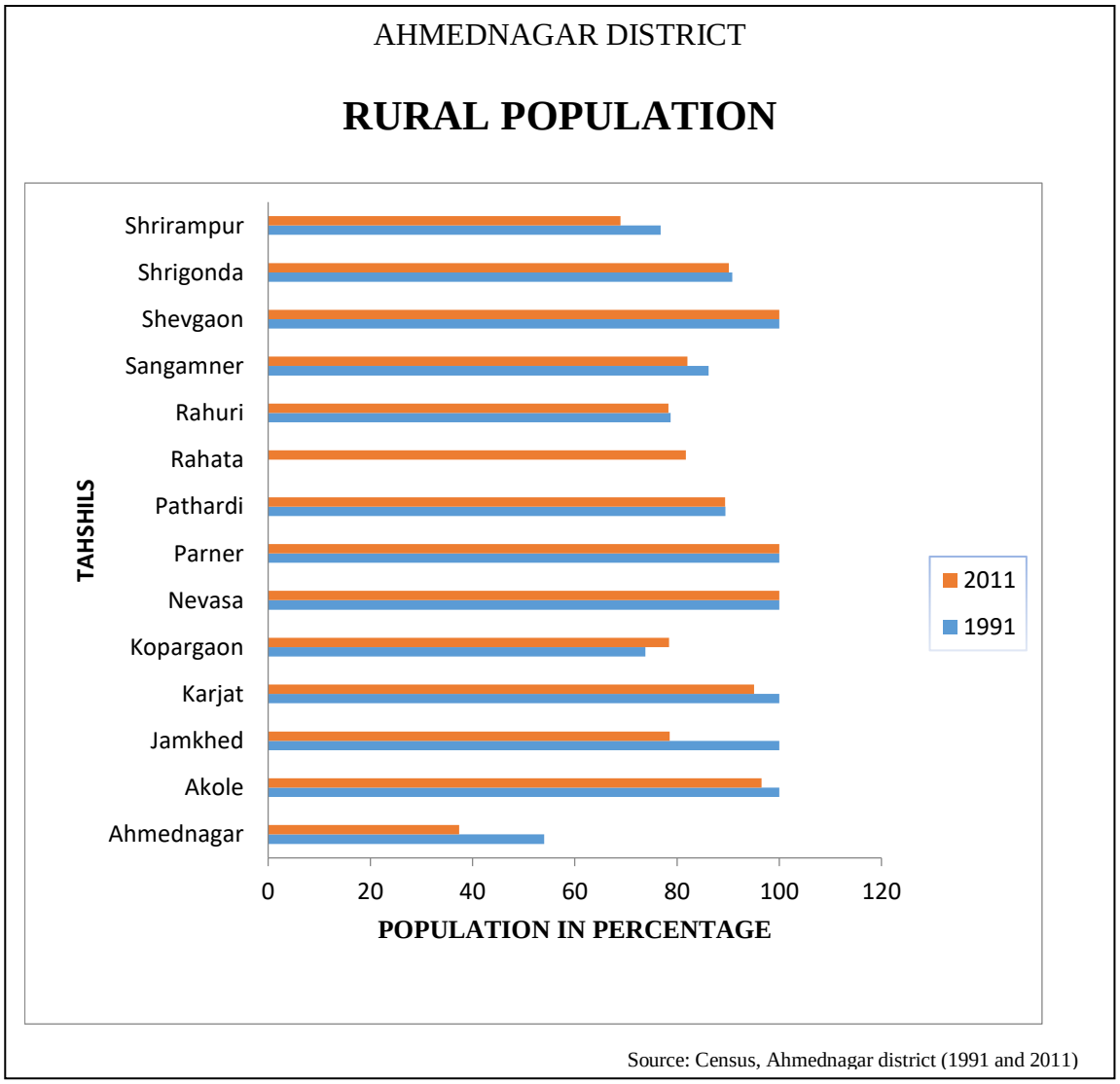


Fig: 3.1 A .Rural population of Ahmednagar district.

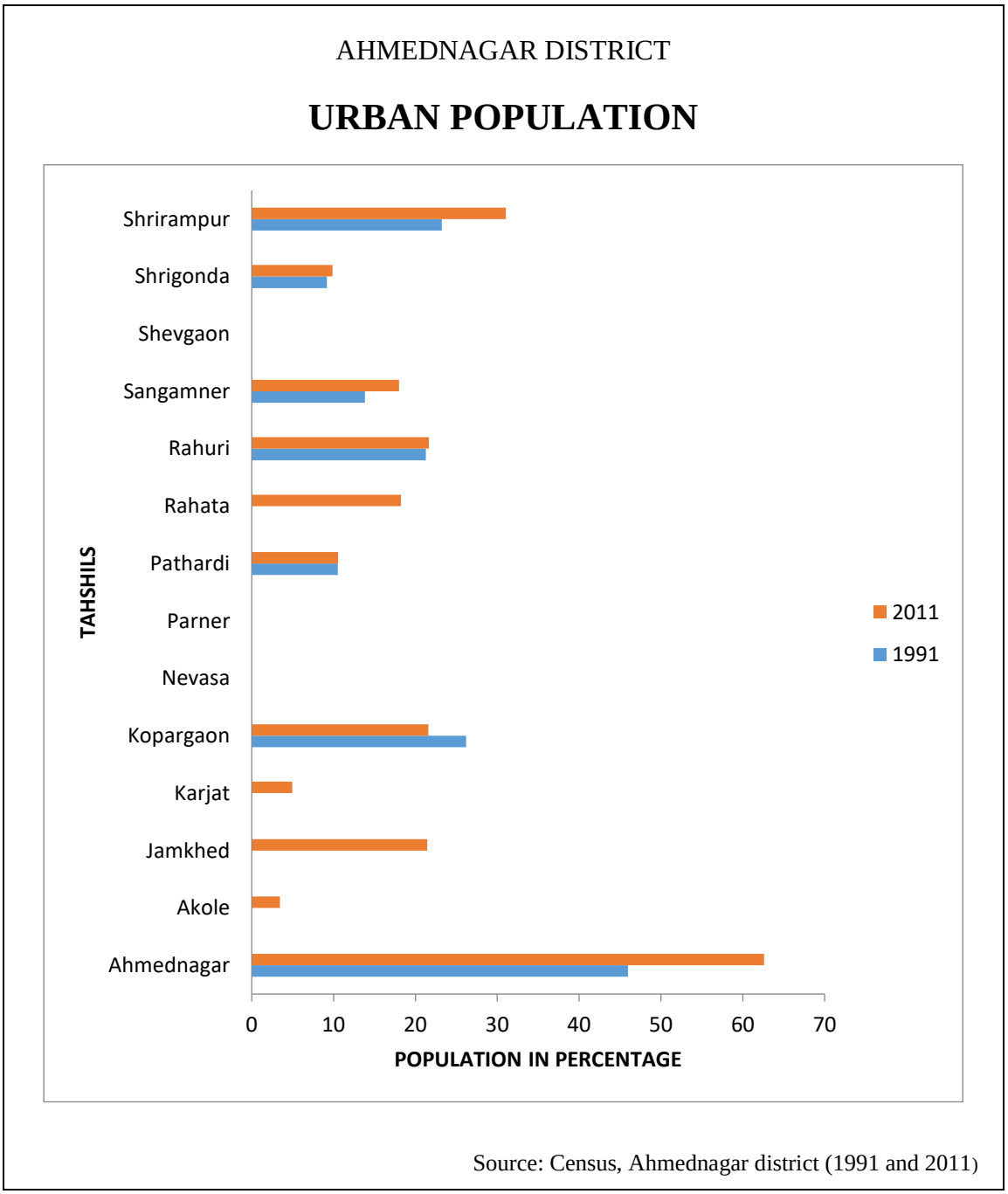


Fig: 3.1. B.Urban population of Ahmednagar district.

According to the census of 2011, population of the district was 45, 43,083 out of that, 36, 30,012 persons (79.90 %) were in the rural area where as 9, 13,071 persons (20.10 %) were residing in urban area. Ahmednagar tehsil records lowest rural population. (37.38 %) along with Shrirampur (68.98 %) while in reaming tehsils have more than 75 percent population is residing in the rural area.

During the period of two decades, rural population was decaling by 1.28 % in district (table 3.1). Change in rural population registered except in the Kopargaon tehsil. Reaming tehsils found negative change but it was significant in tehsils of Ahmednagar, Shrirampur and Jamkhed. This means population of district shows that dependency on agriculture and dairy farming has slightly decreased.

3.2.2. Literacy in Ahmednagar District

A person who can read and write with understanding in any language is known as literate (Census of India). Literacy indicates the quality of population. Education helps human being to develop various skills. So, literacy is a necessity for all those who wish to practice the dairy farming in present days. Literate population adopts new dairying technology, which has positive effects on production of milk. Therefore, literacy is highly effective in the development of dairy farming where population pressure on land is high.

Tehsil wise % of rural literate population and total population for the years 1991 and 2011 are shown in table 3.2 and fig. 3.2 A & B. According to 1991 and 2011 census total literate population in the district was 61.03 % and 70.37 % respectively. During the period of two decades' total rural literacy rate increased by 9.70 % while rural literacy rate increased by 9.54 5%.

In 1991, total literacy rate was 61.03 % where rural literacy was 57.81 percent. Fig 3.2/A shows that below 50 percent literacy was recorded in tehsil Akole whereas 50 to 60 percent literacy was recorded in Jamkhed, Shrigonda,Pathardi,Karjat, Parner, Nevasa and Shevgaon. Tehsils Rahuri, Sangamner, Shrirampur and Kopargaon have literacy rate 60 to 70 percent. Because of district place and urban centre literacy rate is above 70 percent.

According to1991 census, rural literacy rate varies from 64.96 percent in Ahmednagar tehsil to 49.66 % in Akole tehsil. Tehsils Shevgaon, Pathardi, Jamkhed and Karjat have recorded 50 to 55 percent rural literacy while 55 to 60 percent found in tehsils of Nevasa, Shrigonda, Parner and Sangamner. Tehsils of Nagar, Rahuri, Shrirampur and Kopargaon have more than 60 % rural literacy.

Table 3.2 and fig. 3.2/B reveals literacy rate of the year 2011. Ahmednagar tehsil recorded highest literacy (78.21 %) while 65 to 70 percent literacy recorded in Jamkhed,

Shevgaon, Karjat, Akole, Pathardi, Shrigonda, Parner and Nevasa tehsils. Tehsils Rahuri, Shrirampur, Sangamner, Kopargaon and Rahata have 70 to 75 %.literacy.

In 2011 census rural literacy rate varies from 70.68 percent (Ahmednagar) to 61.29 % (Jamkhed).

AHMEDNAGAR DISTRICT

LITERACY (IN %)

Tehsils	1991		2011	
	Total	Rural	Total	Rural
Ahmedagar	73.73	64.96	78.21	70.68
Akole	49.66	49.66	67.09	65.44
Jamkhed	51.51	51.51	65.23	61.29
Karjat	53.34	53.34	66.76	64.74
Kopargaon	64.88	62.45	71.34	68.35
Nevasa	57.09	57.09	68.02	68.02
Parner	56.46	56.46	67.22	67.22
Pathardi	54.01	51.76	66.55	64.22
Rahata	-	-	73.55	71.67
Rahuri	62.81	60.61	70.49	68.23
Sangamner	61.39	58.21	71.28	68.24
Shevgaon	54.72	54.72	64.13	64.13
Shrigonda	58.24	56.9	67.92	66.35
Shrirampur	66.77	64.86	73.33	69.96
District	61.03	57.81	70.73	67.35

Source: Census, 1991 and 2011

Table 3.2. Literacy of Ahmednagar district.

It was above 70 percent in Ahmednagar and Rahata tehsils while 65 to 70 percent in Rahuri, Shrirampur, Nevasa, Shrigonda, Parner, Akole, Sangamner and Kopargaon. Below 65 percent was recorded in Shevgaon, Pathardi, Karjat and Jamkhed tehsils.

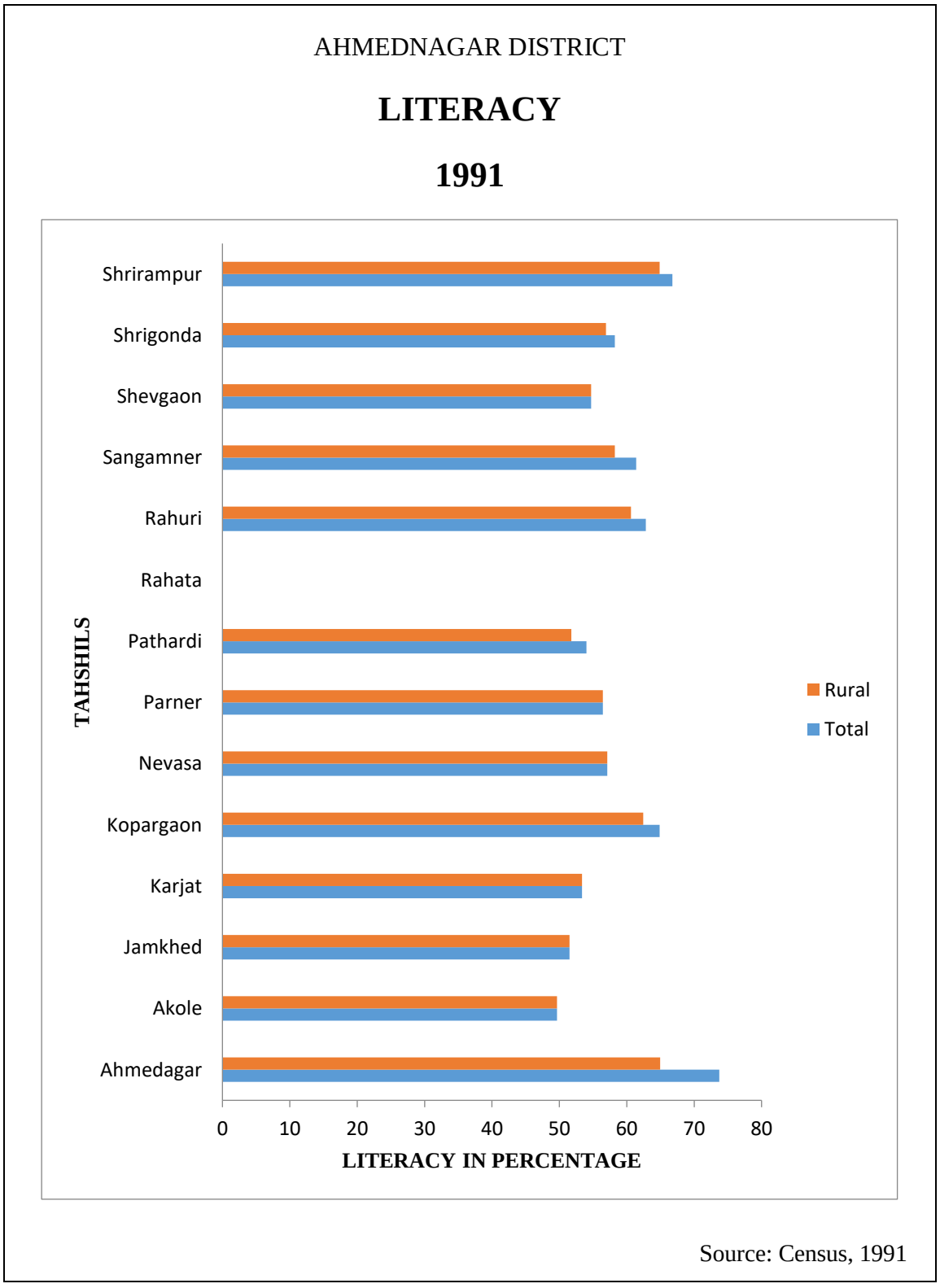


Fig: 3.2 A. Literacy of Ahmednagar district.

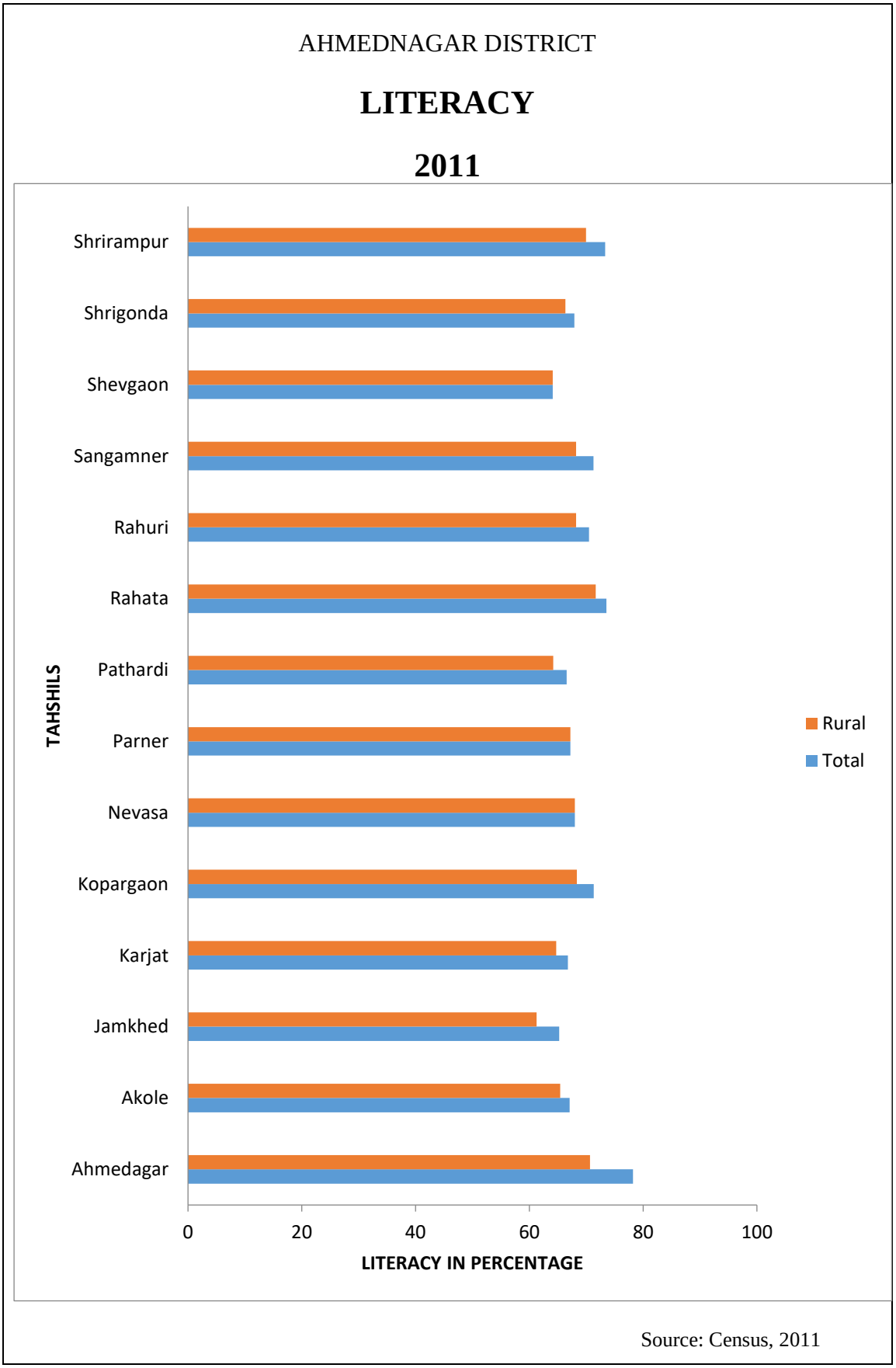


Fig: 3.2 B. Literacy of Ahmednagar district.

3.2.2. Spatial distribution of population density

Population density means numbers of people living in per sq. kms land, the density of population can be analyzed by different point of view. From Geographical point of view density can be explained as crude or surface density, rural density, physiological density, agricultural density, nutritional density and economic density. This type of study is essential to determine extent of population pressure on land and changes therein for making a plan for optimum use of land for sustainable development. Population density over an area highly depends on physical, economic and social factors. In the present study crude, physiological and agricultural density of population was worked out to examine the pressure of population on dairy farming.

i) Crude Density of Population

It is ratio between total population and total geographical area. It depicts only very general condition of population pressure. According to 2011 census crude density of district was 267 persons per sq. Km which is less than Maharashtra (365) as well as India (382).

The crude density of population shown in table 3.3. In fig. 3.3.A. Very low density marked in western, eastern and southern parts of district consisting the Akole, Parner, Shrigonda, Karjat, Jamkhed, Shevgaon and Pathardi tahsil while low density was found in northern parts of district in sangamner, Rahuri and Nevasa tehsil. Moderate density was recorded in Ahmednagar and Kopargaon tehsils while high density was in Shrirampur tehsil.

According to census 2011, very low density marked in Jamkhed, Akole, Parner, Karjat, and Shrigonda tehsils while low density was found in four tehsils namely, Sangamner, Nevasa Shevgaon and Pathardi (fig.3.3/B}. Moderate density was registered in Rahuri tehsil where high density was marked in Kopargaon, Rahata, Shrirampur and Ahmednagar tehsils.

Irrigation facilities and types of soil are the major determining factors of population density in Ahmednagar district. Northern parts of district have high density compared to southern parts of district because of plain topography, Irrigation facilities and sugar industries.

AHMEDNAGAR DISTRICT

POPULATION DENSITY

1991-2011

Tehsils	Crude Density		Physiological Density		Agricultural Density	
	1991	2011	1991	2011	1991	2011
Ahmednagar	322	456	454	598	245	223
Rahuri	248	317	386	537	304	421
Shrirampur	414	568	547	691	420	477
Nevasa	211	276	265	301	261	295
Shevgaon	157	226	232	296	226	291
Pathardi	155	215	189	279	169	249
Jamkhed	136	181	172	295	168	232
Karjat	124	158	185	265	178	252
Shrigonda	147	197	197	285	179	257
Parner	115	147	169	198	160	211
Akole	148	194	285	303	279	293
Sangamner	211	291	351	452	302	371
Kopargaon	315	429	394	588	291	461
Rahata	-	467	0	651	0	532
District	198	267	284	380	242	303

Source: Census Hand book 1991-2011

Table 3.3.Population density of Ahmednagar district.

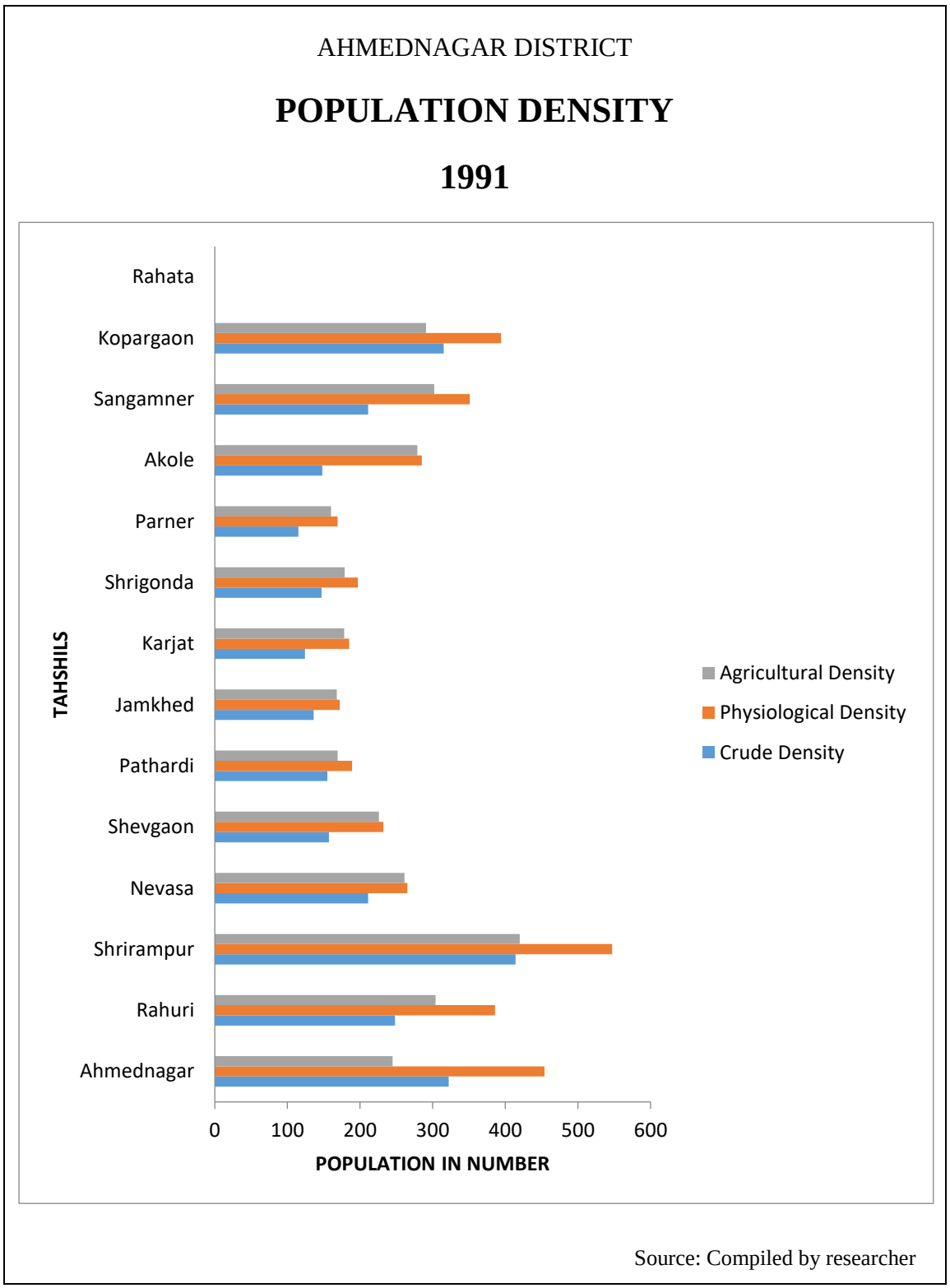


Fig: 3.3 A. Population density of Ahmednagar district.

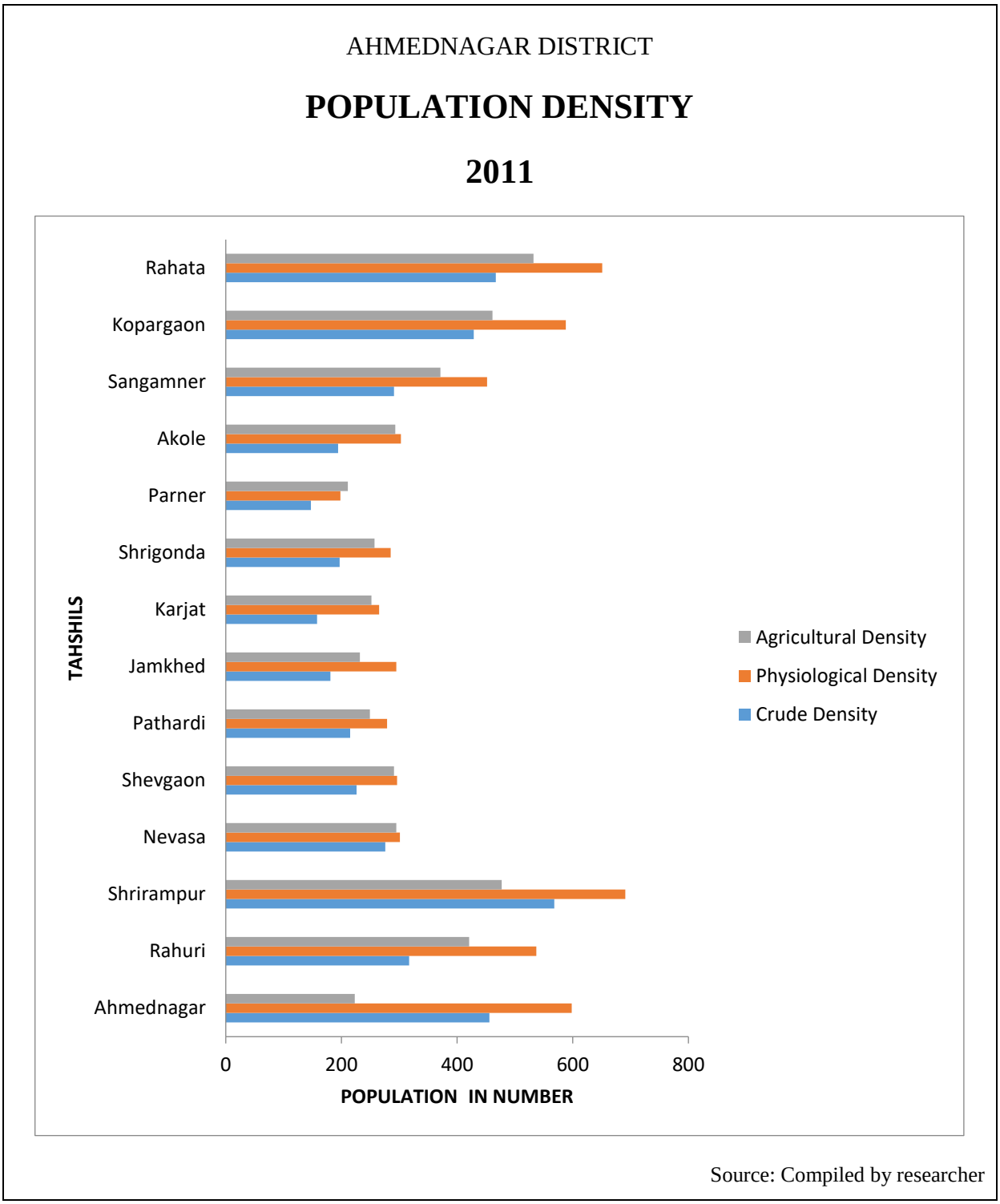


Fig: 3.3 .B. Population density of Ahmednagar district.

In tehsils Ahmednagar, Kopargaon, Sangamner and Shrirampur noticed positive change in crude density of population.

ii) Physiological Density of Population

Physiological population density means ratio between total population and cultivated land, it is also known as man soil density. It is worked out by dividing total population by net sown area in a particular region (Trewartha, G. T. 1953). The crude density shows only population pressure on total geographical area but from dairy farming point of view it is misleading. Thus, the physiological density is felt as it gives rather a more concrete picture.

Table 3.3 shows that according to 1991census, very low density was found in the tahshils of Pathardi, Jamkhed, Karjat, Shrigonda and Parner while low density was in Rahuri, Nevasa, Shevgaon, Akole, Kopargaon and Sangamner tehsils. Moderate density was found in Shrirampur and Ahmednagar tehsils and not a single tehsil that found high density in the district.

Table 3.3 and fig 3.3. B revealed physiological density of population for the year 2011. In census 2011 very low density found in Parner tehsil while low category was in Nevasa, Shevgaon, Pathardi, Jamkhed, Karjat, Shrigonda, Parner and Akole tehsils. Moderate density was recorded in tehsils namely, Rahuri, Sangamner, Kopargaon and Nagar while high density was found in Shrirampur and Rahata tehsil.

The spatial distribution pattern clearly shows that the agriculturally advanced tehsils have high physiological density of population. During the period of twenty year all tehsils recorded positive change in physiological density of population but it was significant in Ahmednagar, Rahuri, Shrirampur, Jamkhed, Sangamner and Kopargaon tehsils.

iii) Agricultural Density of Population

Agricultural density means the ratio between agricultural population and agricultural land i.e. Net sown area (Kashid, D. L. 2010). The crude and physiological density fails to show the actual pressure of agricultural population on net sown area.

To overcome this problem agricultural density of population for tehsils and district was worked out for the years 1991 and 2011.Table 3.3 shows tehsil wise agricultural density of population, it was 242 and 303 persons per hundred hectares net sown area during the years 1991 and 2011 respectively.

According to1991 census, very low density was found in Ahmednagar, Shevgaon, Pathardi, Jamkhed, Karjat, Shrigonda and Parner tehsils while low density was marked in Rahuri, Nevasa, Akole, Sangamner and Kopargaon tehsils. Tehsil Shrirampur recorded moderate category whereas high category was not found in any tehsil (fig 3.3.A).

Fig 3.3.B reveals agricultural density of population of the year 2011. Very low density was found in low irrigated area comprised tehsils of Ahmednagar, Pathardi, Jamkhed and Parner while low density was found in Nevasa, Shevgaon, Karjat, Shrigonda and Akole.Rahuri and Sangamner tehsils registered moderate density while high density was found in northern parts of district comprised Shrirampur, Kopargaon and Rahata tehsils.

During the period of two decades only Ahmednagar tehsil recorded negative change in agricultural density of population, other tehsils recorded positive change in agricultural density of population (table 3.3). But it was significant in tehsils of Rahuri, Pathardi, Karjat, Shrigonda, Sangamner and Kopargaon. By considering the agricultural density of population in Ahmednagar district those tehsils recorded significant positive change their population pressure on agriculture is increased.

3.2.4. Sex Ratio of Ahmednagar district.

In Ahmednagar district, as a whole there are 949 females for every thousand males.

AHMEDNAGAR DISTRICT

SEX RATIO

1901-2011

Year	State	District	Year	State	District
1901	978	1003	1961	936	971
1911	966	983	1971	930	968
1921	950	990	1981	937	970
1931	947	979	1991	934	956
1941	949	973	2001	938	949
1951	941	981	2011	933	941

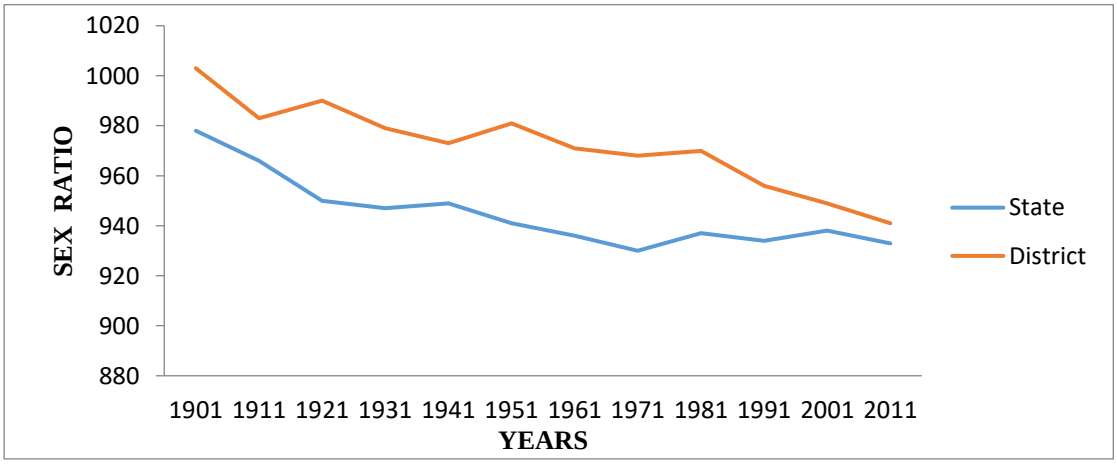
Source: Census Hand book 1901-2011

Table .3.4. Sex Ratio of Ahmednagar district.

AHMEDNAGAR DISTRICT

SEX RATIO

1901-2011



Source: Census Hand book 1901-2011

Fig.3.4. Sex Ratio of Ahmednagar district.

Since 1901 to 2011 Ahmednagar districts sex ratio is declining from 1003 to 941. But it is high compare to the Maharashtra.

3.3. Occupational structure:

In a developing country like India, the total availability of labours (as a human resource) and its division over different economic activities can be considered as a measure of the overall economic development. The availability of labour resources and its involvement in various activities in agriculture and dairy activities represent the scenario of development of the region. The region has 67% population engaged in working force (census 2011). The population can generally, grouped into two groups. These are:

a) Working population.

b) Non-working population.

The working population owes special significance as it is directly involved in economic productive activity like commercial farming, dairy farming etc. The proportions of population, demographic characteristics and economic composition have a bearing on the landuse pattern and activities.

The planning Commission organization has suggested two types of working population.

1. Main workers and
2. Marginal workers.

The main workers have been again grouped into four sub groups these are as follows.

1. Cultivators
2. Agriculture labourers
3. Workers engaged in household industry and
4. Other workers such as trade and transport.

AHMEDNAGAR DISTRICT

OCCUPATIONAL STRUCTURE

1991-2011

Tehsils	Total Workers		Cultivators		AgriLabourers		Farm workers	
	1991	2011	1991	2011	1991	2011	1991	2011
AHMEDNAGAR	180093	147949	50005	65096	26714	27068	76719	69122
RAHURI	104435	124747	39903	53059	36855	38247	76758	80934
SHRIRAMPUR	124176	93062	34435	28196	41904	34432	76339	47385
RAHATA		121767		39457		31839		60977
NEVASA	126405	180838	52533	78362	54057	54958	106590	107686
SHEVGAON	77787	125613	40834	61942	25330	36144	66164	72323
PATHARDI	86773	124424	56471	79281	18403	22818	74874	73728
JAMKHED	50917	80954	28444	40357	13302	21499	41746	41352
KARAJAT	84899	127361	51723	75658	20592	28768	72315	70929
SHIRIGONDA	104233	158323	58356	91468	29748	39578	88104	102313
PARNER	95404	150346	63752	93729	18120	26799	81872	94212
AKOLE	103173	154135	69771	84227	16576	33307	86347	91131
SANGAMNER	156803	217080	85526	118595	28762	46812	114288	125742
KOPERGOAN	137313	115795	46535	44283	50555	41165	97090	69911
District Total	1432411	1922394	678288	955721	380918	485445	1059206	1107745

Table no.3.5. Occupational structure of Ahmednagar district. (Source – Compiled by Author)

AHMEDNAGAR DISTRICT

OCCUPATIONAL STRUCTURE

1991

AHMEDNAGAR DISTRICT

OCCUPATIONAL STRUCTURE

2011

(Source – Compiled by Author)

Fig.3.5 .A/B. Occupational structure 1991& 2011

As per definition main workers are those who are engaged in economic productive activity for a major part of the preceding year (at least six months or 180 days), while marginal workers means those who worked for some time but not for the entire year (census of India, 2011)

Occupational structure has been studied under following groups.

1. Percentage of total workers to total population.
2. Farm workers
3. Percentage of cultivators to farm workers and
4. Percentage of agriculture labourers to farm workers.

3.4. The variation in occupational structure

AHMEDNAGAR DISTRICT

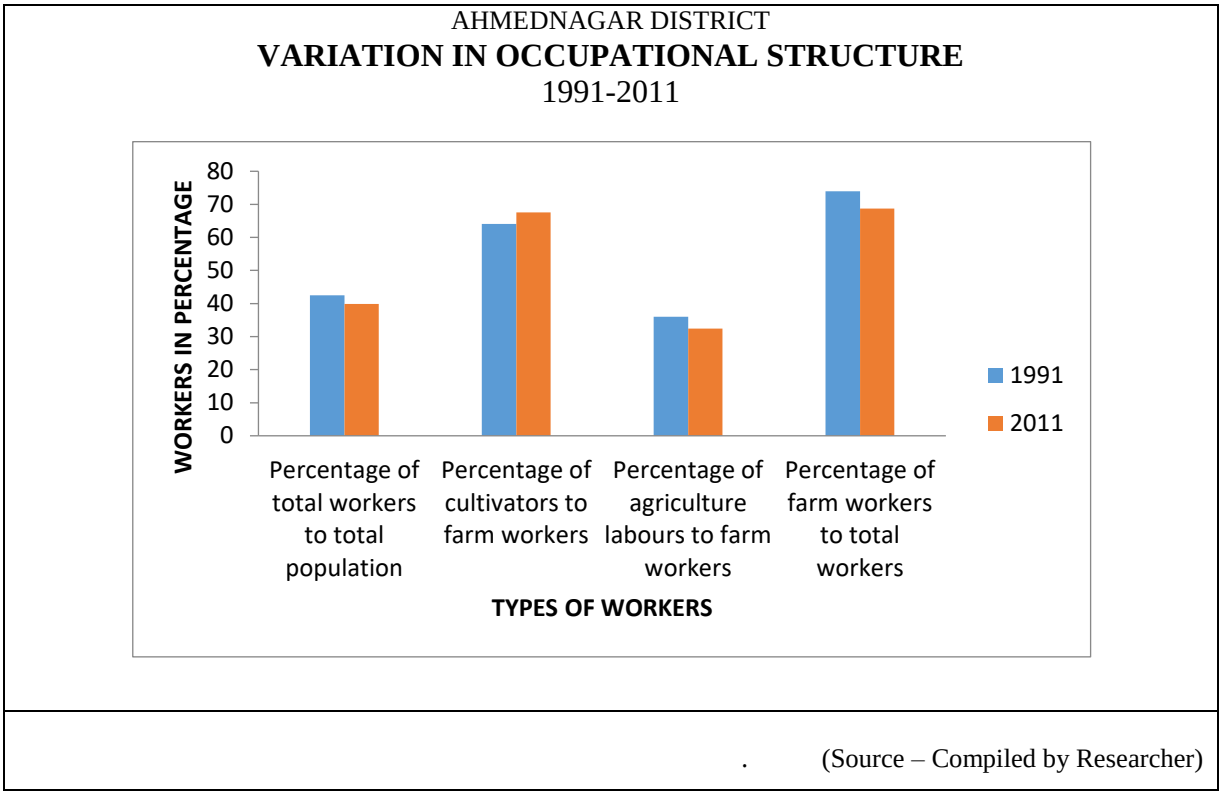
VARIATION IN OCCUPATIONAL STRUCTURE

1991-2011

Sr. No	Categories	Years		Increase / decrease
		1991	2011	
1	Percentage of total workers to total population	42.46	39.87	Decrease by 2.59%
2	Percentage of cultivators to farm workers	64.04	67.59	Increase by 3.55%
3	Percentage of agriculture labours to farm workers	35.96	32.40	Decrease by 3.56 %
4	Percentage of farm workers to total workers	73.94	68.75	Decrease by 5.19%

. (Source – Compiled by Researcher)

Table no. 3.6. Variation in occupational structure of Ahmednagar district.



. (Source – Compiled by Researcher)

Fig.3.6.Variation in occupational structure of Ahmednagar district.

The temporal variations in the ratio of working force to total population, thus reveals the gravity of the problem of ever growing population pressure on land has been causing unemployment and under employment.

3.4.1. Percentage of cultivators to farm workers.

The cultivators include both tenant and owner of farm workers, whereas, farm workers refer to cultivators and agricultural labourers (census of India 1991). The involvement of farm workers in agriculture in the region has significance, as it is a major plateau of Ahmednagar.

Fig.3.5 A and B gives comparative exposition of spatial distribution of cultivators to farm workers for 1991 and 2011 in Ahmednagar district.

Persons (64.04%) in 1991 and (67.59%) in 2011 that shows increase in cultivators by 3.55% in Ahmednagar district.

The spatial distribution of cultivators in 1991 is shown in fig no. 3.5/A. In the Jamkhed tehsil have less number of cultivators due to low fertility of soil and lack of

irrigation facilities in the region. In the middle part of the Ahmednagar district, particularly Sangamner tehsil and Ahmednagar tehsil having high number of cultivators, respectively 85526 and 50005 cultivators to farm workers. The spatial distribution of cultivators in 2011 shown in fig no. 3.5/ B. Numbers of cultivators to farm workers is increasing in Ahmednagar district. Shrirampur tehsil has less number of cultivators, it is due to formation of new tehsil form Shrirampur tehsil namely Rahata tehsil .Same like 1991 in the middle part of the Ahmednagar district, particularly Sangamner tehsil having high number of cultivators to farm workers.

Between 1991 and 2011, number of cultivators have increased only by 3.55%. This may be due to change in occupational structure. From 1991 to 2011, population engaged in dairy farming shows an increment, as people have shifted to dairy farming, and subsequently very less increase of cultivators in the Ahmednagar district

3.4.2. The agriculture labourers to farmworkers.

Fig 3.5 gives comparative exposition of spatial distribution of agricultural labourers to farm workers for the year 1991 and 2011 in Fig no. 3.5/A and no.3.5. B. The spatial distribution of agricultural labourers to farm workers is shown in Fig no. 3.5/A for 1991 in Ahmednagar district

The Fig no. 3.5.A and Fig no. 3.5.B gives comparative exposition of spatial distribution of agricultural labourers to farm worker for 1991 and 2011 in Ahmednagar district. The total agricultural labourers are 380918 Persons (35.96%) in 1991 and 35892 people (32.40%) in 2011 that shows decrease in agricultural labourers by 3.56 % in Ahmednagar district. The fig no.3.6 shows that the agriculture labourers decreased considerably during 1991 to 2011. It has decreased by 3.56% in the Ahmednagar district. Between 1991 and 2011, number of agriculture labourers decreased by3.55%, this may be due to change in occupational structure. From 2001 to 2011, population engaged in dairy farming shows an increment, as people have shifted to dairy farming, and subsequently agriculture labourers decreased in the Ahmednagar district.

3.4.3. Percentage of farm workers to total workers:

Ahmednagar district is predominantly livestock and agricultural region of Maharashtra. Nearly sixty percent of working population is engaged in dairy and agriculture activities. (The district census handbook 1991). The spatial distribution of farm workers to total workers for 1991 in Ahmednagar district is shown in Fig.no.3.5. A The Ahmednagar district had 1059206 farm worker in 1991(73.94%)to the total workers and fig.no.3.5. Bhas shown that farm workers to total workers of 2011. Ahmednagar district has 1107745 farm workers in 2011(68.75%). Between 1991 and 2011, number of farm workers to total workers were decreased by 5.19% this was again may be due to change in occupational structure. From 2001 to 2011, population engaged in dairy farming shows an increment, as people have shifted to dairy farming in the Ahmednagar district.

3.5. Land holding of Ahmednagar district.

The size of land holding is an important factor in determining the efficient use of the resources available to farmers. The application of various proportions of inputs to the land their efficient utilization depends upon the size of farm. Besides physical environment, the socio-economic conditions such as the farmers, resources, capacity, attitude, crop pattern and the type of farming practiced together fix the size of land holding in an area.

With the ever-increasing population, the pressure on land increases leading to the fragmentation of large size farm holdings. A major cause of low agriculture efficiency in India is fragmentation and subdivisions of holdings. Apart from population pressure, the small size of farm could be attributed to laws of inheritance, decline of joint family system, absence of alternative employment opportunities lack of capital investment and attachment to land as a valuable property. The result is the existence of numerous small size farms which are widely scattered pieces of land and hence are uneconomic to cultivate. These uneconomic farms give rise to wasteful method of farm operations, (Datye V. S., 1984)

The disadvantages of fragmentation and scattered holdings are well known. It puts a large proportion of land outside the possibility of effective cultivations involving wastage of time and the need to supervise, it makes capital duplication necessary. The small plots are difficult to work with tractor, weeding and pest control is also difficult and it limits mechanization and experimentation. Overall it is a serious impediment to the agriculture

progress and acts as a deterrent to a full utilization of land and farm force (Sing Jasbir-1974)

The Ahmednagar district like other regions has heavy pressure of growing population which results in subdividing agricultural plot into small holdings.

AHMEDNAGAR DISTRICT **LAND HOLDING**						
	>-10	11-20	21-30	31-40	41-50	51- >
AHMEDNAGAR	1829	7824	4620	1951	26	
AKOLE	26255	5208	1777	316	112	62
JAMKHED	4256	4581	2077	337	98	204
KARJAT	3633	6181	3551	418	4	40
KOPARGAON	426	1319	1463	580	571	1853
NEVASA	1796	2823	2529	887	95	33
PANER	8610	5663	3633	1033	136	17
RAHURI	3935	6712	3119	227	18	4
SANGAMNER	10926	6505	2963	468	215	158
SHEVGAON	4002	4293	2792	609	96	
SHRIGONDA	432	970	976	755	360	1718
Source- Ahmednagar district census handbook 2011 (in Acres)						

Table.no.3.7.Land holding of Ahmednagar district.

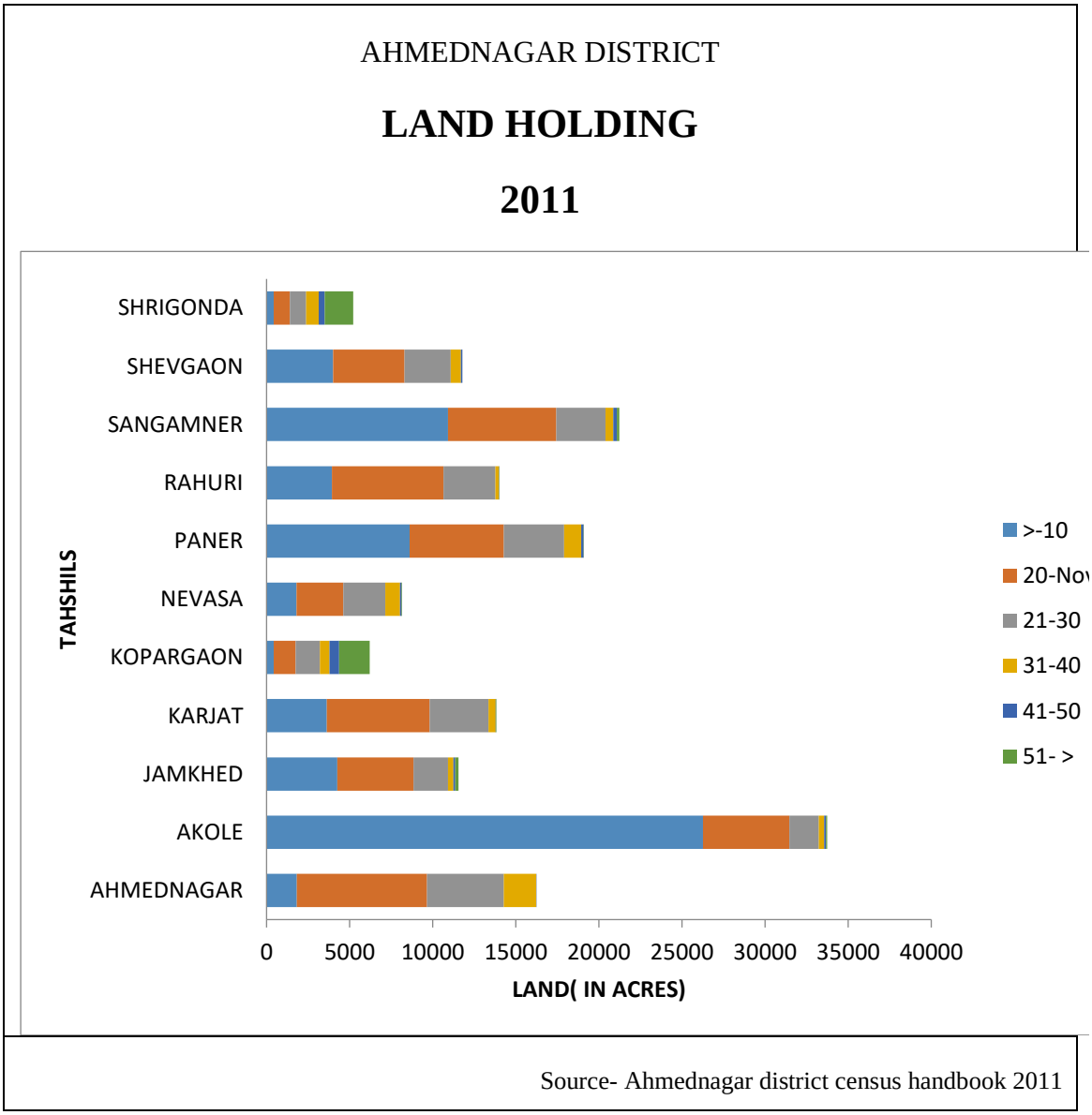


Fig.no.3.7. Land holding of Ahmednagar district'

During the field work and interview with farmers, the fact uncovered that the land of small size creating numerous difficulties, such as proper supervision accessibility of easy inputs, wastage of time, use of improved implements and limitations for mechanization, and thus, small size of land holdings has adverse effect on efficient land utilization.

Table-no 3.7 and Fig.no.3.7 shows land holding of Ahmednagar district, according to the data, small land holding are chiefly found in Akole sub-division. Large land holding found in Kopargaon, Shrigonda and Jamkhed sub-Division and other sub-

division shows middle-size farm, which is directly or indirectly help to develop dairy activities.

3.6. Irrigation

Irrigation is the process of artificially applying water to the soil for raising crops. Irrigation helps in fulfilling moisture deficiency in soils during the crops season so as to ensure proper and sustained growth of crops. In additional land use second or third crop being raised on the land having irrigation facilities which could otherwise may not be cultivated. It ensures the benefits to farmers by reducing the risk of crop failure, increasing the average yields and permitting multiple cropping. (Sinha, U. P., 2011)

The need of irrigation is very much connected with the nature of soils. Coarse shallow soil has less retentive capacity of moisture, need frequent watering. On the other hand, deep black and medium black soils have higher water holding capacity and require less irrigation.

According to Pawar, A. N. 2007, irrigation is the most important input required for the successful cultivation of high yielding varieties. The new seeds require water at specific periods of growth, development and flowering. The timings of irrigation and the quantity of water supplied are decisive for the performance of the crops (Todkari, G.U. 2012).So without understanding irrigation, dairy farming production is a risky venture. Thus, irrigation is the main axis around which the whole dairy activity revolves. The distribution of rainfall in the study area is very less and erratic in nature so irrigation becomes the most important controlling factor of cropping pattern and agricultural productivity as well as dairy farming.

3.2.1 Irrigation Projects in Ahmednagar District:

In Ahmednagar district for the purpose of irrigation and drinking water many irrigation projects are constructed. Wilson dam near Bhandardara in Akole tehsil is constructed on river Pravara. This dam impounded about 11 thousand million cubic feet of water behind the dam. The storage feeds two canals, the Pravara right and left bank, taking off from a pick-up weir 90 km. downstream of the dam at village Ozar. These canals irrigate an area about 32000 hectares mainly in Sangamner, Rahuri, Rahata, Shrirampur and Nevasa tehsils

Table 3.8. **Irrigation Projects in Ahmednagar district**

Tehsils	**Major Projects**	**Medium Project**	**Minor Project**	**Percolation Tank**	**KT Weir**	**Storage Tank**
Ahmednagar	0	0	14	224	6	78
Akole	4	3	3	144	20	208
Jamkhed	0	1	1	99	3	49
Karjat	0	0	3	141	0	76
Kopargaon	0	0	0	32	5	39
Nevasa	0	0	2	12	10	58
Parner	3	1	2	346	2	80
Pathardi	1	3	11	142	4	131
Rahata	0	0	0	0	0	24
Rahuri	1	0	0	44	6	27
Sangamner	0	0	46	171	17	126
Shevgaon	0	1	1	41	0	58
Shrigonda	0	1	2	200	1	49
Shrirampur	0	1	15	18	0	48
Source: Socio-economic abstract of Ahmednagar district						

Table 3.8. Irrigation projects in Ahmednagar district.

Baragaon Nandur dam in Rahuri tehsil, on river Mula is the one of the most importance project of the district. The storage of this dam is about 30,000 million cubic

feet of water and irrigates 52,000 hectares of land through left and right bank canals mainly in the Rahuri, Nevasa and some part of Pathardi and Shevgaon tehsils.

The Ghod project comprises an earthen dam across the river Ghod at Chinchani village in Sirur tehsil of Pune district. Its left bank canal irrigates 17,000 hectares land of Parner and Shrigonda tehsils. However, river Godavari left and right bank canals irrigate the land of Kopargaon and Rahata tehsil.

Devthana dam on the river Adhala, Mandohal dam in Parner tehsil and Pargaon Ghatsheel dam in Pathardi tehsil are some of other dams in the district. Their irrigation capacity depends on amount of precipitation in catchment area. The percolation and storage tank was constructed on the tributaries of major rivers in the district. It is useful to increase groundwater level. Kolhapur type dam (KT weir) is constructed in river bank of Godavari, Pravara, Mula, Sina and Kukdi. The small lakes constructed for the purpose of percolation and seasonal irrigation. The major lakes are Visapur, Bhatodi, Musalvadi and Gunvadi in district. The co-operative sugar factories and farmers' co-operative societies provide lift irrigation facility from river and canals.

3.6.2 Sources of Irrigation

Based on the accessibility of surface and groundwater, relief, soil and climatic characteristics varying sources of irrigation are utilized in Ahmednagar district. These sources are classified in two categories i.e. Surface irrigation and underground irrigation. In present study, the distributional aspects of irrigation in Ahmednagar district are analyzed by means of two different approaches. First is the study of tehsil wise share of surface and underground irrigation to total irrigated area and second is to study the spatial variation of net irrigated area. Tehsil wise percentage share of surface and underground irrigation to total irrigated area was worked out by the following formulae as adopted by Sinha, U. P. (2011).

$$\text{Share of } i^{th} \text{ source} = \frac{\text{Total irrigated area of } i^{th} \text{ source of } j^{th} \text{ tehsil}}{\text{Total irrigated area in } j^{th} \text{ tehsil}} \times 100$$

i) Surface Irrigation

The area irrigated by rivers, lakes, canals and small dams are the sources of surface irrigation. In surface irrigation canals are the major source of irrigation in study region. During 1990-91 surface irrigation was 29.53 percent of the total irrigated area (table 3.2). North part of the district has high share than the south part. The tehsils of Nevasa registered highest share (60.02 percent) followed by Rahuri, Karjat and Kopargaon while lowest share recorded in tehsils of Shevgaon (0.77 percent) followed by Nagar, Jamkhed and Pathardi.

During the year 2010-11 percentage share of surface irrigation was 31.41 percent of total irrigated area. Highest share was recorded in tehsils of Kopargaon, Shrirampur, Rahuri and Akole located in Mula Pravara and Godavari basin (table 3.2) where as it was low in tehsils of Pathardi and Nagar.

During the period of investigation share of surface irrigation increased by 1.88 percent of total irrigated area. Change in area under surface irrigation registered significant positive change in tehsils of Rahuri, Shrirampur, Jamkhed, Shrigonda, Akole and Kopargaon while tehsils Nevasa, Karjat and Sangamner noticed significant negative change. Tehsils of Nagar, Shevgaon, Pathardi and Parner noticed insignificant change in area under surface irrigation. There is an increase in surface irrigation in these tehsils due to Government of Maharashtra has taken efforts to repair and constructed canal water distributaries under the scheme of *Rojgar Hami Yogna.*

The excess use of surface water for irrigation by canals has resulted into the depletion of physical and chemical properties of fertile soils (Isitekhale, H. *Et al* 2014). The flatness of the relief, high water table, arid and semi-arid climate and an excess amount of soluble salts brought in by irrigation in the canals command area, converts the productive land to agriculturally poor land i.e. Saline and alkaline soils. However, in canals command area farmers grown high water require crop i.e. Sugarcane, it has adverse effects on soil productivity due to this, year by year per hectare yield of sugarcane is declined (Patil, K. K. 2007).

ii) Underground Irrigation

Wells and Tube-wells are the principal sources of underground irrigation.

AHMEDNAGAR DISTRICT

IRRIGATED AREA

1990-2011

Tehsils	% share of surface irrigation to total irrigated area		% share of underground irrigation to total irrigated area		Net irrigated Area in %	
	1990-91	2010-11	1990-91	2010-11	1990-91	2010-11
Ahmednagar	1.44	2.98	98.56	97.02	21.31	14.62
Akole	28.51	46.33	71.49	53.67	14.22	15.11
Jamkhed	1.86	14.66	98.14	85.34	8.78	10.86
Karjat	39.13	24.98	60.87	75.02	21.15	19.51
Kopargaon	35.09	44.44	64.91	55.56	37.82	39.87
Nevasa	60.02	35.85	39.98	64.15	33.79	45.38
Parner	28.03	29.11	71.97	70.89	13.59	14.23
Pathardi	3.5	1	96.5	99	13.82	13.87
Rahata	--	21.78	--	78.18	--	95.82
Rahuri	43.85	48.52	56.15	51.48	50.93	73.66
Sangamner	16.81	8.5	83.19	91.5	26.81	30.7
Shevgaon	0.77	3.72	99.23	96.28	19.38	18.29
Shrigonda	35.75	54.88	64.25	45.12	26.53	20.06
Shrirampur	25.33	60.14	74.67	39.86	48.17	82.84
District	29.53	31.41	70.47	68.59	24.37	29.42

Source: Socio economic abstract of Ahmednagar district (1990-91 and 2010-11

Table 3.9. Irrigated area of Ahmednagar district.

Introduction of oil engines and electric pump in place of traditional method of water lifting has helped rapid development of underground irrigation in last two decades. Well irrigation is popular and wide spread in whole district. It is a major source of irrigation particularly in low depth of ground water. However, tube well is mostly confined in the areas of comparatively high depth of ground water. When there is failure of monsoon, crop can be raised only by providing water from underground sources. In the study region, underground water irrigation share is higher than the surface irrigation.

During the year 1990-91 surface irrigation accounted 70.47 percent of the total irrigated area in district. Spatial distribution pattern reveals the maximum share recorded in those tehsils where surface irrigation share is lowest. During the year 2010-11 share of underground irrigation is recorded 68.59 percent (table 3.9). It's share has declined by 1.88 percent during the period of investigation.

Volume of change in underground irrigation sources has noticed significant positive change in tehsils of Nevasa, Karjat and Sangamner while significant negative change found in tehsils of Rahuri, Shrirampur, Jamkhed, Shrigonda, Akole and Kopargaon. In study region ground water sources become dry in summer season and it has adverse effects on agriculture. This calls for rational use of available water through proper water management techniques.

Table 3.9 revealed net irrigated area of year 1990-91 and 2010-11. During the year 1990-91 net irrigated area was 24.37 percent tehsil wise it ranged from as low as 8.78 percent to high as 50.93 percent (fig. 3.8). Jamkhed tehsil of south parts of district, Pathardi and Shevgaon tehsils of eastern parts of district and Parner and Akole tehsils of western parts of district found very low net irrigated area whereas six tehsils namely, Nagar, Nevasa, Karjat, Shrigonda, Sangamner and Kopargaon were noticed low net irrigated area. Tehsils Rahuri and Shrirampur registered moderate category while high category was not found in any tehsils of district during this year.

iii) Net Irrigated Area.

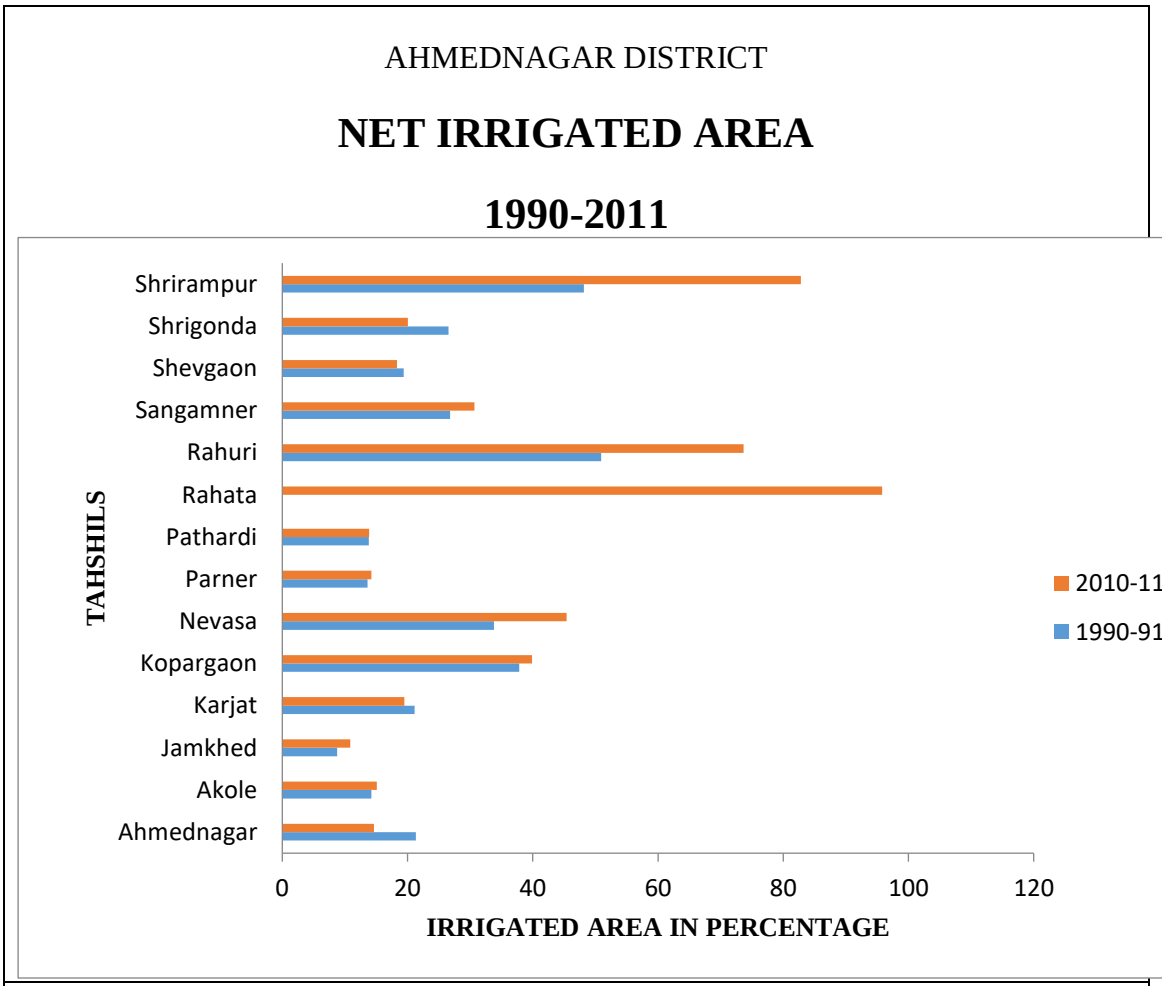


Fig.3.8. Net irrigated area of Ahmednagar district.

Spatial distribution of net irrigated area of the year 2010-11 has shown in fig. 3.8. During this year net irrigated area was 29.42 percent and varies from 10.86 to 95.82 %. Very low net irrigated area was recorded in seven tehsils namely, Ahmednagar, Jamkhed, Karjat, Shevgaon, Pathardi, Parner, Akole while low net irrigated area registered in southern tehsil Shrigonda and northern tehsils Sangamner and Kopargaon. Tehsil Nevasa registered moderate category whereas high category was noticed in northern part of district consisting tehsils of Rahata, Rahuri and Shrirampur.

Significant positive change in tehsils of Rahuri, Shrirampur and Nevasa while significant negative change recorded in tehsils of Nagar and Shrigonda and rest of the tehsils found insignificant change.

3.7. Transport Facilities:

AHMEDNAGAR DISTRICT

TRANSPORTAION NETWORKS

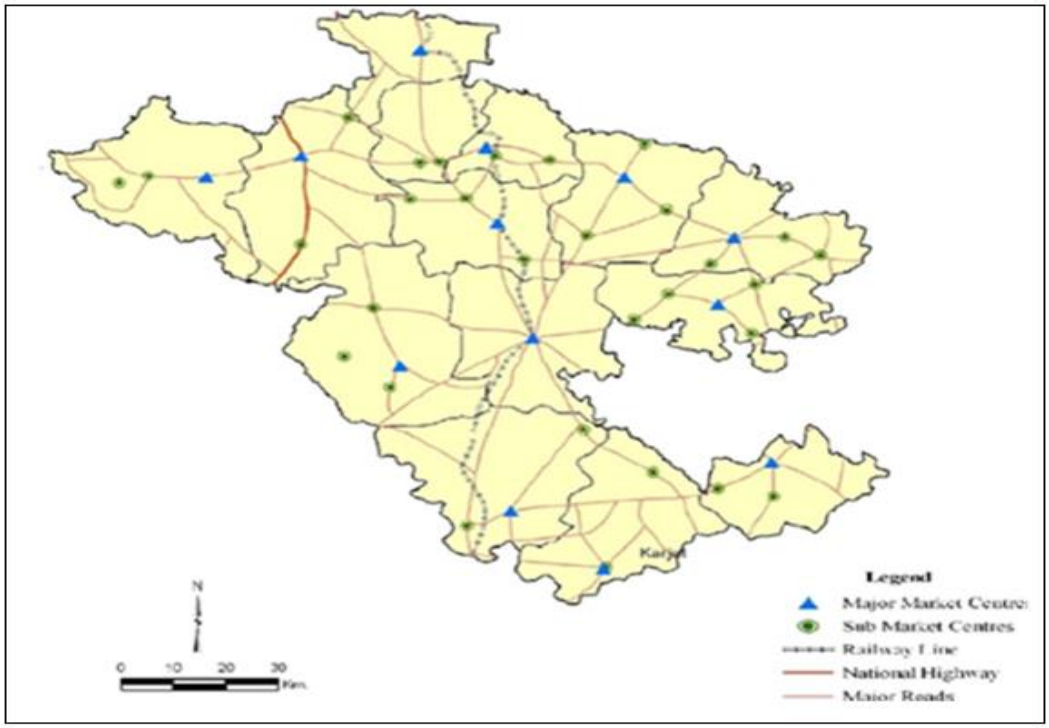


Fig: 3.9. Transportation networks. Socio-economic abstract of Ahmednagar district, 2010-11

AHMEDNAGAR DISTRICT

ROAD TRANSPORTAION NETWORKS

Sr. No.	Type of road	Length (in km)	Total district road (in %)
1	National Highway	61	0.47
2	Major State Highway	19.37	0.15
3	State Highway	1643.09	12.66
4	Major District Road	2727.59	21.02
5	Another District Road	3345.48	25.78
6	Village Road	4570.81	35.23
7	Other Road	466.15	3.59
	Total Road Length	12975.49	100.00

Socio-economic abstract of Ahmednagar district, 2010-11

Table 3.10. Road transportation networks of Ahmednagar district.

Transport facilities also have a direct impact on dairy farming of a region. Better transport help to developed dairy farming. Transportation help, the mobilization of resources and reduces the gap between rural and urban communities. In study region roads are lifelines and it plays an important role in dairy development. They provide door to door service within short time. A network of roads, comprising trunk roads, link roads, approach roads and village roads provides proper access to markets to dairy farmers.

Fig.3.9 shows the transportation network and table 3.10 revealed classifications of roads and their length in district. Total 12975.49 km roads are available for transportation. Out of this 35.23 percent are village road, national highway 0.47 percent, major state highway 0.15 percent, state highway 12.66 percent, major district roads 21.02 percent, other district roads are 25.78 percent and other road 3.59 percent.

The Ahmednagar district has limited facility is available by railway network. Daund-Manmad line of the Central Railway is the only one railway line passing through the district. The total length of this line is 197.00 km in district. This route traverses through Shrigonda, Ahmednagar, Rahuri, Shrirampur and Kopargaon tehsils.

In the study region availability of better transportation facilities farmers are able to supply the perishable goods like, milk within a short time at a reasonable cost of transportation.

Resume

Development of dairy farming of the study region is governed by various non-physical determinants viz. Irrigation, farm implements (traditional and modern), demographic factors, transportation facilities. In study area for the purpose of irrigation many projects are constructed viz. Bhandardara, Mula Dam, Devthana, Mandohal, and Pargaon Ghatsheel. Canals, rivers, wells and tube wells are the major sources of irrigation in district. During the period of two-decade net irrigated area increased in the study region.

In Ahmednagar district livestock plays a prominent role in development. Goat and sheep combine occupied first rank while cattle occupy second rank out of total livestock population in district. During the period of investigation cattle and buffaloes increased continually. This has direct impact on dairy farming.

References:

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CHAPTER- IV

GEOGRAPHICAL FACTORS OF DAIRY FARMING OF AHMEDNAGAR DISTRICT

4.1. General Introduction

4.2. Geographical factors of dairy farming

- 4.2.1. Relief
- 4.2.2. Climate
- 4.2.3. Water
- 4.2.4. Soils

4.3 Socio-Economic factors of dairy farming

- i). Labour
- ii) Capital
- iii) Transport Facilities
- iv). Market

4.4. Others factors of dairy farming:

- i) Feed and Fodder:

4.5. Factors influencing on dairy farming in Ahmednagar districts

- i). Relief.
- ii) Climate.
- iii) Soils.
- iv) Irrigation:
- v) Fodder crops.
- vi). Dairy animals.

4.6. Classification of dairy animals

- 4.6.1 Cattle:
- 4.6.2 Buffaloes
- 4.6.3 Goats and Sheep

4.7. Categories of dairy animals

- 4.7.1. Cow categories
- 4.7.2. Buffaloes categories.

4.1. General Introduction

Dairy farming is an important activity practiced by Indian farmers. It plays an important role in the rural economy in supplementing the income of rural masses, particularly small farmers and landless labours. It also provides subsidiary occupation in rural areas and more to the people residing in hilly and rain fed areas where modern agriculture is not suitable and agricultural output may not sustain the family (Chouhan, T. S. 1987).

In India, the poor and marginal farmers' agricultural operations are based on dairy farming and they are the chief sources of power and manure. The most of the agricultural operations from ploughing to harvesting are carried out by draught animals. Livestock sector not only provides essential proteins and nutrition but also plays an important role in the utilization of non-edible agricultural byproducts. It also provides raw material and byproducts such as hides and skins, blood and bone etc. (Chouhan, T. S. 1987).

4.2. Geographical factors of dairy farming

Different types of geographical factors directly or indirectly have impact on dairy farming. Some of the important factors are as follows.

4.2.1. Relief

Relief means nature of land surface, it includes plain, plateaus and mountains etc. Relief has direct impact on hybrid dairy cattle. Generally, Mountain or hilly areas never support hybrid dairy animals and on the other hand plain area is highly suitable for diary activities because of plain surface. Plateau area have moderate number of hybrid dairy animals.

4.2.2. Climate.

Dairy cattle flourish in cool temperate lands with moderate rainfall sufficient for the growth of grass. In hot climate, milk and other dairy products cannot be preserved for a long period except at a high cost of cold storage and refrigeration. Cattle are also more vulnerable to diseases in warm climates even in well-protected sheds, which again increases the cost of dairy farming.

Beside above factors chilling plants are also required in milk producing area. In Maharashtra and other states of India, milk has to be processed locally where milk producing areas are far away from the consumers. In Maharashtra, state Government and cooperative milk federations establish such chilling plants.

4.2.3.Water

One cow requires nearly 27 to 35 liters of water daily for drinking. Water is not only required for drinking but also for daily washing of animals. Buffaloes require more water as compared to cows. Cattle sheds are also washed with water. Irrigation facilities directly support dairy activities it has impact on milk production as well as on dairy animals.

4.2.4. Soils:

Soil indirectly impact on dairy farming, it has direct impact on cropping pattern. .In Ahmednagar district, maximum part is coved by black soils and medium black soil and coarse shallow soils which are locally called Murum.

4.3 Socio-Economic factors of dairy farming –

Now a day's mixed farming has become an integral part of Indian farming but in this type of farming the framer can- not practice, as it requires certain suitable conditions.

Some of the important factors required for dairy farming are as given below.

i)Labour:

Dairy farming requires both types of labour (Skilled and unskilled) as there is different type of technological as well as general work which requires different types of labourers such as for cleaning washing feeding, milking and milk testing etc.

ii) Capital:

Capital investment is required for various purposes such as purchasing the dairy animals (Cow & Buffaloes), construction of stables and purchase of vehicles for transportation. Presently banks and village level co-operative milk societies have provide capital.

iii) Transport Facilities:

It also plays an important role. Milk and milk products are carried out with the help of different means of transport like scooter, cycles, motorbike, tempo etc. Dairy products require special transport facilities like tanker, cooler etc.

iv) Markets:

Milk is very important constituent of human diet, it being a perishable commodity the dairy farming had to be located near the market. Thus, in Von Thunen's model this activity was located near the city market. But today due to the improvement in transportation facilities and improvement of speed, capacity and frequency it is not necessary for dairy farming to be located close to the market areas.

4.4. Others factors of dairy farming:

i) Feed and Fodder:

The quality and quantity of feed and fodder is, most important for cows and buffaloes. The quality of milk and milk per animal (cow & Buffaloes) depends upon the type of feed and fodder used for milk animals. For good feed, dairy activity should be undertaken in an area where feed and fodders are produced with low cost.

4.5. Factors influencing on dairy farming in Ahmednagar districts

Above all factors have impact on dairy farming, but in Ahmednagar district some other factors are more dominating toward the development of dairy farming.

These factors are as follows

i) Relief:

In Ahmednadar district we found variation in relief features ,Western part of Ahmednagar district is having hilly area ,Kalsubai is the highest peak in Sahyadri in Maharashtra having 1646 meters height from sea level is in western part of Ahmednagar district. Maximum pa**r**t of Akole tahsil having hilly area which has impact on dairy farming of Akole tehsil, having minimum production of milk mainly because of topography**.**

Central part of district having plateau it is mainly in Parner, Nagar, Sangamner, Shrigonda and Karjat. Plateau area moderately supports dairy activities. Sangamner tahsil having highest milk production but on plateau contribution is very less.

Kopargaon, Rahata, Shrirampur, Rahuri, Sangamner,Nevasa, Shevgaon tehsils maximum part having plain surface which is useful for dairy farming ,these tehsil have maximum production of milk.

ii) Climate:

The climate of the district is characterized by a hot summer and general dryness during major part of the year except during south-west monsoon season, Year can be divided into four seasons. The cold season from December to February is followed by the hot season from March to the first week of June .The south –west monsoon season is from the second week of June till the end of September, while October and November constitute the post monsoon or retreating monsoon season. When the relative humidity is between 60% and 80% thereafter it decreases. Ahmednagar gets rain mainly from south-west monsoon but the distribution is mostly uneven.

The climate is also a noteworthy constitution exerting influence on crops and dairying activities in Ahmednagar district. The study region receives maximum rainfall in monsoon season. Average temperature of Ahmednagar district is 30^0 c. Temperature has direct impact on types of dairy animals and milk production. Climatically district supports mixed breed of cow. Mahatma Phule Krishi vidyapeeth, Rahuri,Dist-Ahmednagar developed Phule Triveni,

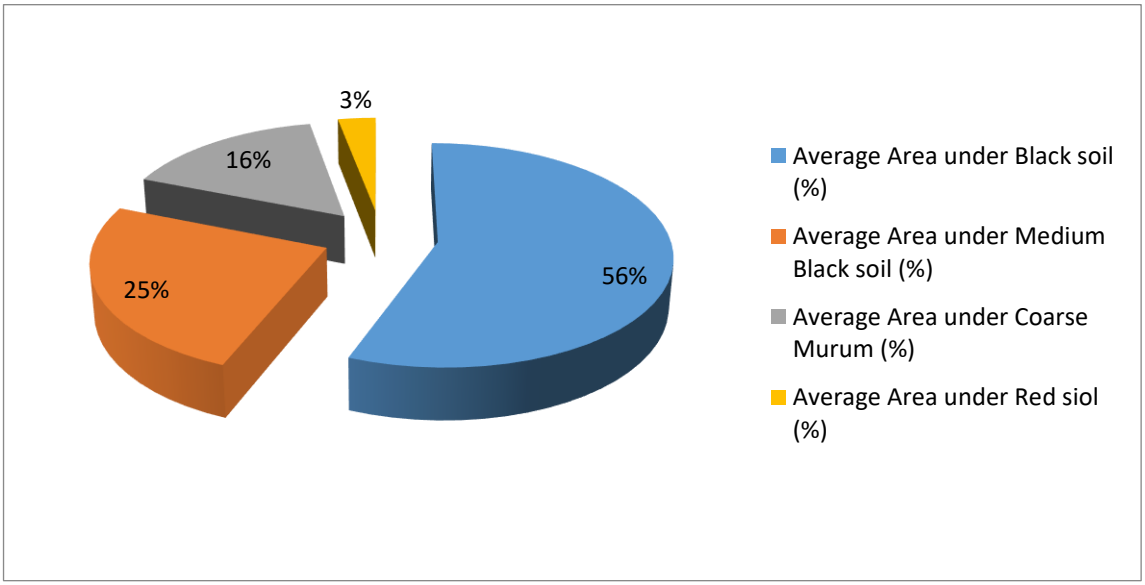
breed of cow. This breed consists of Holestian, Friesean,Jersey and Gir combinations. It is cross bred and has average milk production of 3000 to 3500 litres per lactation with 3.8 to 4.2 % fat in milk. (Cattle and Buffalo breeding research centre at MPKV,Rahuri.). Maximum chilling plants in Ahmednagar district, are mostly owned by private owners, which help to develop dairy farming in Ahmednagar district

iii) Soils:

The soils in the district can generally be classified into three groups, viz., black or kali, Medium black, Coarse soil (Murum) and red or tambat.

AHMEDNAGAR DISTRICT

SOILS TYPES



(Source – Compiled by Researcher)

Fig.no.4.1.Average area under the soil of Ahmednagar district.

Fig.no.4.1. shows Average area under the soil of Ahmednagar district. In Ahmednagar district maximum area shows under black soil.(56%) and very less area under Red soil(3%). These, Coarse soils are very poor in fertility. The plains in Kopargaon and Shrirampur talukas have comparatively a good depth of soil which indirectly help to

developed agriculture. Near the Pravara and Godavari rivers white tracts of deep rich lands are found. Two especially barren tracts may be noticed, one on the borders of Karjat and Shrigonda and the other north of a line drawn east to west through Takli-Dhakeshvar, ten miles north of Parner, and as far north as the slopes down to the Mula. The second waste is of great extent and is mostly un-arable being little better than bare basalt, unfit for anything except sheep-grazing. Near the range of the hills that runs south-east down the centre of the Shrigonda and Karjat sub-divisions, the land is very poor with occasional patches of good light soil near Karjat, Koregaon and other places. In the hilly areas to the west of Akola, red soil, deeper on the slopes than on the levels, is found which not support milking animals.

iv). Irrigation:

Irrigation facilities have direct impact on dairy activities of Ahmednagar district. Ahmednagar district is suitable for irrigation as nearly 60% of total land is irrigated by different sources of irrigation such as canal, well, tube well, tank, lake, river etc.

Table no.4.1 shows the area irrigated by different sources of irrigation as well as milk production of Ahmednagar district. Tehsil Sangamner shows 92.25 % area under irrigation, its positive impact on milk production (5.58 lakh per day),.Sangamner tehsil shows highest daily milk production in the district. After Sangmner Rahuri tehsil shows 89.5% irrigated land and it is second largest milk producing tehsil of the district. (4.27 lakh per day). Tehsils Kopergaon, Rahata having also maximum area under irrigation(78.3 and 91.5% respectively)and milk production is 3.01 and 3.5 respectively in the tehsil ,in this tehsil farmers are interested in sugarcane cultivation it has impact on milk production.

AHMEDNAGAR DISTRICT

SOURCE OF IRRIGATION

Tahshils	Govt.Canal	Well	Well with electricity	Tube well	Others	irrigated land %	Milk production (in lakh)
Ahmednagar	..	864	13826	..	185	64.77	2.2
Akole	1029	7	4818.7	..	26	36.23	1.5
Jamkhed	174	2215.5	4798.2	..	597.9	29.97	0.95
Karajat	3156	694.94	11214	..		29.21	0.85
Kopergoan	31913	19703	2298	..	..	78.3	3.01
Nevasa	28891	..	13469	..	..	36.89	1.8
Parner	8816	10	11219	336	100	52.01	1.7
Pathardi	3	3906	7532	..	136	30.15	0.79
Rahata	9577	2763	7530	237	303	91.5	3.5
Rahuri	12797	633	13181	723	1711	89.5	4.27
Sangamner	2984	3955.5	8132.6	136.4	70.3	92.25	5.58
Shevgaon	6418	17	8971	..	..	44.12	1.1
Shirigonda	13786	7498.7	8602		178.3	83.5	2.52
Shrirampur	16727	..	21157	..	..	81.9	2.1

Source- Socio-Economice abstract of Ahmednagar district

Table.4.1.Source of irrigation of Ahmednagar district.

Tehsils Jamkhed,Karjat,Pathardi, show less percentage of irrigation (29.97,29.21 and 30.21% respectively).Because of lack of water in particular tehsils show low milk production.(0.95,0.85 and 0 .79 lakh liter per day). Tehsils Parner, Shevgaon, Akole, Nevasa show moderate irrigation as well as milk production.

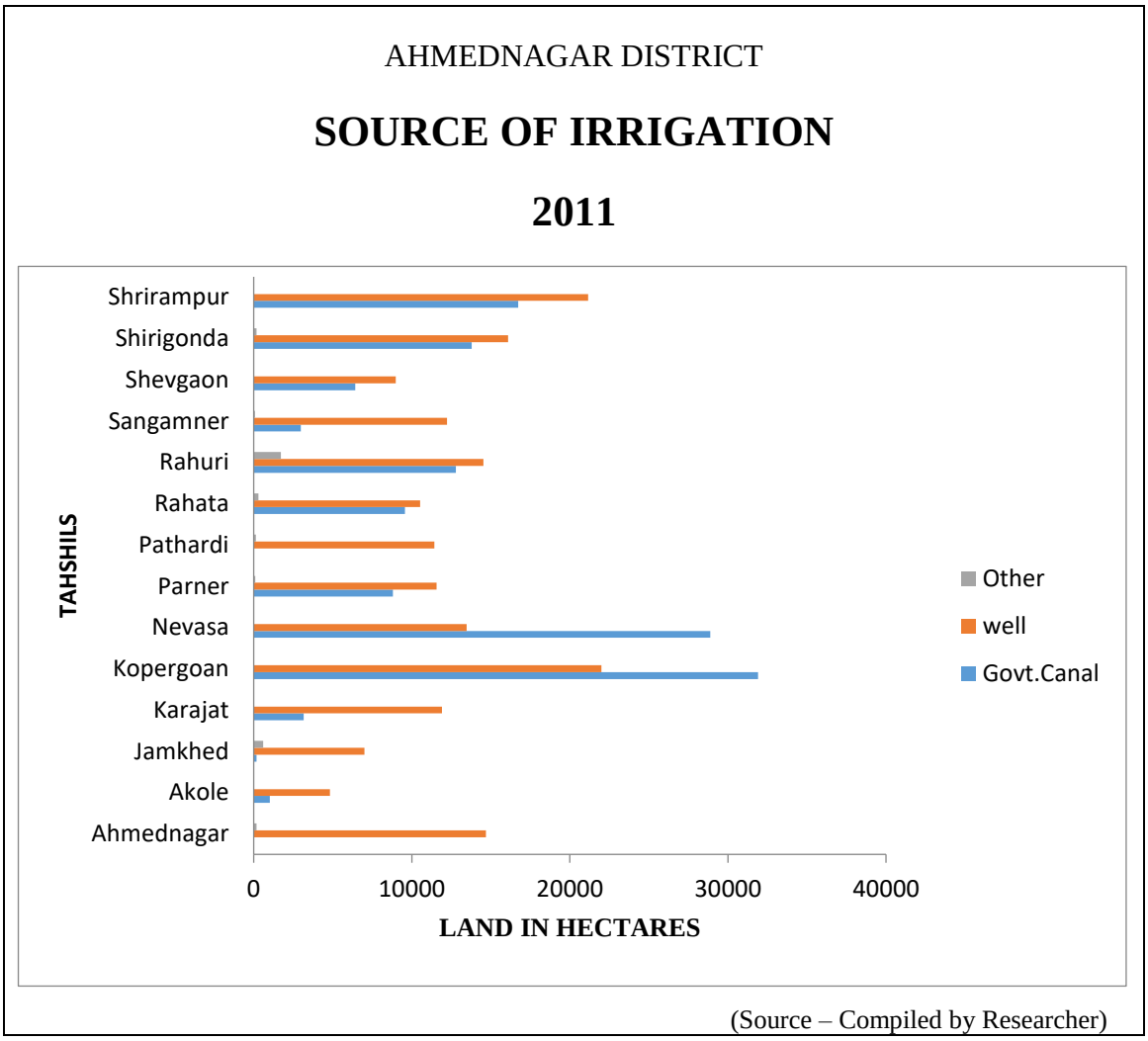


Fig.no.4.2. Source of irrigation of Ahmednagar district.

Maximum land of district is irrigated by well, well with electricity and government canal.

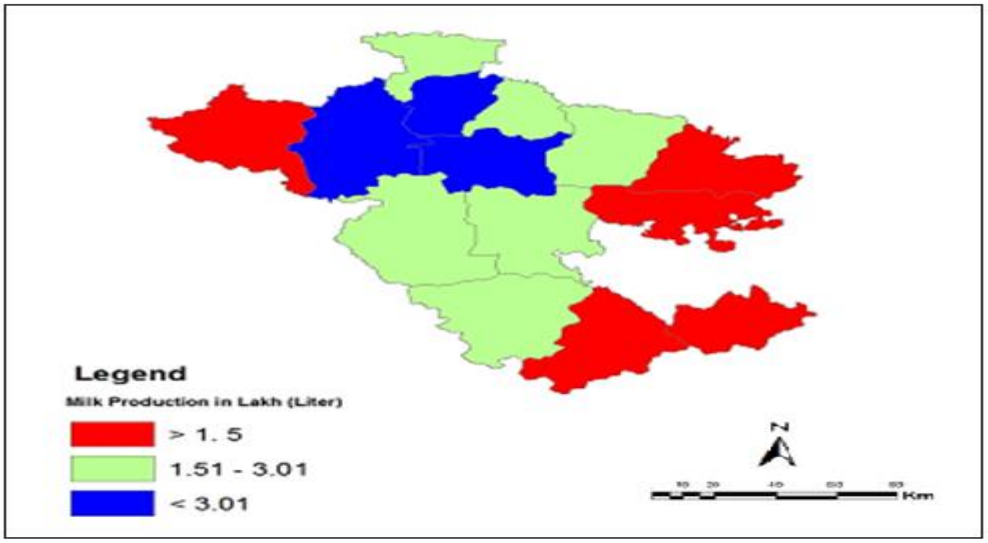
Tehsils like Kopergaon, Rahata and Shrirampur are getting water from Government canal.Canals are developed on river Pravara at Ozar in Sangamner tehsil. Tehsil Nevasa and Rahuri use canal water for irrigation, canal is coming from Mula dam near the Baragaon nandur in Rahuri tehsil. Kukadi canals provide water for irrigation in tehsil Shrigonda. Ahmednagar and Shrirampur tehsils have maximum well irrigation. Tehsil Nevasa having only canal and well irrigation, which help to develop dairy farming in a large scale. In tehsils like Akole, Jamkhed, Karjat and Pathardi have very low percentage of irrigated land which

has impact on the production of the milk. Tehsils like Kopergaon,Rahata,Nevasa,Rahuri and Shrirampur show maximum irrigated land and help to develop dairy farming.

AHMEDNAGAR DISTRICT

PRODUCATION OF MILK

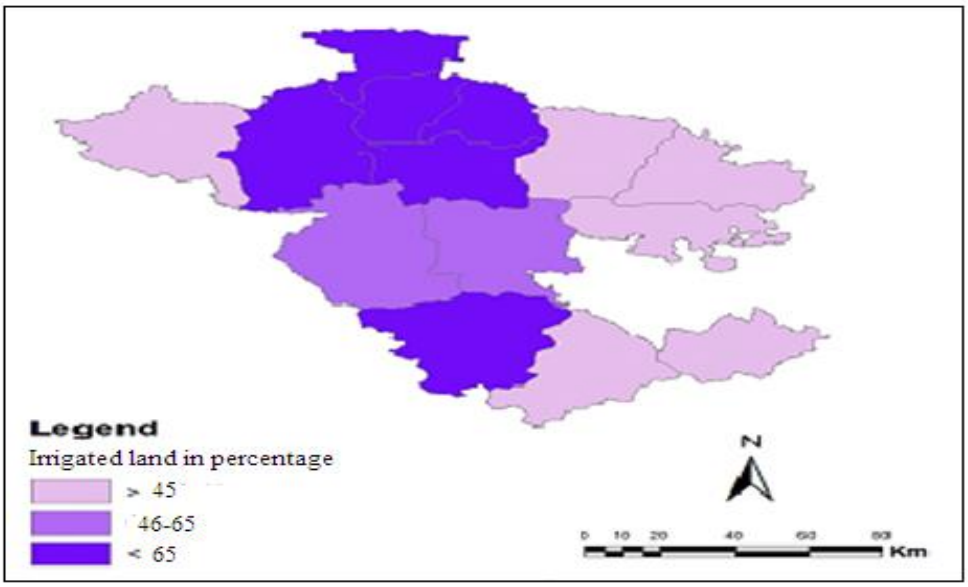
2014



AHMEDNAGAR DISTRICT

IRRIGATED LAND

2014



(Source – Compiled by Researcher)

Fig.4.3. Production of milk and irrigated land of Ahmednagar district.

Fig.4.3 show close relationship between milk production and irrigated land.

v). Fodder crops:

Fodder crops include different types of grasses. Jowar, bajara, etc.Basically, sometime sugarcane is also use as a fodder for dairy animals in Ahmednagar district farmer consider sugarcane as a major fodder crops. Farmer cultivates sugarcane for dairy farming, in the area having maximum water availability.

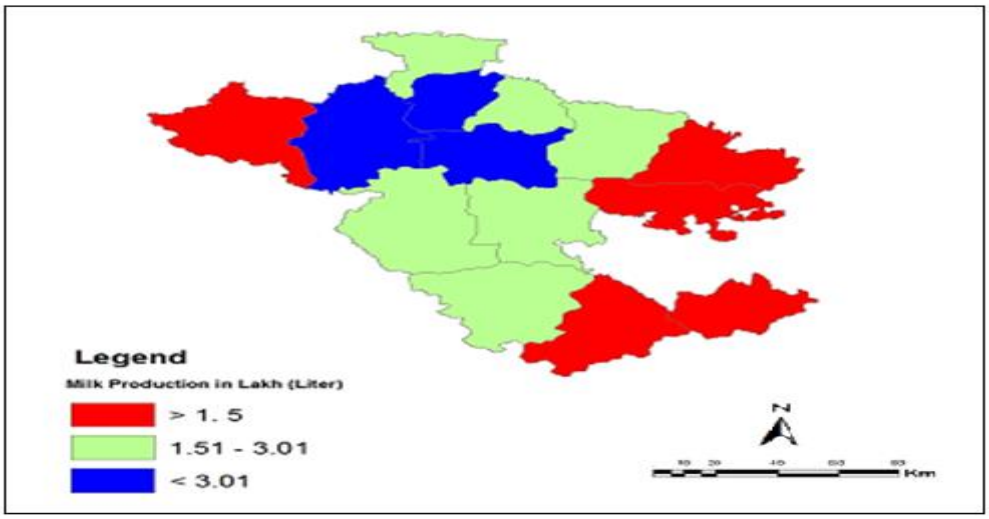
AHMEDNAGAR DISTRICT **FODDER CROPS** 2014			
Sr.No	Taluka	Milk production (in lakh)	Fodder crop %
1	AHMEDNAGAR	2.2	51.36
2	AKOLE	1.5	57.36
3	JAMKHED	0.95	39
4	KARJAT	0.85	38.3
5	KOPERGOAN	3.01	59.89
6	NEVASA	1.8	43.22
7	PARNER	1.7	56.21
8	PATHARDI	0.79	30.1
9	RAHATA	3.5	70.3
10	RAHURI	4.27	70.76
11	SANGAMNER	5.58	73.14
12	SHEVGAON	1.1	41.01
13	SHIRIGONDA	2.52	57.32
14	SHRIRAMPUR	2.1	49.9
Source- Socio-Economice abstract of Ahmednagar ditrict-2014			

Table.no.4.2. Area under fodder crops of Ahmednagar district.

AHMEDNAGAR DISTRICT

PRODUCATION OF MILK

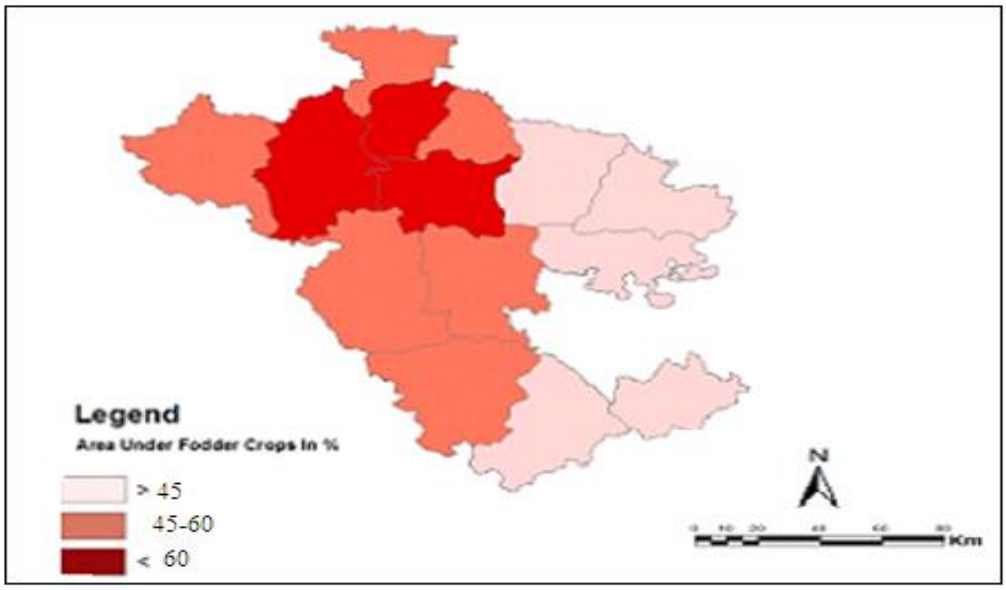
2014



AHMEDNAGAR DISTRICT

FODDER CROPS

2014



(Source – Compiled by Researcher**)**

Fig. 4.4. Production of milk and fodder crops of Ahmednagar district.

Table no 4.2 and Fig 4.4 show positive impact of area under fodder crops on dairy farming. Tehsils Sangamner ,Rahuri,Rahata And Kopergoan show maximum area under fodder crops And same tehsils shows maximum milk production, its clearly indicate positive relation in fodder crops and milk production.

vi). Diary animals:

AHMEDNAGAR DISTRICT

PRODUCTION OF MILK AND DAIRY ANIMALS

2014

Sr. No	Tahsils	Milk Production	Dairy animals in lakh
1	AHMEDNAGAR	2.2	1.57
2	AKOLE	1.5	1.01
3	JAMKHED	0.95	0.88
4	KARJAT	0.85	0.78
5	KOPERGOAN	3.01	1.78
6	NEVASA	1.8	1.12
7	PARNER	1.7	1.25
8	PATHARDI	0.79	0.66
9	RAHATA	3.5	1.8
10	RAHURI	4.27	2.1
11	SANGAMNER	5.58	2.45
12	SHEVGAON	1.1	0.89
13	SHIRIGONDA	2.52	1.63
14	SHRIRAMPUR	2.1	1.43

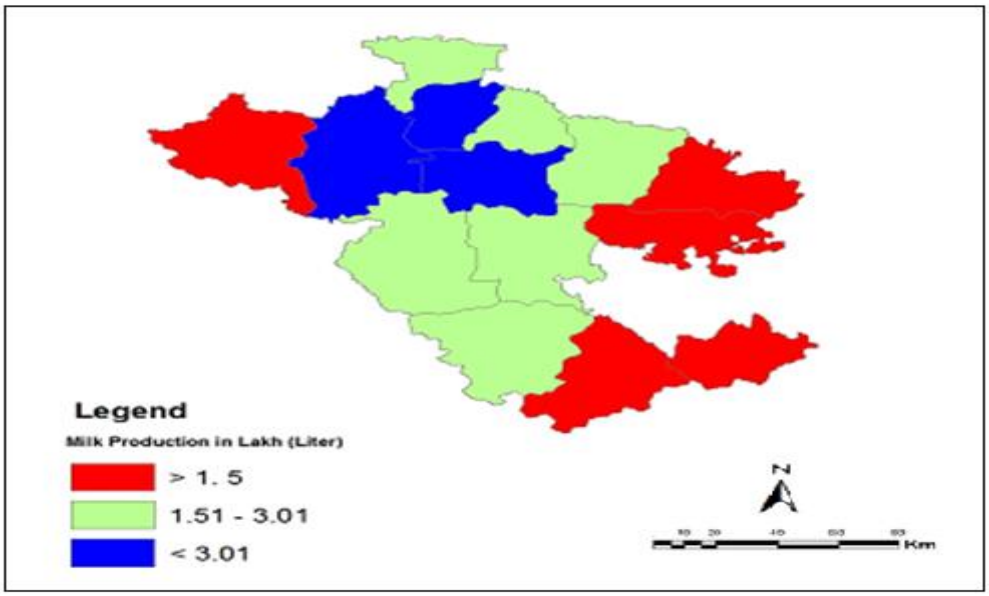
Source-Animal census 2014

Table.no.4.3. Production of milk and dairy animals of Ahmednagar district.

AHMEDNAGAR DISTRICT

PRODUCTION OF MILK

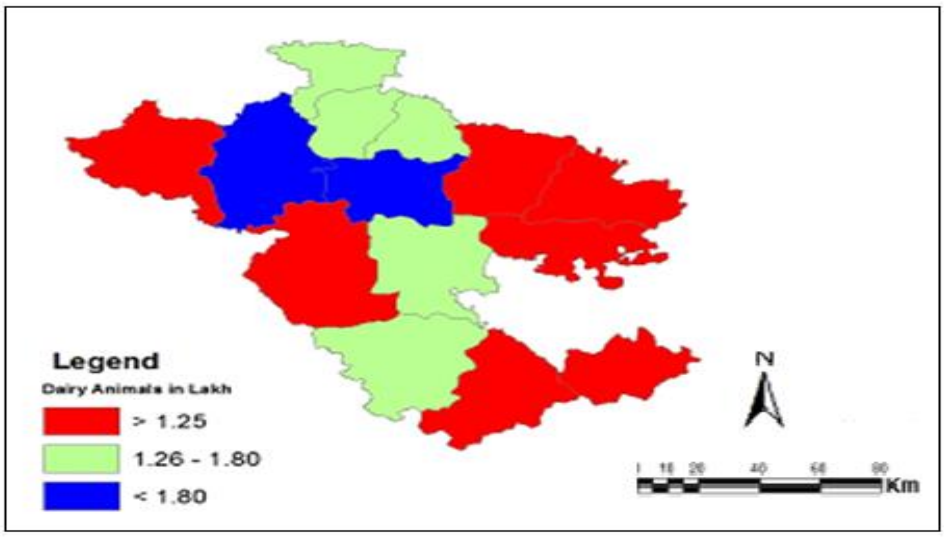
2014



AHMEDNAGAR DISTRICT

DAIRY ANIMALS

2014



(Source – Compiled by Researcher)

Fig.no.4.5. Production of milk and dairy animals of Ahmednagar district.

Human beings started domesticating animals from very early stage. Man, has an instinctive love for domestic animals and his home seems to be incomplete without them.

The cow, the dog, the goat, the horse, the sheep became his domestic friends. Now a day farmer started domesticating cow, buffaloes only for milk purpose. Diary animals directly help rural farmers to improve their family income though dairy farming. In Ahmednagar district, maximum number of farmers rear animals only for dairy farming. Table no 4.3 and Fig.4.4 shows diary animals impact on milk production.

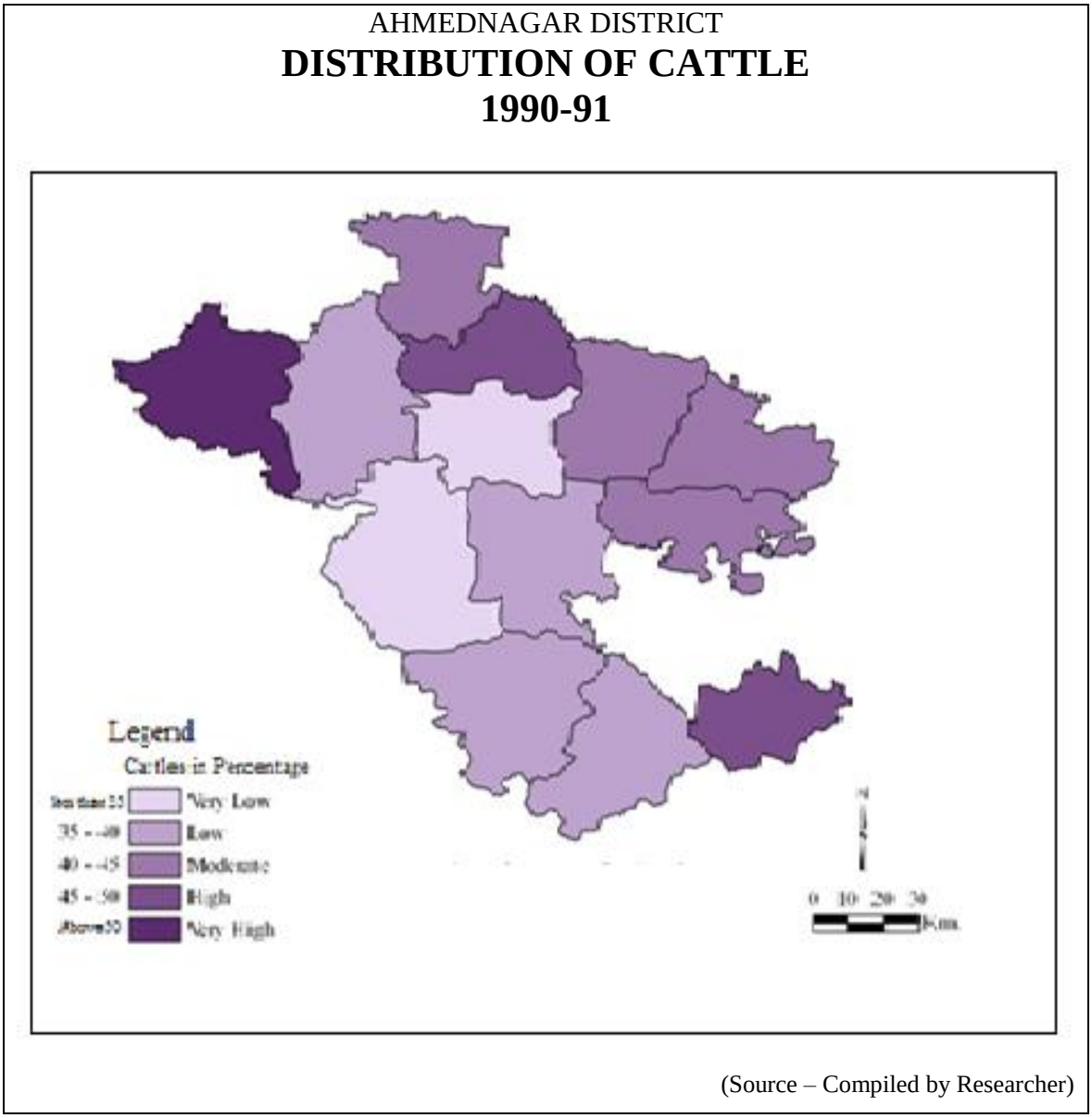
4.6. Classification of dairy animals:

AHMEDNAGAR DISTRICT **CLASSIFICATION OF DAIRY ANIMALS** **1990-2011**						
	Cattles		Buffaloes		Goats and Sheep	
Tahsils	1990-91	2010-11	1990-91	2010-11	1990-91	2010-11
Ahmednagar	36.32	33.61	8.57	14.69	47.28	50.72
Akole	58.06	50.43	10.96	10.79	25.48	38.45
Jamkhed	47.75	45.6	6.53	15.59	38.23	38.1
Karjat	35.33	31.95	3.15	6.58	54.94	55.8
Kopargaon	43.35	36.42	4.84	9.7	38.34	49.8
Nevasa	43.03	36.17	6.6	15.66	43.09	47.09
Parner	33	32.09	2.94	5.86	57.68	61.43
Pathardi	42.67	38.21	7.64	11.91	43.58	49.45
Rahata	-	14.95	-	7.96	-	76.61
Rahuri	34.86	14.43	2.83	5.02	54.83	77.47
Sangamner	38.83	22.98	1.91	2.88	51.43	73.88
Shevgaon	42.68	42.34	7.36	11.13	40.11	44.11
Shrigonda	37.05	38.22	7.65	13.36	47.98	47.26
Shrirampur	45.73	29.82	4.97	9.93	39.82	56.48
Source-Animal census 2014						

Table no.4.4. Classification of dairy animals of Ahmednagar district.

Dairy animals can be classified into three major groups such as Cattle, Buffaloes and Goats and Sheep, but in study area majority of farmer rear goats and sheep not for milk but for wool and meat purpose. Milk of these animals is mostly used for domestic purpose. Table no.4.5 shows the classification of dairy animals of Ahmednagar district. In year 1990-91 to year 2010-11 number of dairy cattle have decreased, Buffaloes have increased in districts and sheep and goats have also increased.

4.6.1 Cattle:



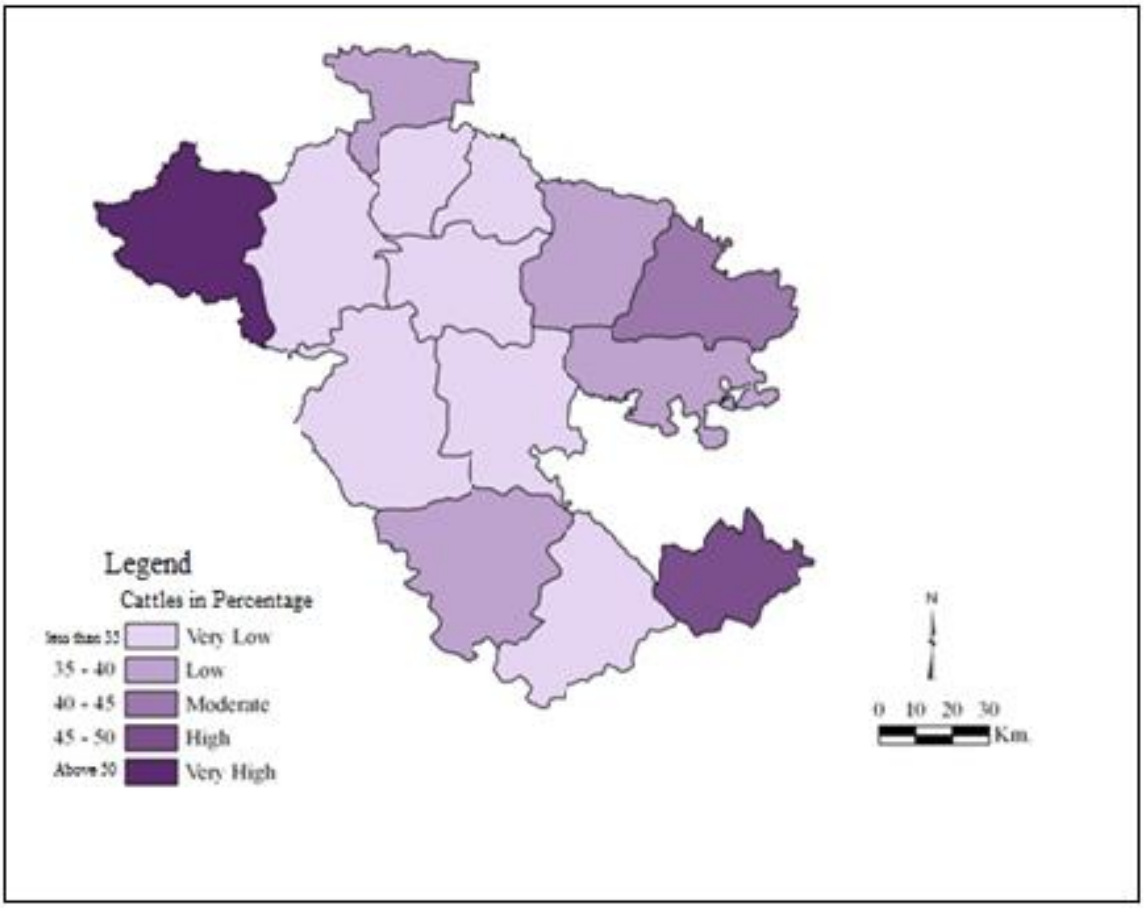
(Source – Compiled by Researcher)

Fig.4.6.A.Distribution of cattle of Ahmednagar district (1990-1991)

AHMEDNAGAR DISTRICT

DISTRIBUTION OF CATTLE

2010-11



(Source – Compiled by Researcher)

Fig.4.6.B. Distribution of cattle of Ahmednagar district (2010-2011)

The percentage of cattle to total livestock population was worked out for each tehsil and district as a whole (Table 4.4) and divided into five different categories namely, very low, low, moderate, high and very high having the ranges less than 35, 35-40, 40-45, 45-50 and above 50 respectively.

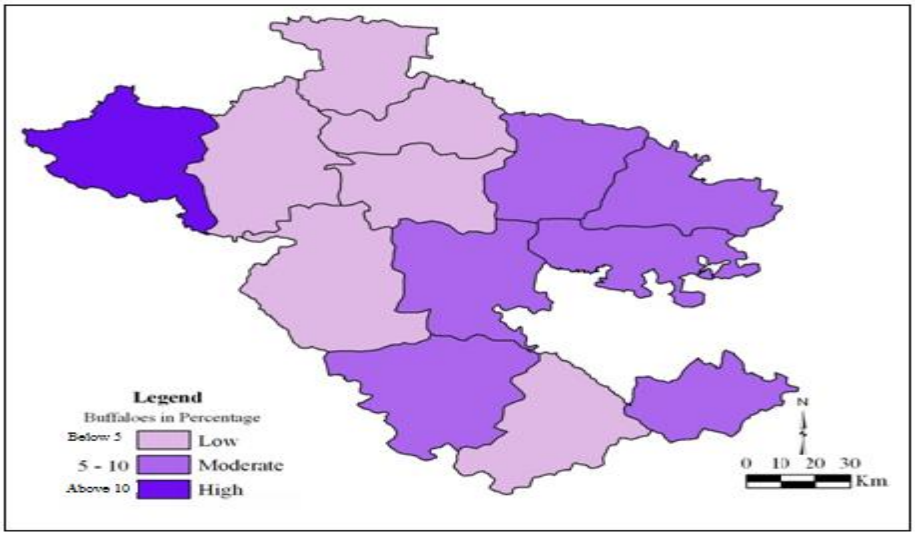
Cattle occupy second rank out of total livestock in district. The total cattle population was 1134532 (40.09 percent) in 1990-91 and 771122 (33.65 percent) in 2010-11.

4.6.2 Buffaloes.

AHMEDNAGAR DISTRICT

DISTRIBUTION OF BUFFALOES

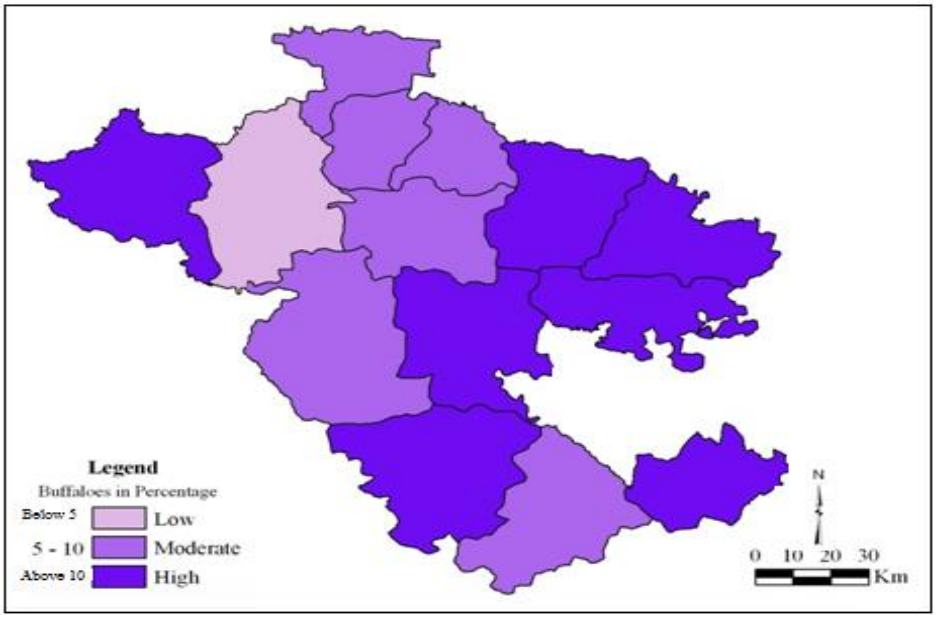
1990-91



AHMEDNAGAR DISTRICT

DISTRIBUTION OF BUFFALOES

2010-11



(Source – Compiled by Researcher)

Fig.4.7.A&B. Distribution of buffaloes of Ahmednagar District.

Buffaloes are domesticated mainly for milk and reproduction while male buffaloes are mainly used for insemination and draught animals in certain parts of the district. The proportion of buffaloes to total livestock population for each tehsil is very low.

Fig 4.7 A/B reveals percentage share of buffaloes to total livestock during the year 1991-2011. Low percentage of buffaloes recorded in only Sangamner tehsil while moderate percentage of buffaloes found in Rahuri, Shrirampur, Karjat, Parner, Kopargaon and Rahata tehsils. High percentage of buffaloes marked in Nagar, Nevasa, Shevgaon, Pathardi, Jamkhed, Shrigonda and Akole tehsils.

During the period of two decade's percentage of buffaloes in total livestock population was increased. It percentage share significantly increased in tehsils of Nagar, Shrirampur, Nevasa, Jamkhed, Shrigonda and Kopargaon while rest of the tehsils recorded insignificant change.

4.6.3 Goats and Sheep

In India about five million households are engaged in rearing of sheep and goats (India, 2012). In Ahmednagar district, some small and marginal farmers rear goat and sheep for their livelihood. Sheep is reared for milk, mutton, hair and skin while goat for milk, skin and mutton. In study area sheep and goat occupied first rank in total livestock.

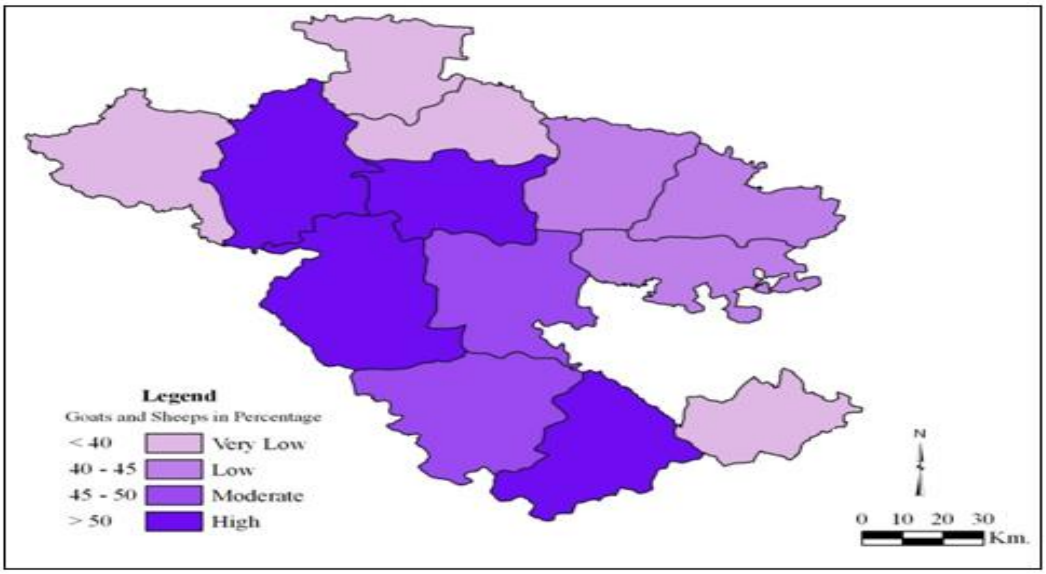
The percent contribution of goat and sheep to total livestock was worked out divided into four different categories i.e. very low (below 40) low (40- 45) moderate (45-50) and high (above 50). It is revealed that district has 46.72 and 54.92 percent contribution of goat and sheep in total livestock population during the years 1990-91 and 2010-11 respectively.

During the year 1990-91, very low percentage of goats and sheep found in Akole, Jamkhed, Kopargaon and Shrirampur tehsils while low category registered in Shevgaon, Nevasa and Pathardi (fig. 4.8/A). Moderate percentage of goats and sheep found in Shrigonda and Nagar tehsils whereas high percentage of goats and sheep observed in Sangamner, Rahuri, Karjat and Parner tehsils.Fig4.8/B reveals that during the year 2010-11, very low percentage of Goats and Sheep found in Akole and Jamkhed tehsils whereas low percentage of Goats and Sheep observed in Shevgaon tehsil.

AHMEDNAGAR DISTRICT

DISTRIBUTION OF GOATS AND SHEEP

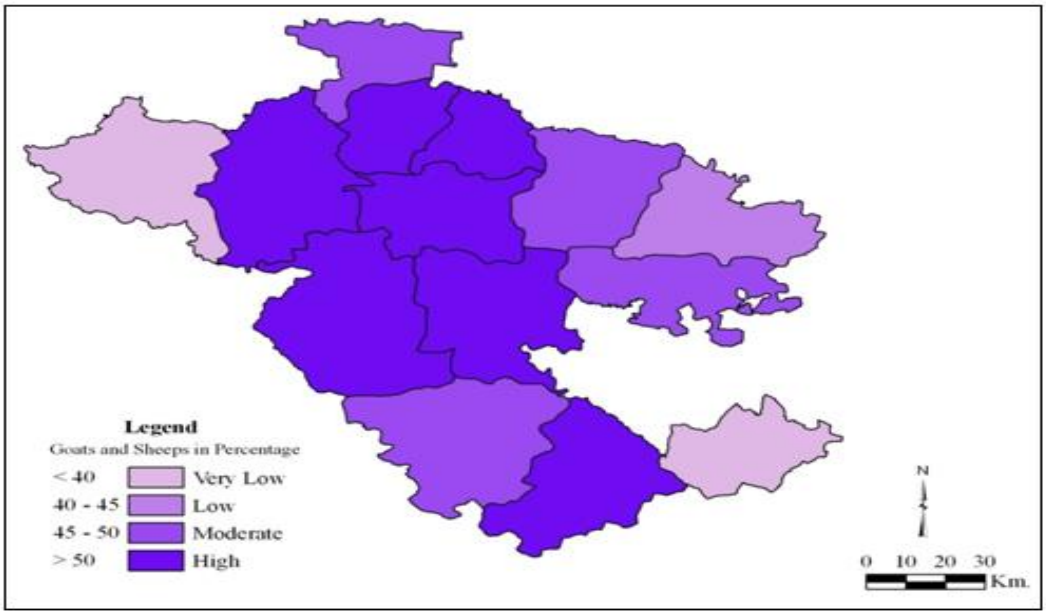
1990-91



AHMEDNAGAR DISTRICT

DISTRIBUTION OF GOATS AND SHEEP

2010-11



(Source – Compiled by Researcher)

Fig.4.8.A/B. Distribution of goats and sheep of Ahmednagar district.

Moderate percentage of goats and sheep recorded in Kopargaon, Nevasa, Pathardi and Shrigonda tehsils while high percentage of Goats and Sheep as found in Rahuri, Rahata, Sangamner, Parner, Shrirampur, Karjat and Nagar tehsils.

4.7. Categories of dairy animals:

AHMEDNAGAR DISTRICT

PERCENTAGE OF DAIRY ANIMALS

Sr.No	Taluka	Cow		Buffalos	
		Hybrid	Deshi	Hybrid	Deshi
1	AHMEDNAGAR	63.12	36.88	67.69	32.31
2	AKOLE	37.12	62.88	20.9	79.1
3	JAMKHED	35.04	64.96	28.3	71.7
4	KARJAT	29.73	70.27	20.1	79.9
5	KOPERGOAN	75.52	24.48	15.55	11.28
6	NEVASA	56.21	43.79	82.33	17.67
7	PARNER	49.58	50.5	26.87	73.13
8	PATHARDI	24.52	75.48	25.8	74.2
9	RAHATA	85.48	14.52	52.33	47.77
10	RAHURI	86.39	13.61	71.63	28.37
11	SANGAMNER	88.87	11.13	77.38	22.62
12	SHEVGAON	36.87	63.13	33.36	67.43
13	SHIRIGONDA	73.76	26.24	32.33	67.67
14	SHRIRAMPUR	63.03	36.97	68.61	31.39

Source-District Dairy Development officer, Animal census 2007.

Table no.4.5. Percentage of dairy animals of Ahmednagar district.

Dairy animals can be classified in two major groups. These are as follows:

i) Cow category

ii) Buffalo category

In sub category are a Hybrid cow and deshi cow as well as Hybrid buffalos and deshi buffaloes.

4.7.1. Cow category.

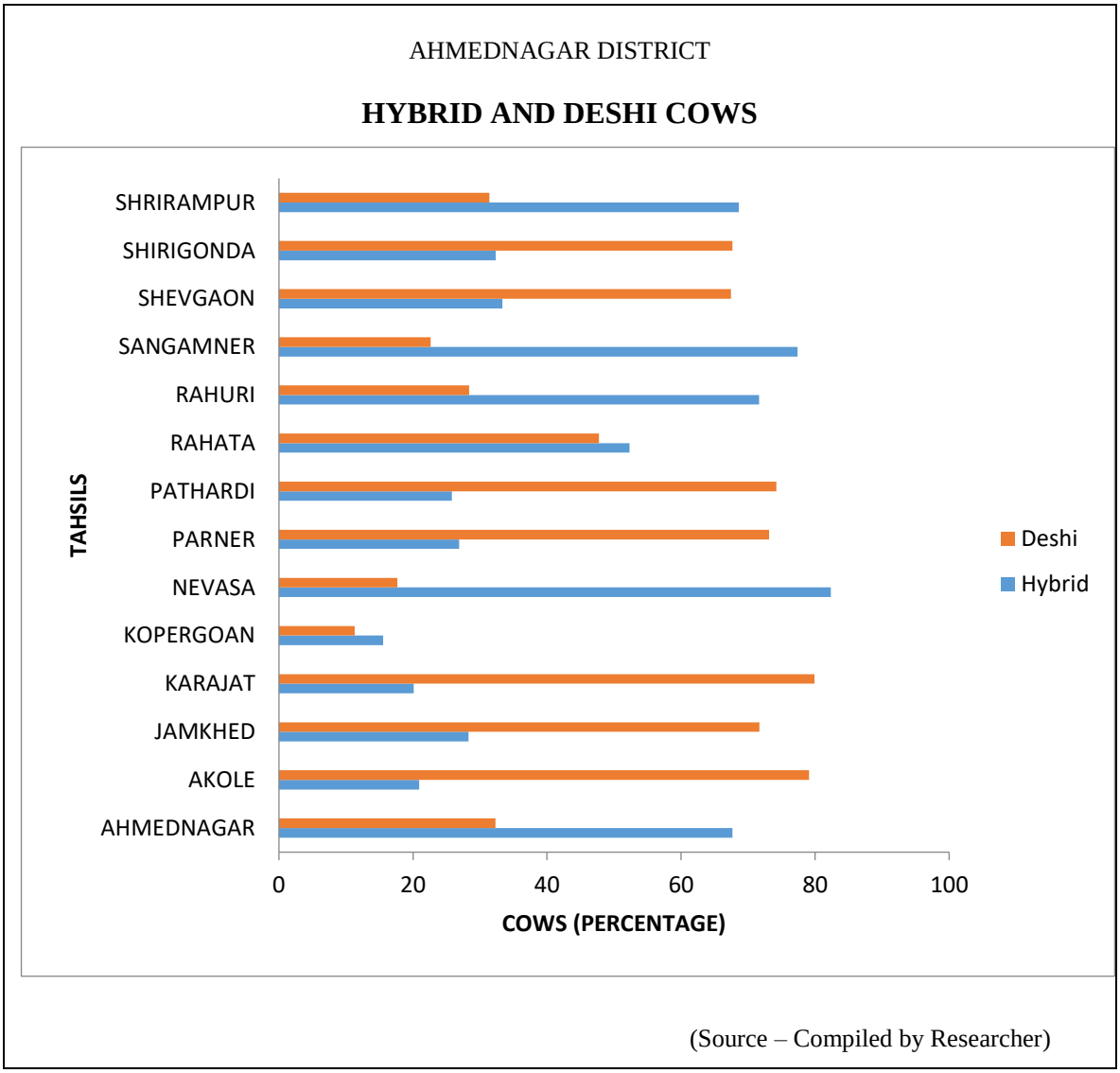
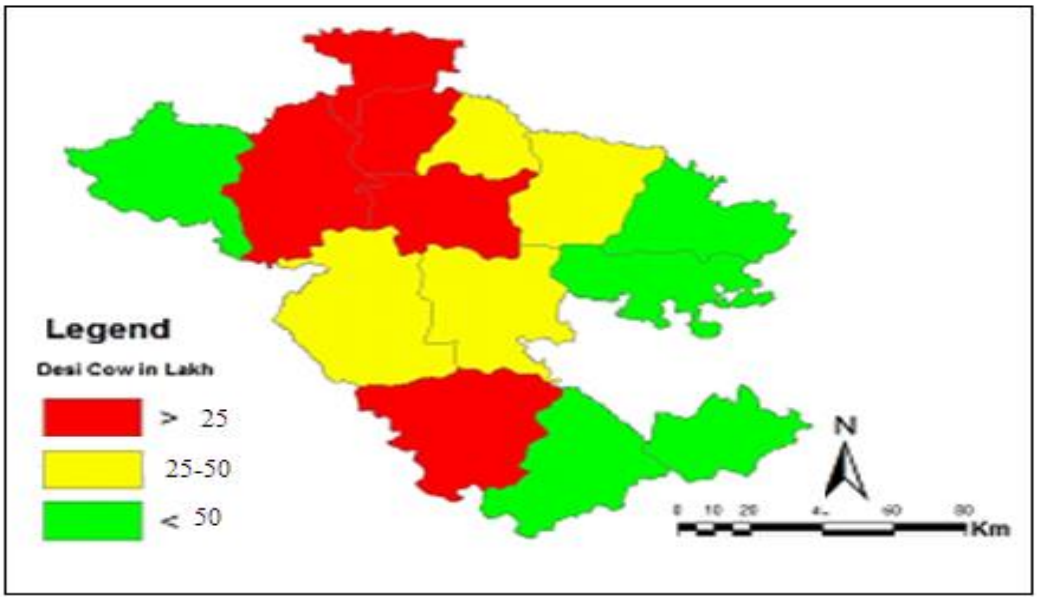


Fig.4.9. Hybrid and deshi cows of Ahmednagar district..

Table 4.5 shows the categories of dairy animals of Ahmednagar district. Fig 4.9 shows uneven distribution of cows in Ahmednagar district. Tehsils Kopergaon, Rahata, Rahuri, Sangamnr, Shrigoda and Ahmednagar shows high percentage of cows in the district. Tehsils Akole, Jamkhed, Karjat,Shrirampur and Sevgaon show moderate percentage of cows. And Tehsil Pathardi, Parner having less number of cows.

AHMEDNAGAR DISTRICT

DESHI COWS



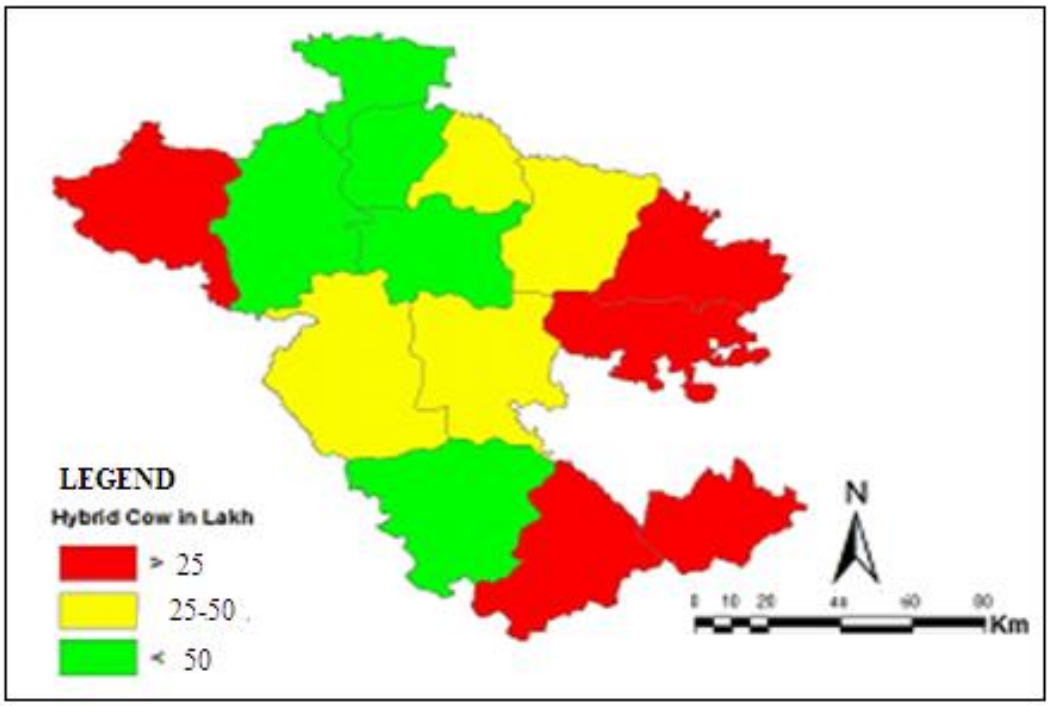
(Source – Compiled by Researcher)

Fig 4,10.A. Deshi cows of Ahmednagar district

Fig 4,10.A. shows high percentage of deshi cows in tehsils Pathardi Karjat, Jamkhed, Shevgaon and Akole . Milking capacity of deshi cows is very less compared to hybrid cows, farmer rear these cows only for domestic purpose, i.e. these tehsil shows less milk production of the district.

AHMEDNAGAR DISTRICT

HYBRID COWS



(Source – Compiled by Researcher)

Fig 4.10. B. Hybrid cows of Ahmednagar district.

Fig 4.10 B shows tehsils Sangamener Rahuri Rahata having maximum percentage of Hybrid cows ,farmer rear this cow only for milk i.e. these tehsils record maximum milk production .Followed by these shown high percentage of hybrid cow in tehsils Kopergaon, Shrigonda,Ahmednagar and Shrirampur .

4.7.2. Buffaloes category:

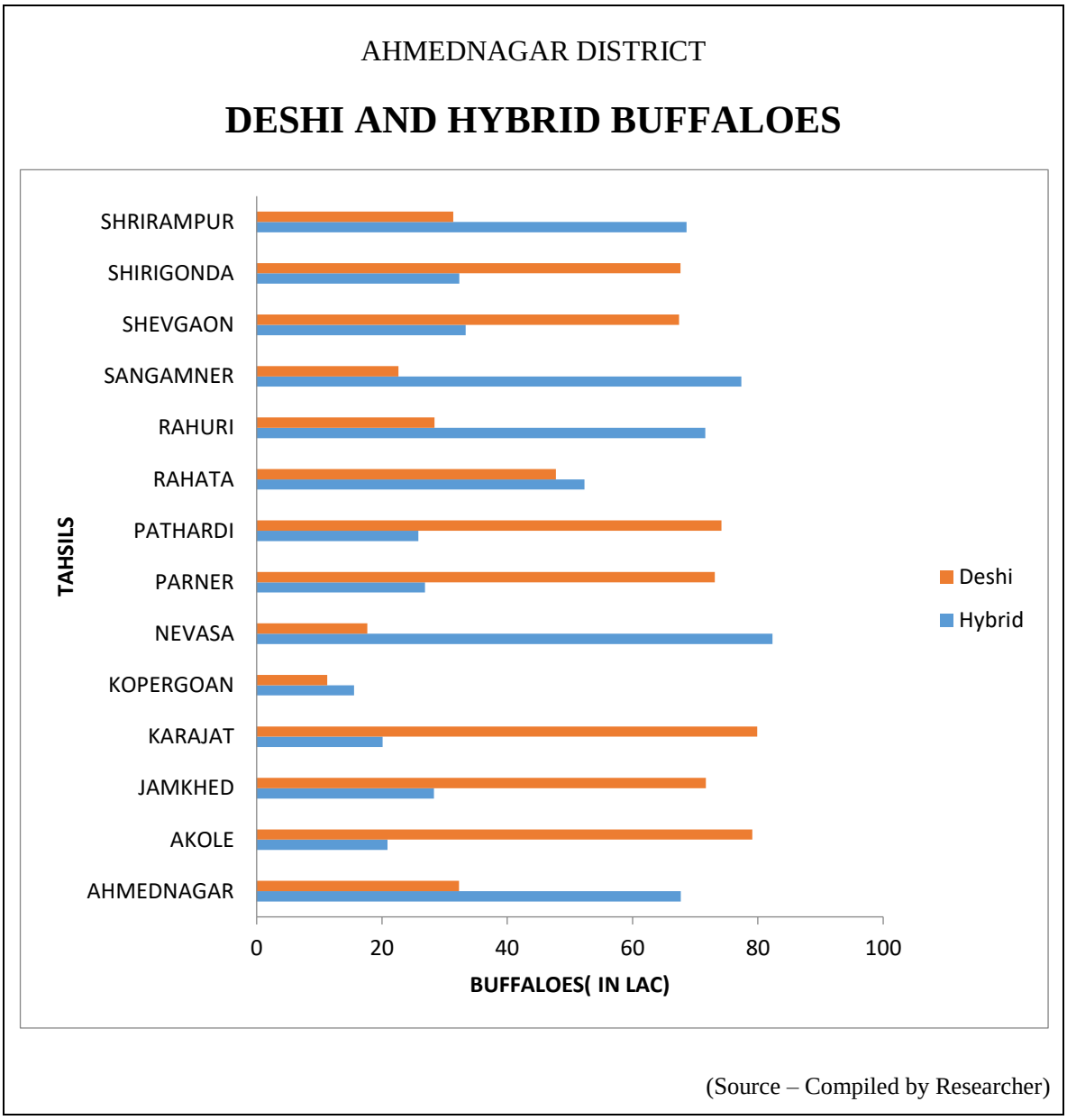
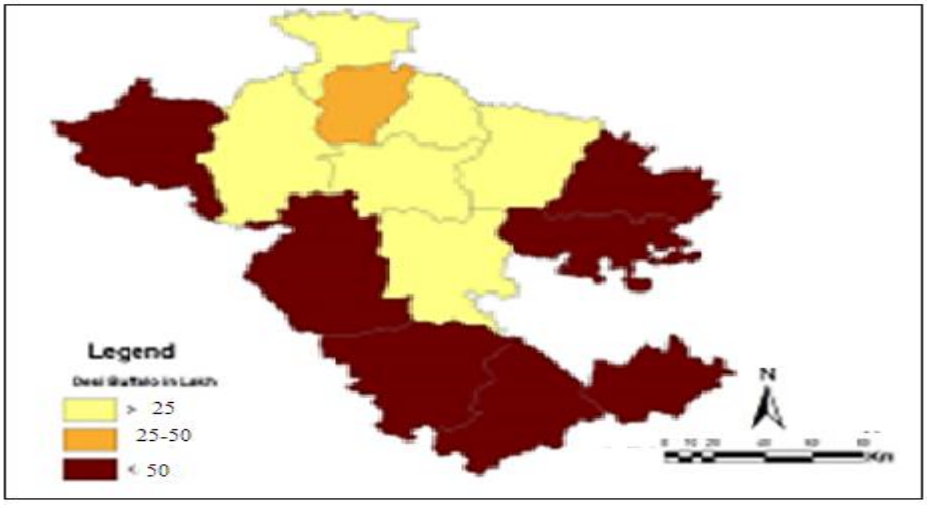


Fig.4.11. Deshi and hybrid buffaloes of Ahmednagar district.

Buffalos play very dominat role in milk and milk oriented activities. In Ahmednagar districts, farmer rear buffalos mostly for domestic purpose. Only in few tehsils like Sangmner, Nevasa,Rahuri, shrirampur and Ahmednagar, farmer sale buffalos milk in markets, buffaloes milk having good price compared to cow milk. Fig no.4.11 shows maximum deshi buffaloes compared to hybrid buffaloes in Ahmednagar district.

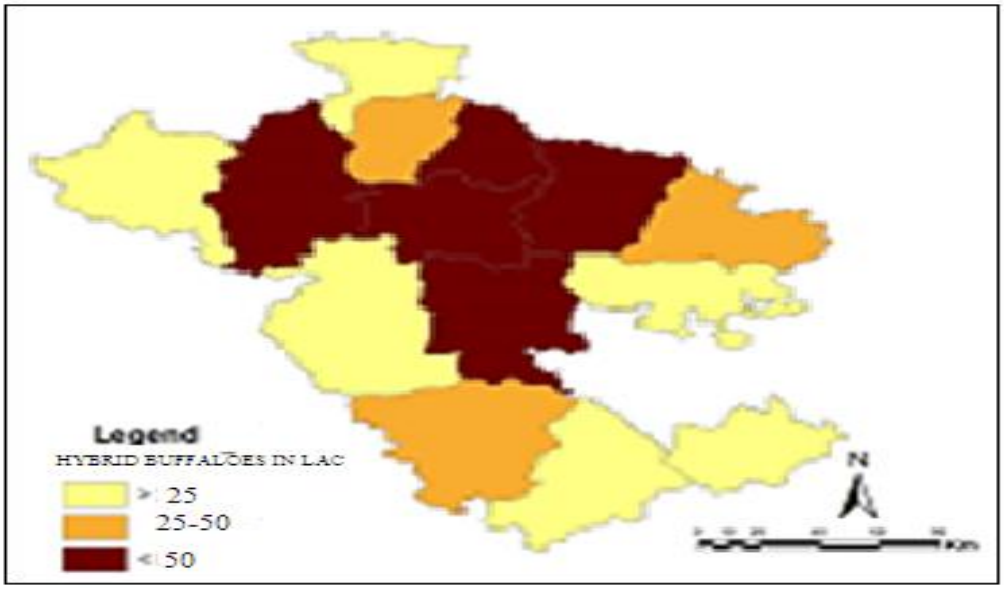
AHMEDNAGAR DISTRICT

DESHI BUFFALOES



AHMEDNAGAR DISTRICT

HYBRID BUFFALOES



(Source – Compiled by Researcher)

Fig. 4.12.Deshi & Hybrid buffaloes of Ahmednagar district.

Sangmner,Nevasa,Rahuri,Shrirampur, Karjat, Pathardi ,Parner etc.Only Kopergaon tehsil

of Ahmednagar district shows less number of buffalos but because of high percentage of hybrid cow Kopergaon tehsil is having high milk production. Akole, Jamkhed, Karjat, Parner, Shevgaon and Shrigonda shows maximum percentage of deshi buffalos, farmer rear these buffalos only for domestic use and not for commercial purpose.

Resume

This chapters gives a brief explanation of various factors affecting dairy farming in study area. Geographical factors include relief, climate, water etc. Socio-economic factors also have indirect impact on dairy farming such as Capital. Transport facilities have direct impact on dairy farming. Other factor like feed and fodder also affect positively on dairy farming. Irrigation, fodder crops, dairy animals are more dominating factors to develop dairy farming in Ahmednagar district. Classification of dairy animals is also explained in this chapter, i.e. Cattle, buffaloes and goats etc also impact on dairy farming. Hybrid and deshi cows and buffaloes play an important role in the development of dairy farming in Ahmednagar district. Finally, spatial distribution of animals and their impact on dairy farming is explained in brief.

References:

Socio-Economice abstract of Ahmednagar ditrict-2001-2014

Chouhan, T. S. 1987 “Agricultural Geography”, Academic Publisher, Jaipur, p: 214.

District Dairy Development officer record 1991-2014

District Dairy Development officer Ahmednagar District

Animal census 2003

Animal census 2007

Animal census 2014

CHAPTER - V

OVERVIEW OF DAIRY FARMING IN AHMEDNAGAR DISTRICT

5.1. General Introduction:

5.2. Growth and development of dairy farming of Ahmednagar district

5.3. Structure of dairy farming of Ahmednagar district.

5.4. Milk Collection and distribution system.

5.4.1. Milk Collection by Co-Operative Diaries.

5.4.2: Milk Collection by Private Dairies.

5.4.3 Major Private milk collection plants

5.5. Spatial Distribution of co-operative dairies and milk collection

5.6. Seasonal variation in milk collection.

5.7. Spatial Variation of dairy animals of Ahmednagar district:

5.8. Spatio-temporal variation in dairy farming:

Resume

Reference

5.1. General Introduction:

Dairy farming is practiced everywhere in Ahmednagar district. Farmer of the districts practice dairy farming as a substitute activity for agriculture. Near about seventy percentage farmers of the Ahmednagar district directly participate in dairy farming. Irrigation, types of dairy animals, transportation, fodder crops, relief feature etc have impact on distribution of dairy farming. In Ahmednagar district tehsils like Parner,Karjat,Jamked,Pathardi etc. having less milk production.

5.2. Growth and Development of Dairy Farming of Ahmednagar District.

AHMEDNAGAR DISTRICT

GROWTH AND DEVELOPMENT OF DAIRY FARMING

Sr. No.	YEAR	Milk Collection in 1991-2014 (in lakhs liters)			
		Govt.dairy	Co-operative	Private	Total
1	1991	2.6	2.04	1.12	5.76
2	1992	2.63	2.32	1.09	6.04
3	1993	2.64	3.17	1.11	6.92
4	1994	2.22	4.1	1.27	7.59
5	1995	1.75	4.61	1.24	7.6
6	1996	1.91	4.98	1.21	8.1
7	1997	1.73	5.6	2.12	9.45
8	1998	1.44	6.29	2.72	10.45
9	1999	1.53	6.4	3.9	11.83
10	2000	1.8	6.05	4.74	12.59
11	2001	2.21	7.09	4.45	13.75
12	2002	1.88	7.49	4.39	13.76
13	2003	1.25	6.81	5.05	13.11
14	2004	1.26	6.64	6.14	14.04
15	2005	1.49	6.83	7.38	15.70
16	2006	1.47	6.48	9.34	17.29
17	2007	1.11	7.18	12.26	20.55
18	2008	0.83	7.23	13.04	21.1
19	2009	0.45	6.52	14.83	21.8
20	2010	0.21	5.61	16.36	22.18
21	2011	0.16	6.5	17.9	24.56
22	2012	0.13	6.3	23.14	29.57
23	2013	0.12	6.79	24.61	31.52
24	2014	0.05	6.12	27.95	34.12

Source-District Dairy Development officer of Ahmednagar district

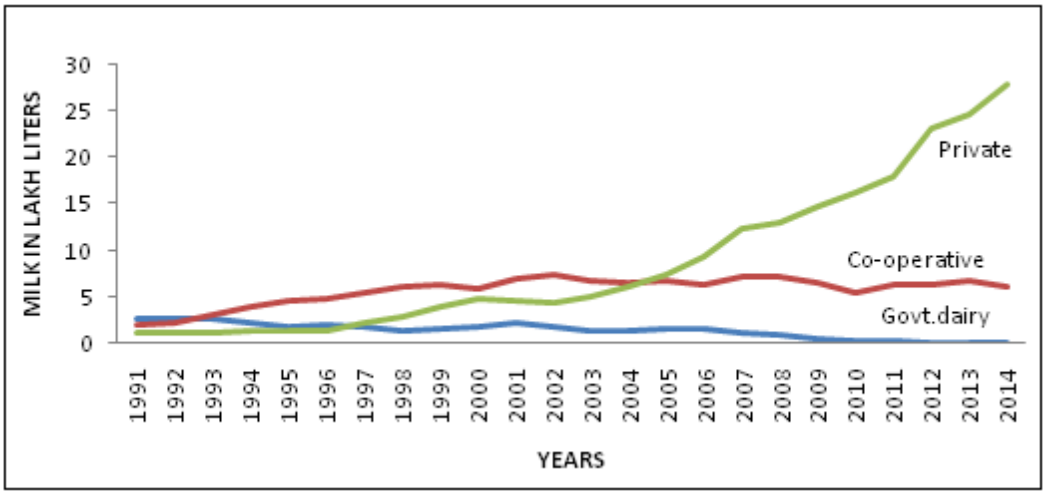
Table.no 5.1 Growth and Development of Dairy Farming of Ahmednagar district.

Table no.5.1 shows continuous growth of milk production in study area. Since 1991 to 2014 dairy farming developed positively in Ahmednagar district. Milk collection of the district increased by 5.76 lakh liters to 34.12 lakh liters, after year 2000 farmers participation increased in large scale, which resulted in increased milk production. Farmer used modern technology as well as hybrid variety of cows and buffaloes only for milk purpose, it has result positive growth of dairy farming in study area.

AHMEDNAGAR DISTRICT

GROWTH AND DEVELOPMENT OF DAIRY FARMING

1991-2014



Source-District Dairy Development officer Ahmednagar district

Fig.5.1 Growth and development of dairy farming of Ahmednagar district.

Fig.no 5.1 shows change in milk collection by source of authorities. In year 1991 daily milk collection of Government dairy was high compared to cooperative dairy and private dairy farm. In year 1991 government dairy shows maximum daily milk collection (2.6 lakh liter) ,followed by cooperative dairy(2.04 lakh liter) and private dairy(1.12 lakh liter) .After year 1993 cooperative dairy milk collection continuously increased up to year 2002(3.17 to 7.49 lakh liters respectively)and government dairy milk collection decreased continually till year 2014 (2.06 to 0.05 lakh liter).after year 2005 private dairy collected maximum milk

compared to government dairies and cooperative dairy. Cooperative dairies daily milk collection become stable .and milk collection of government dairies decaling rapidly ,its impact on private sectors and their milk collection increase continually till today. After 1993 government close their collection center and help to developed cooperative moment in Maharashtra. But very soon in year 2004 cooperative dairy milk collection was decreased because they loose the trust of dairy farmers. Corruption was the major factors to declining milk in cooperative dairy sector. Bableshawar cooperative dairy plant was very well known in Ahmednagar district, plant sale his Shriram dudh brand in the market. Today 81.92 percentage of milk collected by private dairy for in the study area and 18.09 lakh liters of milk collected by cooperative and government dairy. Fig no, 5.1 shows growth of dairy farming of Ahmednagar district. Since year 1991 to 2014 (15 year of time) dairy milk production increased 5.76 lakh liters to 34.12 lakh liters and private sector played an important role in dairy development in Ahmednagar district.

5.3. Structure of dairy farming of Ahmednagar district:

In Ahmednagar district, previously dairy activity was developed mainly on co-operative basis but now a day private sector playing important role in dairy development in study area. The support of government and interest of the farmers are the main reasons of development of dairy farming in Ahmednagar district. The dairy farming is developed in rural area, based upon a five tier system like, milk producing farmers, the village milk collection Centre, co-operative milk societies, the Taluka sangh, are linked with district union and state federation which are guided by the national co-operative dairy federation of India.

The structures of dairy farming are as follows:

1. Milk producer farmer at first level.
2. Small village milk collection Centre, at the second level.
3. Primary Co-operative Milk societies at Village in third level
4. District or Taluka Co-operative Milk Federation at fourth Level.
5. The Maharashtra State Co-operative milk federation Ltd. at the top level.

All above milk collection centers are linked to each other and help to develop dairy farming positively in Ahmednagar district.

5.4. Milk Collection and distribution system:

Milk is collected in a very systematic manner, showing a well-defined flow from milk producer to consumer. It is also called as systematic flow of milk from rural area to urban area. The chart shows the system of milk collection & distribution.

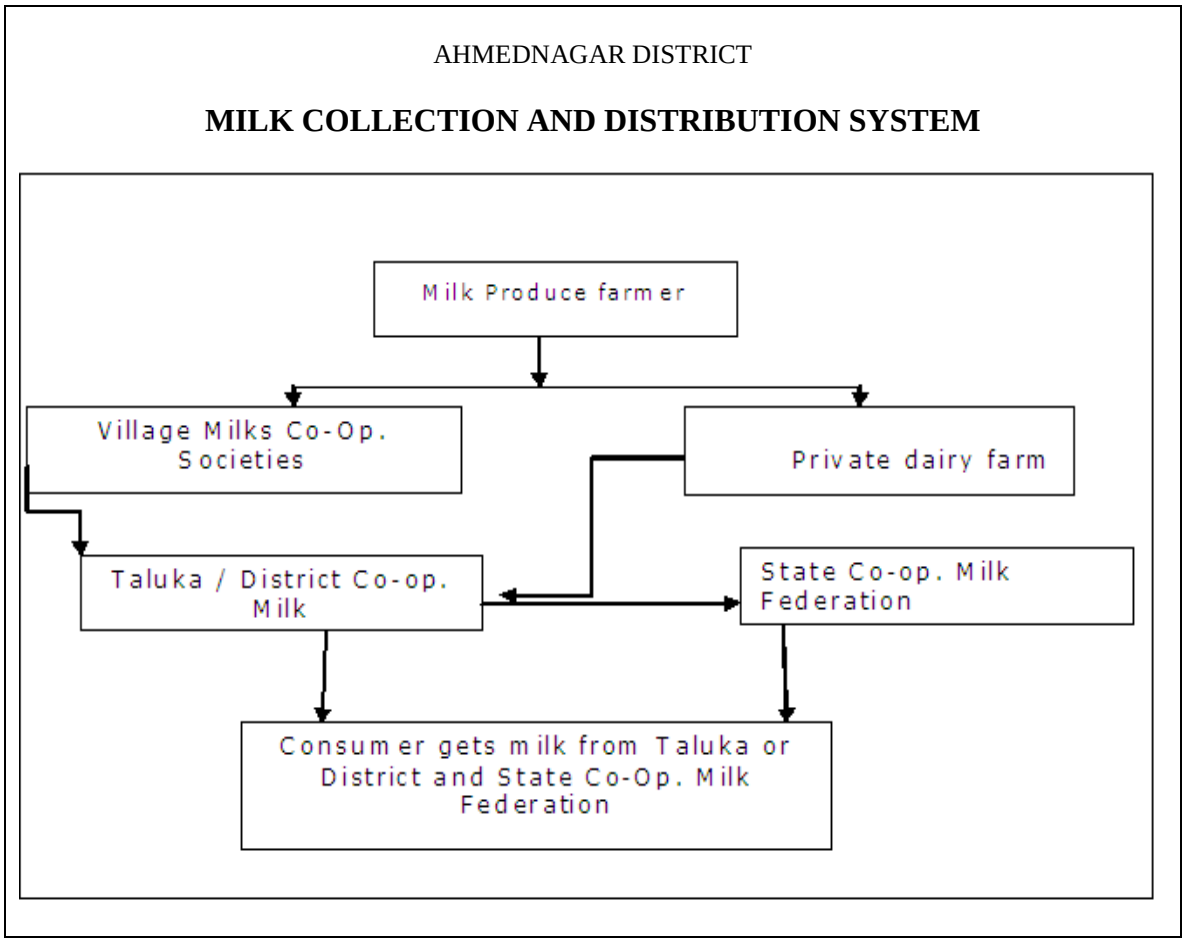


Fig.no.5.2. Milk collection and distribution system Source- Compiled by author

Above chart (Fig.no.5.2) shows the milk collection and distribution of the study area. Farmer has a choice to supply milk, in cooperative dairy farm in village level or private dairy in village. Now a day maximum milk producing farmer are interested to provided milk to private dairy farm because they trust on them or they provide capital to poor farmer for dairy farming without interest and private dairy owner paid farmer daily, weekly, quarterly or

monthly according to requirement and demand of the farmer. Milk co-operative societies linked with districts or taluka sangh, Taluka sangh collect milk for various small dairy, procced on milk and directly send in urban area or costumer. All dairy sale their milk with different name in market like Rajhans milk by Sanghamer Tatuka sangh,Thorat milk by S.S.thorat private milk plant. Maulidudh, Akshy milk, Prabhat milk, Shriram dudh, Priyadharshani milk, Ranjak milk etc.from various private milk plants of Ahmednagar district. Farmer near the urban places sale their milk direct to consumer without proper link of distribution.

5.4. 1: Milk Collection by Co-Operative Diaries:

AHMEDNAGAR DISTRICT.

DAILY MILK COLLECTIONBY CO-OPERATIVE DIARIES

SR.NO.	Name of the Co-operative diaries	Ave daily milk collection
1	Ahmednagar taluka sangh	2744
2	Pathardi taluka sangh	18328
3	Shevgaon taluka sangh	9335
4	Jamkhed taluka sangh	4340
5	Karajat taluka sangh	5949
6	Parner taluka sangh	9403
7	Shirigonda taluka sangh	19795
8	Shrirampurdudhsangh	39633
9	Shrirampur taluka sangh	6474
10	Nevasa taluka sangh	15857
11	Rahuri taluka sangh	13260
12	Kopergoan taluka sangh	39938
13	Sangamner taluka sangh	256953
14	Amaruthsagar co-sanghakole	62863
15	Pravarabableshar	3771
16	Panjarpol	18
17	Rahata taluka sangh	15173

Source-District Dairy Development officer.

Table.5.2. Milk collection by co-operative diaries of Ahmednagar district.

Table no. 5.2 show Co-operative diaries milk collection of the district. Ahmednagar districts having 17 co-operative milk sangh and various private milk collection plants collect milk from the district as well as from neighboring district. Sangmner taluka sangh collect maximum milk daily (256953 liters) from the tahsil Sangmner as well as neighboring tehsil like Rahuri, Kopergaon,Akole etc.

5.4.2: Milk Collection by Private Dairies:

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AHMEDNAGAR DISTRICT. **DAILY MILK COLLECTIONBY PRIVATE DAIRIES**		
SR.NO.	Name of Tehsil having major Private dairies	Ave daily milk collection
1	Shirirampur	1165
2	Nevasa	1450
3	Kopergoan	62664
4	Sangamner	20112
5	Rahata	766
Source-District Dairy Development officer.		

Table.5.3. Milk collection by private dairies of Ahmednagar district.

Table no. 5.3 shows Private dairies milk collection of the district. Ahmednagar districts having various private milk collection plants collect milk from the district as well as from neighboring district. Kopergoan tehsil collect maximum milk daily (62664 liters) from the tehsil as well as neighboring tehsils like Rahuri, Sangamner, Rahata etc.

5.4.3 Major Private milk collection plants

1. S. R. Thorat Milk Products Pvt. Ltd**.**

S. R. Thorat Milk Products Pvt. Ltd commonly known as a Throat dairy has revitalized the dairy business of Maharashtra within a very short span.

Thorat dairy started in 1994, on a modest scale and today is a trusted symbol of pure milk and milk products in millions of households and commercial establishment across Maharashtra.

Located at Sangamner, 145 km away from Pune and 70 km from Nashik (NH-50). It comes near well-known MNC's and Indian Corporates that specialize in ice cream manufacturing, baby food production, pharmaceuticals and confectionery businesses. Their stringent quality standards and in-dept. knowledge in dairy product processing, has earned them a reputation for being a high excellence company that is committed to the consistent production of hygienic milk and milk products.

The factor has led to the successful launch of Thorat dairy's UHT milk and milk products under the brand name, "Gagangiri Fresh". Having achieved this, Thorat Dairy has now proudly entered the premier segment of the dairy industry of the nation.

2. Prabhat Dairy Pvt Ltd.

Prabhat dairy pvt ltd collect milk form maximum farmers of Shrirampur, Rahata, Rahuri and surrounding talukas of Ahmednagar district. The plant is located in Nirmalnagar, Post-Tilaknagar, Tal-Rahata, District, Shrirampur - 413720, Maharashtra, India.These are very well know milk and milk product brands in local market as well as in Maharashtra.

5.5. Spatial Distribution of co-operative dairies and milk collection

AHMEDNAGAR DISTRICT

MILK COLLECTION BY CO-OPERATIVE DIARIES

Sr. no.	Taluka	No.sof dairy	Buffaloes milk (%)	Cow milk (%)	Total milk in lakh
1	Ahmednagar	232	23.1	76.9	2.2
2	Akole	239	20.12	79.88	1.5
3	Jamkhed	128	19.21	80.79	0.95
4	Karajat	484	13.02	86.08	0.85
5	Kopergoan	154	16.2	83.8	3.01
6	Nevasa	112	33.2	66.8	1.8
7	Parner	317	26.32	73.68	1.7
8	Pathardi	291	12.3	87.7	0.79
9	Rahata	125	25.96	74.04	3.5
10	Rahuri	193	34.12	65.88	4.27
11	Sangamner	261	37.17	62.83	5.58
12	Shevgaon	149	23.15	76.85	1.1
13	Shirigonda	187	26.13	73.87	2.52
14	Shrirampur	110	27.88	72.12	2.1

Source-District Dairy Development officer

Table.5.4. Spatial Distribution of co-operative dairies and milk collection

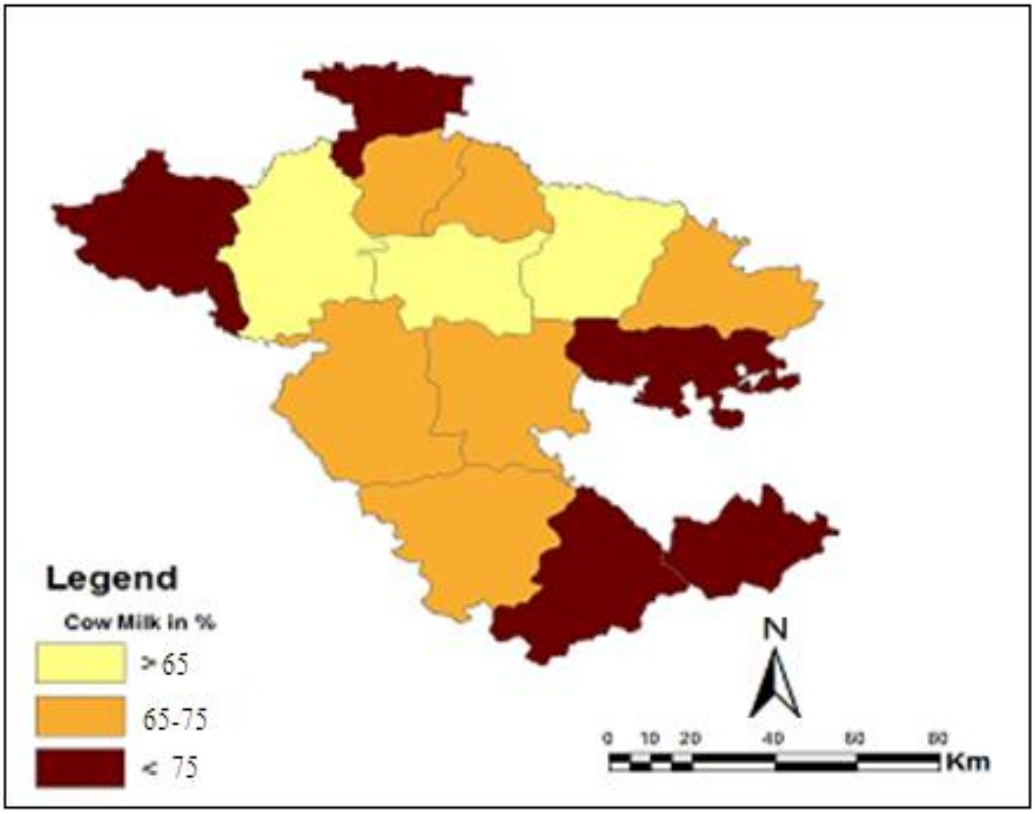
Table.no.5.4 shows spatial distribution of cooperative dairy and their milk collection of Ahmednagar district. Tehsil Karajat show highest number of cooperative dairies (484) but less collection of milk (0.85 lakh) because of low grade cow and buffaloes domesticate by

farmers of these tehsil and other side tehsil Samgmner shows only 261 cooperative dairies but highest milk production (5.58 lakh) because of high variety of cows and buffaloes.

AHMEDNAGAR DISTRICT

COW MILK COLLECTION BY CO-OPERATIVE DIARES

2014



(Source – Compiled by Researcher)

Fig.5.3.Cow milk collection by co-operative diaries of Ahmednagar district.

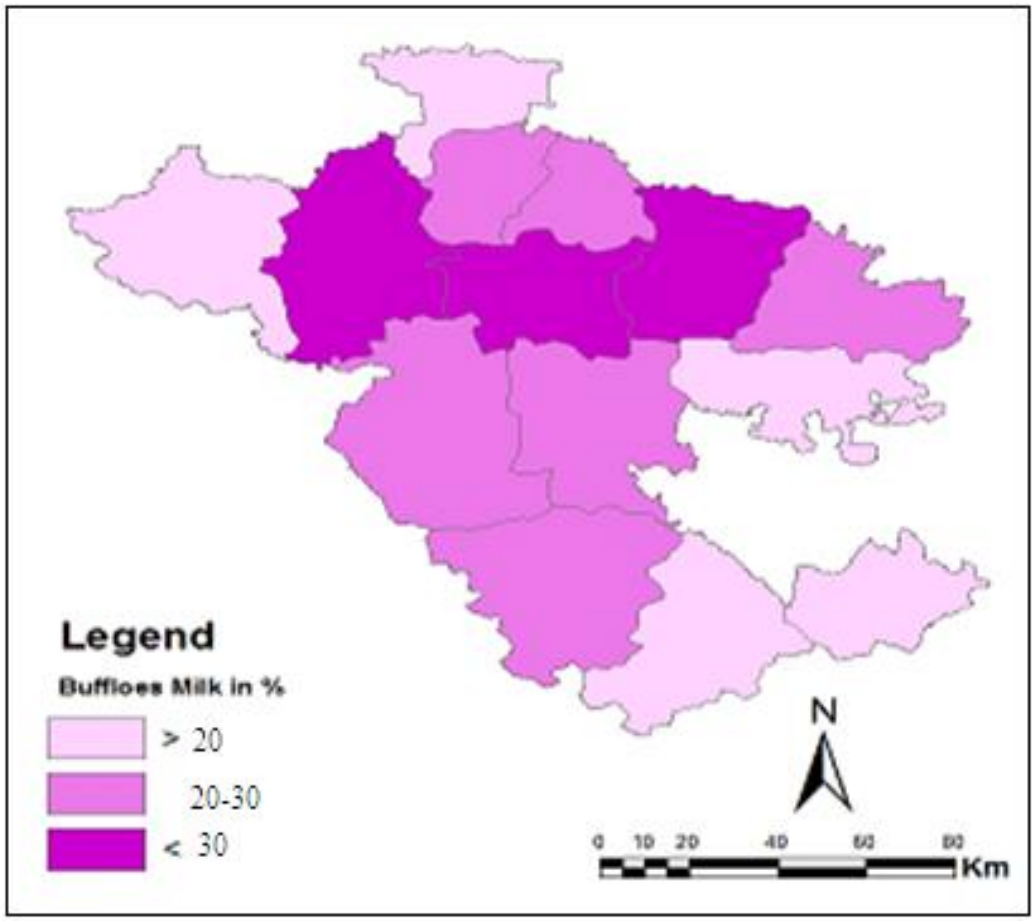
Fig.no.5.3.Shows tehsils wise Cow milk collection. Tehsils Akole, Kopergaon, Karjat, Jamkhed and Pathardi show more than 75 percent cow milk collection .Above mentioned tehsil found high number of cows compared to buffaloes, because of relief factors and irrigation facilities. Tehsils Akole,Jamked,Karjat,and Pathardi having high % of Deshi cow which provide less milk ,but share of daily milk collection of cow is higher than buffaloes.

Tehsils Rahata,Shrirampur,Shevgaon ,Ahmednagar.Parner and Shrigonda show more than 60% and less than 75 % cow milk collection, these area support both deshi and hybrid varieties of cows. Farmers of Ahmednagar district domesticate maximum numbers of hybrid cows only for milk purpose.

AHMEDNAGAR DISTRICT

BUFFALOES MILK COLLECTION BY CO-OPERATIVE DIARIES

2014



(Source – Compiled by Researcher)

Fig.5.4. Buffaloes milk collection by co-operative diaries of Ahmednagar district.

Fig.no.5.4.Shows tehsils wise buffaloes milk collection. Tehsils Akole,Kopergaon,Karjat, Jamkhed and Pathardi show less than 25 percent buffaloes milk collection. Above mentioned tehsil found less number of buffaloes compared to cows, because of relief factors and irrigation facilities. Tehsils Rahata,Shrirampur,Shevgaon ,Ahmednagar.Parner and Shrigonda show 20 to 30 percent buffaloes milk collection ,these area support both deshi and buffaloes. And finally leading milk producing tehsils of Ahmednagar district like Sangamner,Rahuri and Nevasa show high percent of buffaloes milk compared to other tehsils ,plain surface better sources of irrigation and transportation may responsible for high percentage of buffaloes milk collection.

5.6. Seasonal variation in milk Collection:

AHMEDNAGAR DISTRICT

MONTH WISE VARIATION IN MILK COLLECTION 2013-2014

Sr.No.	Months	Milk Collection in 2013-2014 (in lakhs)			
		Govt.dairy	Co-operative	Private	Total
1	April	0.06	7.84	14.99	22.89
2	May	0.09	8.35	14.81	23.25
3	June	0.08	8.45	15.73	24.26
4	July	0.07	8.1	15.84	24.01
5	August	0.07	8.04	15.35	23.46
6	September	0.07	7.88	16.31	24.26
7	October	0.08	7.69	15.24	23.01
8	November	0.08	8.74	18.5	27.32
9	December	0.09	8.67	19.25	28.01
10	January	0.004	8.8	18.31	27.11
11	February	0.003	8.85	18.26	27.21
12	March	0.003	7.76	17.29	25.05

Source-District Dairy Development officer Ahmednagar district

Table 5.5. Month wise variation in milk collection of Ahmednagar district.

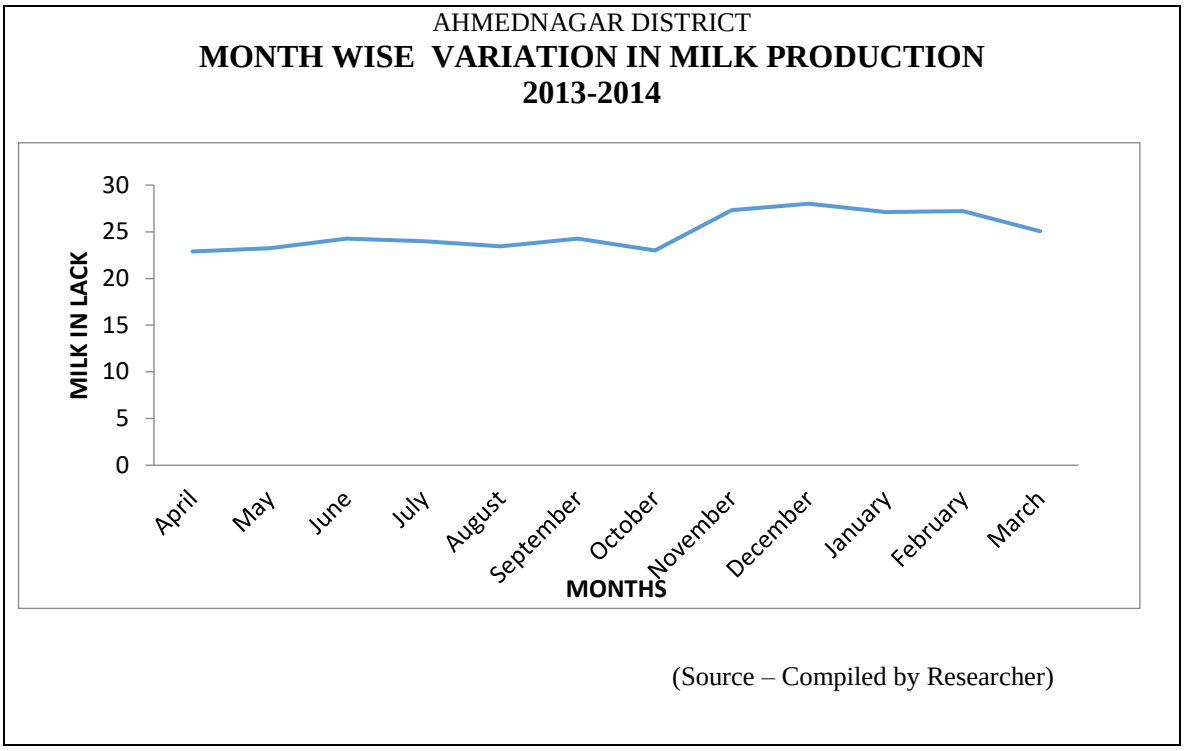


Fig.5.5. Month wise variation in milk collection of Ahmednagar district.

Fig no. 5.5. Month wise seasonal variation in milk production of Ahmednagar district

Fig. No. 5.5. Shows month wise milk collection of Ahmednagar district. Ahmednagar district having monsoon types of climate, it is Winter, Summer and Rainy season .generally months of June to September known as rainy season, November to February known as winter season and March to May is summer season. Fig.5.5. Shows high milk collection in winter season compared to rainy and summer season, it may be because of cool climate, availability of green fodder and less diseases.

AHMEDNAGAR DISTRICT

AVERAGE SEASONAL VARIATION IN MILK PRODUCTION (in lakh liters.)

2001-2014

Year	summer	Rainy	Winter
2001-02	13.59	13.19	13.89
2002-03	13.64	13.68	13.79
2003-04	13.32	12.99	13.45
2004-05	16.17	15.45	15.72
2005-06	17.12	16.52	17.69
2006-07	20.25	19.89	18.68
2007-08	21.76	19.37	22.17
2008-09	21.9	20.16	21.07
2009-10	23.07	21.45	22.13
2010-11	23.45	22.51	22.56
2011-12	23.57	23.02	22.6
2012-13	23.86	23.99	27.41
2013-14	25.16	24.21	25.76

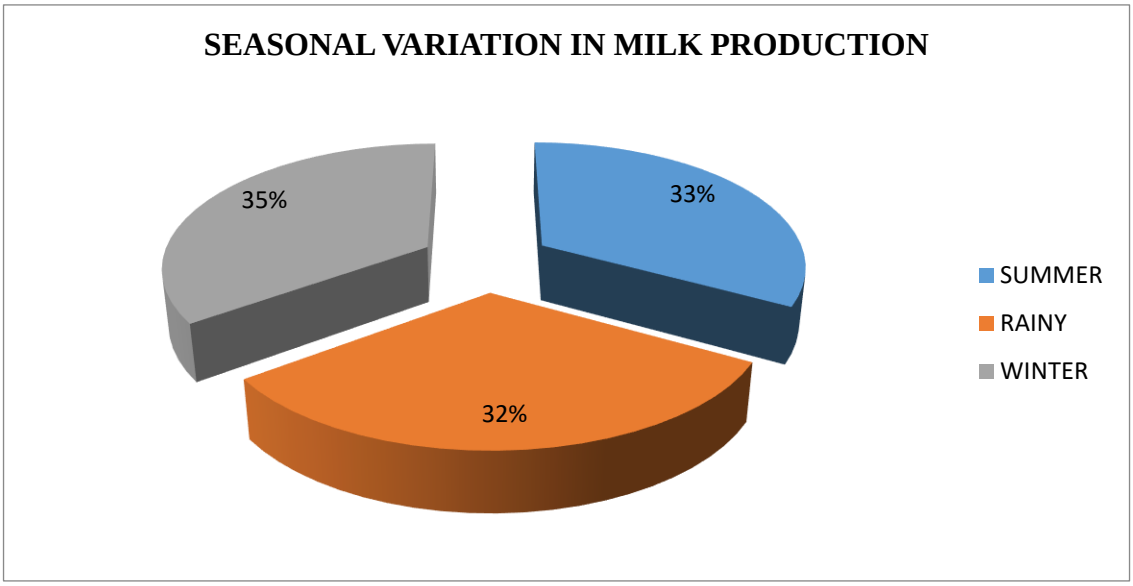
Source-District Dairy Development officer Ahmednagar district

Table. 5.6 Avera**ge** seasonal variation in milk collection of Ahmednagar district.

AHMEDNAGAR DISTRICT

AVERAGE SEASONAL VARIATION IN MILK COLLECTION (in lakh liters.)

2001-2014



(Source – Compiled by Researcher)

Fig.5.6 Avera**ge** seasonal variation in milk collection of Ahmednagar district.

Fig.no.5.6 shows yearly average variation in milk collection since last fourteen years. Since 2001 to 2014 winter season milk collection is always more than summer and rainy season. In Ahmednagar district 35 percent milk collected in winter season, 34 percent in rainy season and remaining 31 percent in summer season. In summer season milk collection has shown less compared to other seasons only because of high temperature and shortage of fodder crops.

5.7. Spatial Variation of dairy animals of Ahmednagar district:

AHMEDNAGAR DISTRICT **SPATIAL VARIATION OF DAIRY ANIMALS**		
Sr.No	Tehsils	Dairy animal in lakh
1	AHMEDNAGAR	1.57
2	AKOLE	1.01
3	JAMKHED	0.88
4	KARJAT	0.78
5	KOPERGOAN	1.78
6	NEVASA	1.12
7	PARNER	1.25
8	PATHARDI	0.66
9	RAHATA	1.8
10	RAHURI	2.1
11	SANGAMNER	2.45
12	SHEVGAON	0.89
13	SHIRIGONDA	1.63
14	SHRIRAMPUR	1.43
Source-District Dairy Development officer of Ahmednagar district.		

Table 5.7. Spatial variation of dairy animals of Ahmednagar district

Spatial Variation of dairy animals found in Ahmednagar district. Some tehsils like Sangamner,Rahuri, Kopergaon and Ahmednagar having maximum dairy animals,

which support to increase the milk production of particular tehsils. Numbers of dairy animals directly or indirectly depend on relief, climate and fodder crop. Tehsils having good condition for dairy animals support maximum number of dairy animals. Non irrigated area of the district, farmers' rear low or deshi breed cows and buffalos, which never support commercial dairy farming in study area. Table no 5.7 shows the spatial variation of dairy animals of the study area.

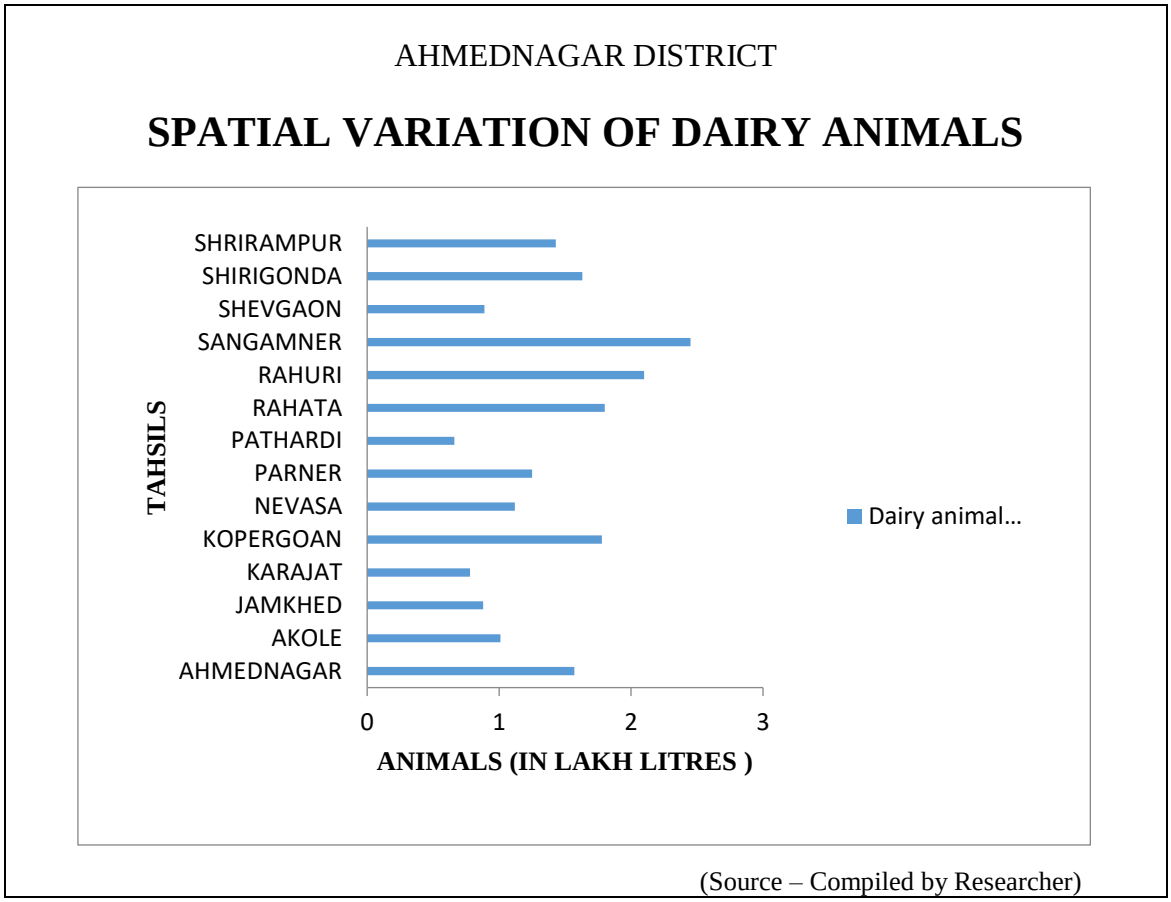


Fig .5.7. Spatial variation of dairy animals of Ahmednagar district

Fig no 5.7. Shows uneven distribution of dairy animals of Ahmednagar district .Tehsil Sangamner having highest number of dairy animals (2.45 lakh) help to developed dairy farming on large scale. Followed by Sangamner tehsils Rahuri (2.1lakh), Rahata (1.8lakh), Kopergaon (1.78.lakh),Shrigonda (1.63 lakh) and Ahmednagar (1.57.lakh), shows maximum dairy animals .Less number of dairy animals shown in Pathardi 0(.66 lakh),Karjat (0.78 lakh) Jamkhed (0.88 lakh) and remaining tehsils shows moderate dairy animals in the study area. Dairy animal have direct impact on milk production.

5.8. Spatio-temporal variation in dairy farming:

AHMEDNAGAR DISTRICT

SPATIO-TEMPORALVARIATION IN MILK COLLECTION (in lakh litres.)

2005-2014

Sr.	Tehsils	2005 - 2006	2006 - 2007	2007 - 2008	2008 - 2009	2009 - 2010	2010 - 2011	2011 - 2012	2012 - 2013	2013 - 2014
1	Ahmednagar	1.1	1.47	1.93	1.87	1.79	2.1	2.15	2.11	2.2
2	Akole	0.64	0.89	0.97	1.02	1.2	1.21	1.32	1.42	1.5
3	Jamkhed	0.41	0.67	0.68	0.66	0.54	0.68	0.77	0.78	0.95
4	Karjat	0.55	0.65	0.66	0.72	0.75	0.81	0.79	0.83	0.85
5	Kopergoan	1.05	1.12	1.16	1.15	1.64	1.45	1.42	2.76	3.01
6	Nevasa	0.81	0.83	0.87	0.99	0.94	0.93	1.12	1.73	1.8
7	Parner	2.01	1.03	1.05	1.36	1.96	1.95	1.92	1.89	1.7
8	Pathardi	0.61	0.63	0.62	0.63	0.68	0.67	0.83	0.8	0.79
9	Rahata	1.59	2.34	2.87	2.95	2.71	2.75	2.93	3.15	3.5
10	Rahuri	1.99	2.18	3.11	3.01	2.32	2.33	2.73	3.97	4.27
11	Sangamner	1.15	1.86	2.98	3.15	3.75	3.8	4.58	5.02	5.58
12	Shevgaon	0.78	0.82	0.98	0.77	0.73	0.72	0.82	0.89	1.1
13	Shirigonda	1.22	1.55	1.45	1.6	1.41	1.39	1.45	2.24	2.52
14	Shrirampur	1.26	1.23	1.21	1.22	1.38	1.41	1.73	1.98	2.1

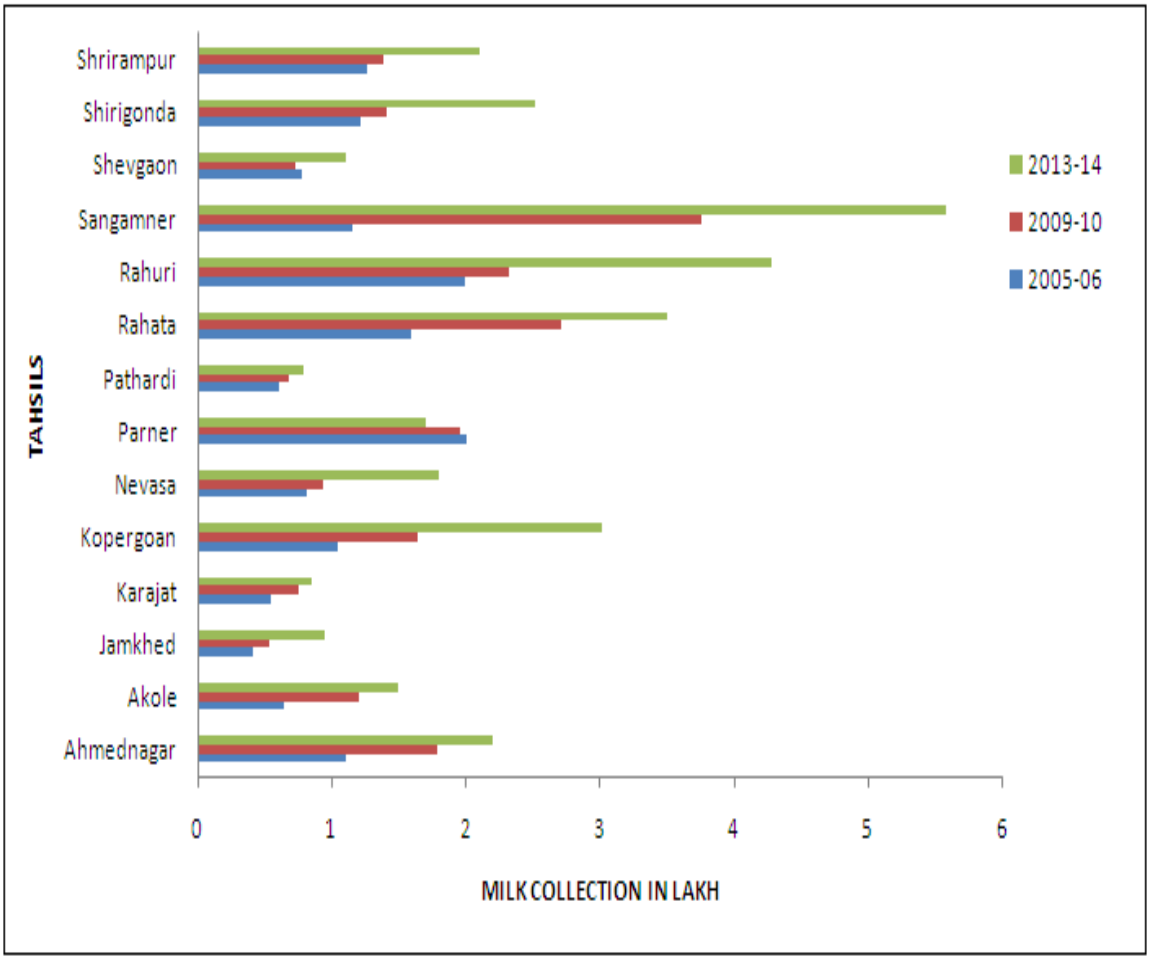
Source-District Dairy Development officer Ahmednagar district

Table. 5.8.Spatio-temporal variation in dairy farming of Ahmednagar district.

AHMEDNAGAR DISTRICT

SPATIO-TEMPORALVARIATION IN MILK COLLECTION

2005-2014



(Source – Compiled by Researcher)

Fig. 5.8. Spatio-temporal variation in dairy farming of Ahmednagar district (in lakh litres).

Fig 5.7. Shows Spatio-temporal daily Milk Collection of Ahmednagar district since 2005 to 2014.All tehsils of Ahmednagar district show positive growth in milk production but tehsils like Sangmner,Rahuri,Rahata and Kopergaon shows maximum positive change in milk collection in year 2013-2014 compared to other tehsils. It is only

because of changing cropping pattern in agriculture , irregularity in income from traditional crops particularly sugarcane ,farmer change cropping system in agriculture and start cultivating fodder crops and practice dairy farming in large scale which effect on dairy activities in above mentioned tehsils as well as in Ahmednagar district. Irrigation, increase number of dairy animals, development of private dairy and transportation facilities also responsible to constantly increase milk production and dairy farming in Ahmednagar district.

Resume:

This chapter provides basis information of dairy farming of Ahmednagar District, such as growth and development of dairy farming, structure, milk collection system and its distribution of Ahmednagar district. Milk collection by Co-operative dairies and private dairies systematically explain in this chapter. This chapter also explain seasonal variation of milk production, Spatial Variation of dairy animals of Ahmednagar district. Finally Spatio-Temporal variation and their impact on dairy farming of Ahmednagar district, explained in brief.

Reference:

Han.J. and Kamber M. Data Mining: Concept and techniques .Morgan Kaufmann 2000.

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Dairy Development officers record 2001-20014 of Ahmednagar district.

CHAPTER -VI

QUANTITATIVE ANALYSIS OF DAIRY FARMING OF AHMEDNAGAR DISTRICT

6.1. General Introduction

6.2. Correlation:

6.3. District Level Correlation Analysis: Observations

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- 6.4.2. Inter-dependence between Milk production and Number of Cattle
- 6.4.3. Correlation between milk production and Hybrid cows
- 6.4.4. Effect of Native animals over milk production
- 6.4.5. Milk Production and Irrigation
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- 6.6.1. Concept of Production:
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Reference.

6.1. **General Introduction**

Quantitative data collected from primary and secondary sources was analyzed statistically, in order to get meaningful inferences. The quantitative analysis included Karl Pearson's Bivariate Correlation Analysis, Simple Regression Analysis, Time series Analysis and Cost-Benefit Analysis. All these exercises were used to gather specific information about the variables and their inter-relationships. Simple Correlation was used to know how the Independent variable (Milk Production) was affected by individual dependent variables. Primary data of 14 tehsils of Ahmednagar district was collected through questionnaire survey. This data for all 14 tehsils was used to find the scatter and the trend of regression. Time series analysis was used to understand the temporal development of dairy activity in the given time period of about two decades.

Firsthand information regarding the expenses incurred for cattle rearing and dairy farming were collected from the questionnaire survey. Similarly, the actual annual production of milk, and the income generated thereby, was also recorded. Data from these questionnaires (30 per Tehsil) was averaged to get one average value for each tehsil. Thus, the data from 420 questionnaires was summarized into average values. These values were used for correlation, regression and cost-benefit analysis.

On the other hand, secondary data for the entire Ahmednagar district was also obtained from District Dairy Development Officer. This data was used for simple correlation analysis of the entire Ahmednagar District, and to study the temporal changes in dairy farming activity between 1991 to 2014.

6.2. Correlation:

Sometimes it is necessary to know the relationship between two variables. For instance, a farmer would like to know the effect of irrigation and milk production. If the two are related, he would like to know the nature of relationship and to use that knowledge to his benefits. Correlation techniques mostly use to understand the relationship between two variables. If two variables vary together in the same direction or in opposite directions, they are said to correlate. (A.V.Deshpande and M.L Vaidya 2002)

If as X variable increases, Y increases consistently, we say that X and Y are positively correlated. Sometime some variable are negatively correlated to each other,

where X is increases and Y are decreases. If the change in one variable is proportional to the change in other variables are said to be perfect correlation. Correlation can be found out by four major methods like Scatter diagram, Correlation table, Correlation graph and Coefficient of correlation.

Karl Pearson's Coefficient of correlation method is used to find out correlation of various variables to the milk production of Ahmednagar District. The coefficient of correlation denoted by r and named after Karl Pearson. The value of r lies between -1 and +1.

If $0 < r < 1$ mean the correlation is positive

If $r = 1$, mean the correlation is perfect positive

If $-1 < r < 0$ mean the correlation is negative

If $r = -1$, mean the correlation is perfect negative

And If there is no correlation between two variable $r = 0$

Thus, only four indices are used in this analysis. For establish correlation of thirteen variables were carefully chosen.

The chosen variables are as below:

X 1 – Daily Milk production (lakh litres)

X 2 – Irrigated land in percentage

X 3 – Number of Dairy animals

X 4 – Percentage area under Fodder crops

X 5 –Percentage of Hybrid Buffaloes

X 6 – Percentage of Deshi Buffaloes

X 7 – Percentage of Hybrid Cows

X 8 – Percentage Deshi Cows

X 9 – Crude density of population

X 10–Physiological density of population

X 11 – Agricultural density of population

X 12 – Percentage Literacy

X 13 –Total Number of Workers

The reason for selection of above variables was strengthening the result of hypothesis that Maximum number of farmers of irrigated area practice dairy farming. And there is relationship between dairy farming and types of dairy cattle. Selection of fodder crop as a variable is of vital importance, since, it represents an essential element for the development of dairy farming. Therefore positive correlation is expected between irrigated land and milk production, as well as dairy cattle and milk production. Variable X3 i.e. Dairy animals plays a prominent role in development of dairy farming. They are the main source of milk production in the study area. In normal circumstances, it would be logical to assume that larger the number of dairy cattle, more shall be the milk production.

Variable X5 and X6 pertain to another dairy animal reared along with cattle, that is, buffaloes. Farmers in the study area rear buffaloes of local breeds, as well as of Hybrid varieties. Not only that buffaloes require different conditions of rearing than cows, the characteristics and fat content of buffalo milk is significantly different than that of the cow milk.

Variables X9 to X12 are the demographic and socio-cultural aspects of environment. Literacy indicates the quality of human being. Education helps human being in many ways to develop various skills, so literacy is a necessity for all those who wish to practice the dairy farming on modern lines. Literate population is likely to adopt new dairy technology it has positive effects on dairy farming. In India, dairy operations are mainly human labour intensive because of small size of holding, lack of mechanization and poor economic conditions.

6.3. District Level Correlation Analysis: Observations

As mentioned earlier, the secondary data obtained from the District Dairy Development Officer, was arranged in form of a 14 x 13 data matrix. This data was subjected to Pearson's product moment coefficient of correlation. Student't' test has been applied to determine significant 'r' values at 0.05 and 0.01 percent level of significance. The results obtained (table 6.1) show certain significant associations among the various selected variables which are described as follows:

X1. Daily milk production

Table 6.16 shows that variables X2, X3, X4, X5 AND X7 shows the positive correlation with milk production. This X1 is positively and significantly correlated to irrigated land in percentage X2(r = 0.859977), number of dairy animal in lakh X3(r =0.97454), Fodder crop in percentageX4(r = 0.89426) and hybrid cows in percentage X 7 (r = 0.918176) daily milk production at 0.05 % level of significant. Positive but not significant correlation found with hybrid buffaloes in percentageX5 (r =0.565952),

Literacy in percentage X12(r = 0.520726), Total Workers X13 (r = 0.465697).and Crude density of population X9 (r = 0.398864) were the social and cultural factors, which do not show as strong correlation with the milk production. It indicates that number of people engaged in dairy farming and their educational status does not affect dairy development significantly.

X 2 Irrigated land

This index exhibits a very strong positive correlation with number of dairy animals(r = 0.9218), Hybrid Cows(r = 0.9463) and percentage of fodder crops(r = 0.8420) daily milk production at 0.01% level of significance. This is logically expected since availability of irrigated land would not only insure fodder availability, but farm leftovers which can also be used as animal feed. This index also shows a positive correlation with cultural and social factors such as crude density of population (r = 0.6300), Literacy in percentage (0.6511) Total Workers(r = 0.5973)and,hybrid buffaloes in percentage. (r = 0.0.465), though not as strong as its correlation with number of animals.

Correlation Matrix (For the Entire Ahmednagar District, based on Secondary data)													
VARIABLE	*X1*	*X2*	*X3*	*X4*	*X5*	*X6*	*X7*	*X8*	*X9*	*X10*	*X11*	*X12*	*X13*
X1	1												
X2	0.859977	1											
X3	0.97454	0.921864	1										
X4	0.89426	0.842076	0.907672	1									
X5	0.565952	0.465152	0.547879	0.365996	1								
X6	-0.65744	-0.60371	-0.69004	-0.47045	-0.6892	1							
X7	0.918176	0.946336	0.962916	0.88269	0.573061	-0.72656	1						
X8	-0.9182	-0.94633	-0.96289	-0.88253	-0.57321	0.726739	-1	1					
X9	0.398864	0.630046	0.484034	0.354182	0.50208	-0.70232	0.569957	-0.5702	1				
X10	-0.34036	-0.10485	-0.22431	-0.24671	-0.0851	0.23124	-0.21625	0.216045	0.122056	1			
X11	-0.2716	-0.05374	-0.22456	-0.1995	-0.21255	0.276743	-0.2029	0.202637	0.016741	0.799264	1		
X12	0.520726	0.65112	0.622315	0.496687	0.552016	-0.64291	0.645498	-0.64559	0.839345	0.072573	-0.24832	1	
X13	0.465697	0.597383	0.567076	0.518235	0.04226	-0.31731	0.600577	-0.60062	0.107036	0.013175	0.025117	0.202599	1

Source- Compiled by researcher

Table. 6.1. Correlation Matrix (For the Entire Ahmednagar District, based on Secondary data)

This may be indirectly explained that in irrigated areas, the economic conditions of the farmers would be better, and which shows in other social parameters as well.

X3.Dairy animals

This dairy farming index is highly positively correlated with fodder crops (r = 0.0.9076) milk production(r = 0...0.9745), and with the number of hybrid Cows (r = 0.9629) at 0.01 % level of significant. However, positive but comparatively less significant correlation is seen with hybrid buffaloes in percentage.(r = 0.5478). This may show that the farmers in the study area are still more inclined towards cow rearing than rearing buffaloes. Correlation with Literacy in percentage (r = 0.6223) and Crude density of population (r = 0.4840) is also mildly positive. However, the trend continues here as well, that the cultural characteristics of population do not seem to be affecting the number of dairy animals.

X4 .Fodder crops

Percentage area under fodder is positively correlated with milk production (r = 0.8942), and number of Hybrid Cows (r = 0.694). Availability of fodder would naturally support a larger animal population. However, level of agricultural operations is also improved, if area under fodder is high. Farmers who have cultivation of fodder crops, also adopt usage of high yielding variety of seeds (r = 0.766), use of chemical fertilizers (r = 0.850) and agricultural credit (r = 0.686) at 1 % level of significant. All these are characteristics of progressive farming.

6.4. Regression analysis:

When we know that two given variables are correlated to a certain degree, it is possible to estimate the value of one of the variables, given the value of other variable; e.g. if we know that there is positive correlation between the Milk production and irrigated land, dairy animals, fodder crops and hybrid cows, we can find an equation establishing the relation between Milk production and irrigated land, dairy animals, fodder crops and hybrid cows,
Correlation coefficient only determines whether the variables are related and if so, how strong is the relationship. But it is not useful for prediction. The equations used for prediction

or estimation are known as regression equation. i.e., with help of regression analysis we establish a model which expresses the functional relationship between the two variables. These are also known as the estimating equations.

6.4.1. Scatter diagram methods of regression analysis

Scatter diagram shows to what extent the observed values of the variables vary from the perfect correlation condition. If all the points lie on a straight line, which is the case when there is the perfect correlation, we estimate the value Y given corresponding value of X, but in practice we rarely find perfect correlation. In this case we can draw a line by inspection in such a manner that it seems to be the best possible line which can represent the data, and estimate values of Y.

We draw this line in such a way that there are approximately the same numbers of points above as well as below the line, and the deviation of the points above the line and those of the points below the line are equal. A homogeneous data set would have most of the points lying along the regression line, while in case of a heterogeneous data set, the points would fall away from the regression line.

The regression analysis was done using the actual data collected from the primary survey. The 30 values for each variable (obtained from 30 questionnaires per tehsil) were averaged to get one value per variable per tehsil. The salient features observed in the regression analysis are as follows-

Analysis of Farmers Questionnaires of study area.															
Tehsils	No's of Person in family	No's of literate Person in family	Land holding of family	Irrigated land Acre	No's of hybrid Cows	No's of deshi Cows	No's of Deshi Buffaloes	No's of hybrid Buffaloes	Per day milk production by dairy cattle	Market price of milk per litre	Expenditure for feed and fodder (in 000 Rs)	Expenditure for labour (in 000 Rs)	Expenditure for veterinary services (in 000Rs)	Other expenditure (in 000 Rs)	Area under fodder crop in percent
Ahmednagar	6	4	8	7	3	2	0	1	8	20	60	40	6	30	51.36
Akole	8	5	6	3	2	3	1	0	4	19	40	20	5	20	57.36
Jamkhed	8	6	7	3	1	3	1	0	3	20	30	20	4	25	39
Karjat	7	6	6	2	1	3	1	0	3	20	30	25	4	25	38.3
Kopergoan	8	7	8	7	6	1	0	1	12	20	62	36	6	40	59.89
Nevasa	6	5	6	3	3	2	1	1	6	20	50	30	5	30	43.22
Parner	8	5	7	3	2	3	0	1	6	20	40	25	5	30	56.21
Pathardi	6	4	7	2	1	4	0	1	3	20	30	20	4	25	30.1
Rahata	6	6	5	5	4	1	0	0	10	21	65	40	6	30	70.3
Rahuri	7	7	8	7	5	1	0	0	12	20	70	50	7	35	70.76
Sangamner	7	6	6	5	6	0	1	0	13	21	75	40	7	25	73.14
Shevgaon	6	5	6	3	2	3	0	1	5	20	40	30	5	25	41.01
Shirigonda	6	5	6	5	3	3	0	1	7	20	45	25	5	24	57.32
Shrirampur	7	6	5	4	3	2	0	1	6	20	50	30	6	25	49.9

Source: Compiled by researcher

Table. 6.2. Analysis of Farmers Questionnaires of study area.

6.4.2. Inter-dependence between Milk production and Number of Cattle

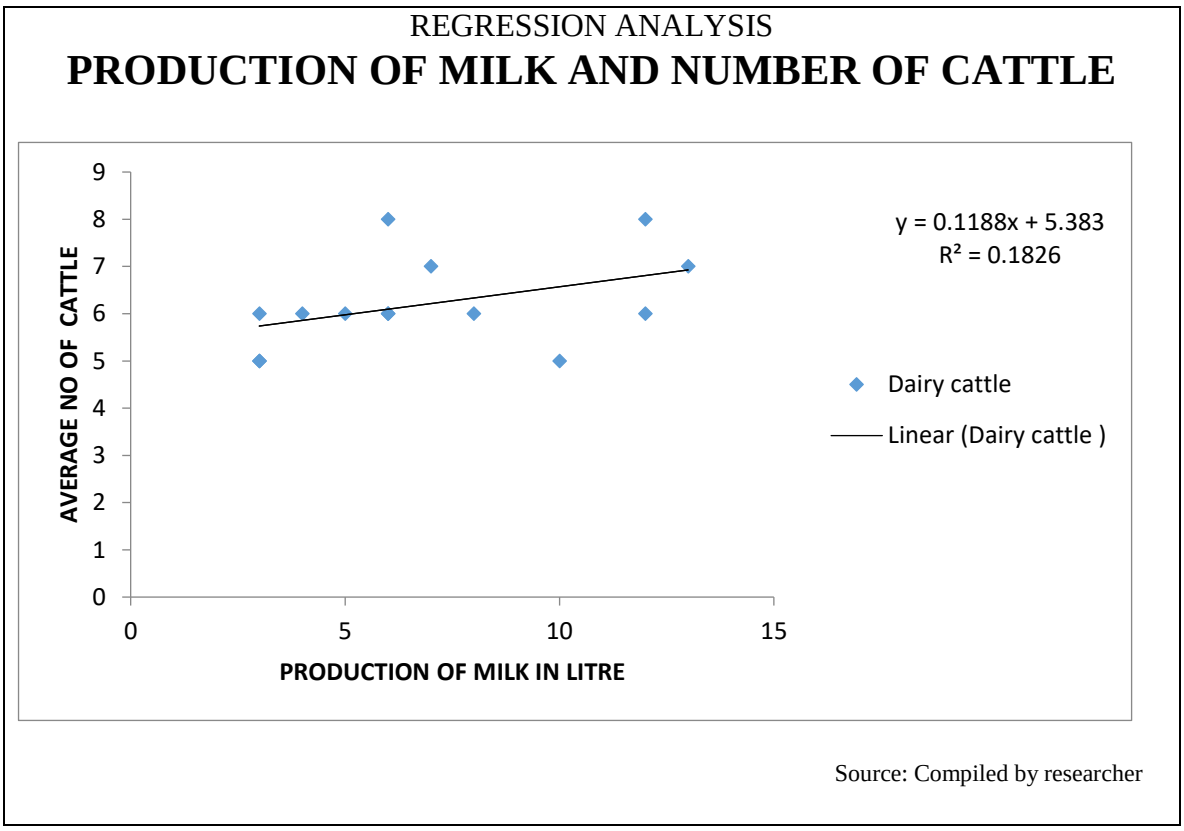


Fig.6.1. Regression analysis of production of milk and number of cattle.

Figure 6.1 explains the relationship between the amount of milk production and the number of cattle. These two variables would otherwise be closely associated with each other, and a strong correlation would be expected. However, the data set collected from the primary survey does not bring out any significant relation between these two variables. Correlation between amount of milk produced and the number of cattle have an insignificant correlation, thereby suggesting that these two facts are not share a cause-consequence relationship. This means that the number of animals does not decide the amount of milk produced. In other words, there may be lesser amount of milk produced even if number of animals is high, or conversely, lesser number of animals may yield a higher amount of milk.

This anomalous correlation brings out the importance of Hybrid variety of animals, which have a much higher milk yield than the native animals. Even if the number of Hybrid Cows is less, they give more milk as compared to a larger number of deshi cows. Thus, even with less animal population, milk production is high. On the other hand, where farmers have not opted for Hybrid animals, the milk yield of native cows is very small. Even in their population is larger, the effective milk collection remains less than the Hybrid varieties. Due to this, one does not find any significant correlation between number of cattle and the amount of milk produced.

6.4.3. Correlation between milk production and hybrid cows:

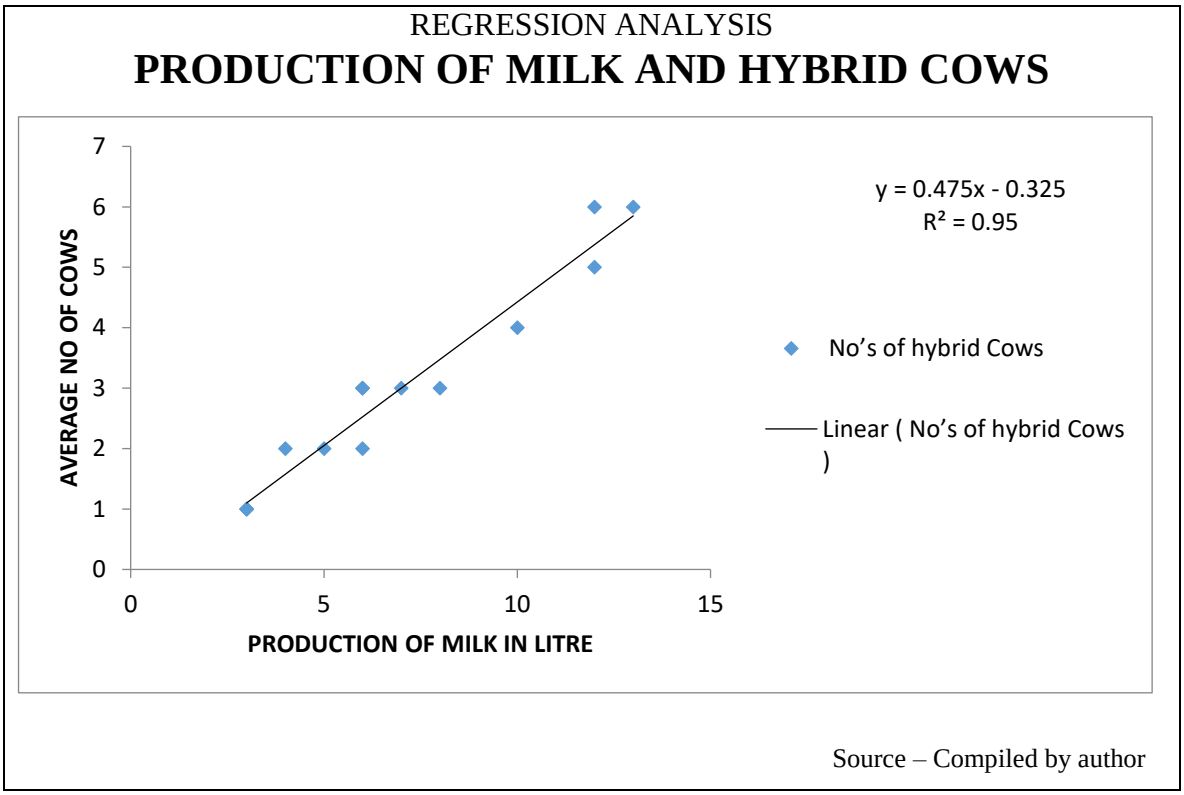
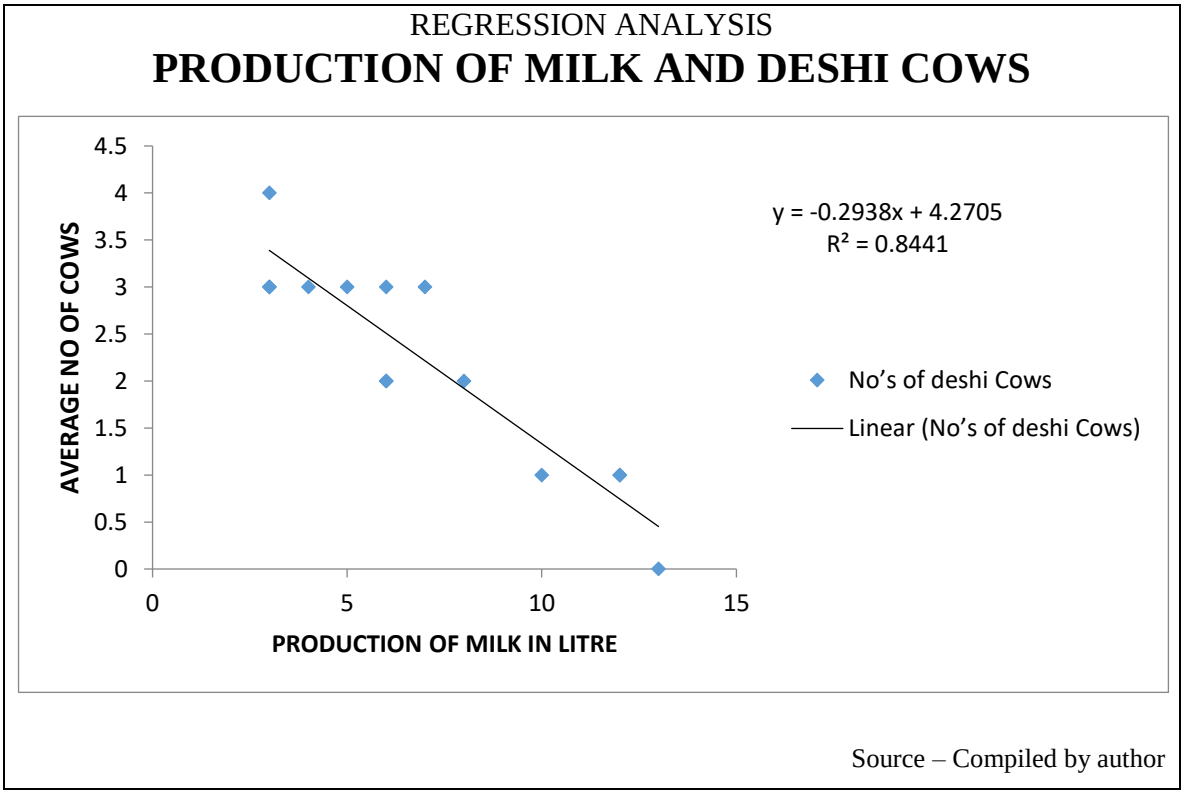


Fig.6.2. Regression analysis of production of milk and hybrid cows.

The factor which has been explained in 6.4.3., expresses itself very clearly in the above figure. When a correlation and regression of total milk yield and population of only Hybrid cows is attempted, it shows a very strong positive correlation of 0.95, and almost a perfect fit with the regression line. It is therefore clear that the increase in milk content is solely due to the Hybrid variety of animals. If population of Hybrid animals is more, the amount of milk collected shall also be more. However, if there are a larger number of

native animals, the production remains low despite a larger animal population. The field survey confirmed this fact beyond doubt. The farmers reported that while the Hybrid cows give about 20 litres of milk during the peak milking season, a native cow yields not more than 3-4 litres.

6.4.4. Effect of Native animals over milk production:



Source – Compiled by author

Fig.6.3. Regression analysis of production of milk and deshi cows.

The same argument can be further strengthened by exhibiting the regression analysis of correlation between production of milk and the number of Deshi (Native Cows). It can be clearly seen that more the number of Deshi cows, lesser is the total production of milk. Lower the number of Deshi cows, which obviously implies larger number of hybrid cows, higher is the milk production. Thus, both the figures 6.2 and 6.3 are complementary to each other, and which suggest that the amount of milk production is a direct function of the type of animals reared.

6.4.5. Milk Production and Irrigation :

Another important significant relationship is observed between production of milk and the possession of irrigated land. As most parts of Ahmednagar district fall in a very low rainfall zone, availability of water is of crucial importance to agriculture as well as animal rearing. Availability of irrigation is also a suggestive variable. If a farmer can arrange for irrigations facilities, it implies that the economic condition of the farmer is reasonably good. Consequently, other variables such as availability of hybrid cows, vaccination and healthcare etc., which are influenced by high economic standard, shall also get positively associated. It may be observed from the regression fit that size of irrigated land also tends to show some kind of effect over milk production.

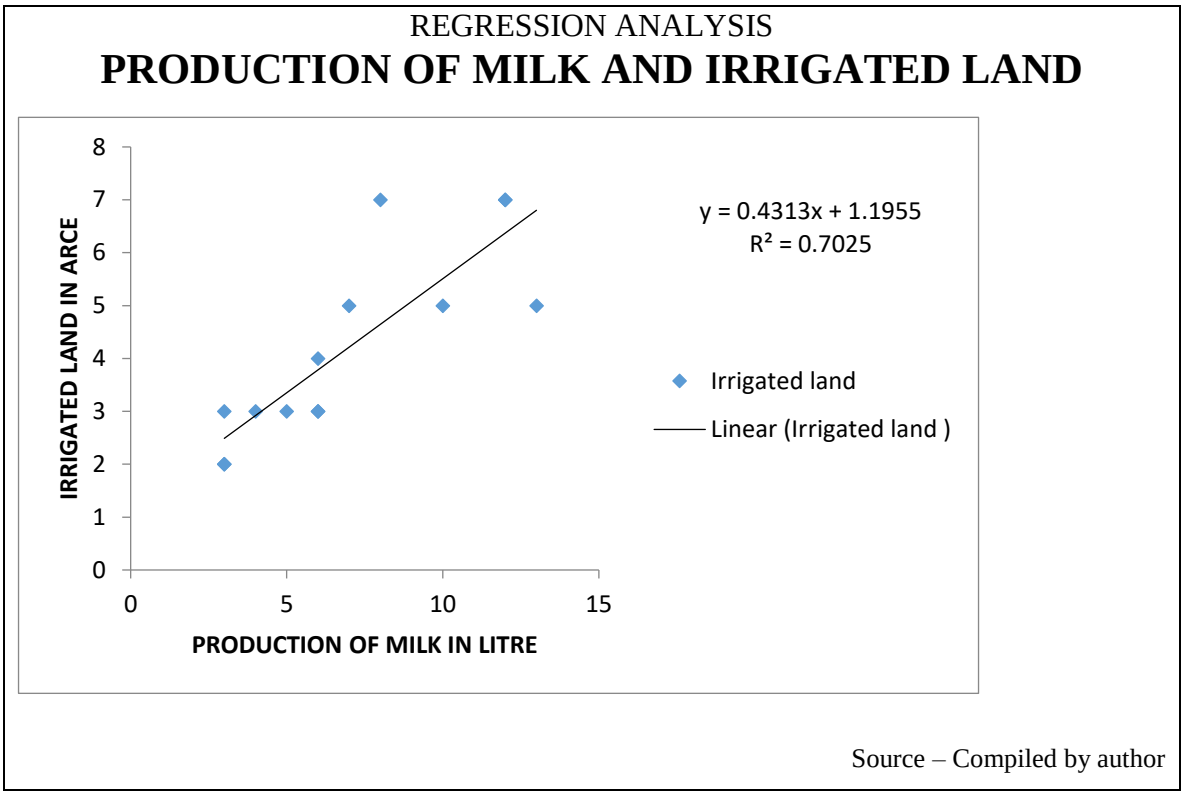


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Fig.6.4. Regression analysis of production of milk and irrigated land.

If the size of the irrigated land is small, that is 2-5 acres, it shows a better fit with the regression line. However, as the size of the irrigated land increases, its association with total milk production becomes less marked. It means that large irrigated farms do not

necessarily produce more milk. Field observations confirmed this pattern. Personal interviews with the farmers revealed that smaller irrigated farms would grow fodder or crops like jowar and cotton. Fodder and farm leftovers support dairy activity in small irrigated fields. However, if a farmer owns a large irrigated tract (5-10 acres), he would rather utilize it for sugarcane cultivation, without opting for dairy farming. Thus, availability of irrigation alone would not decide the feasibility of dairy farming. Rather, availability of irrigation and size of farm together, can explain the variations in total milk production.

6.4.6. Milk Production and Fodder Cultivation:

Area under fodder crop is also another significant variable which has a positive correlation with milk production. Having a dedicated fodder cultivation for cattle, shall ensure a yearlong supply of green fodder.

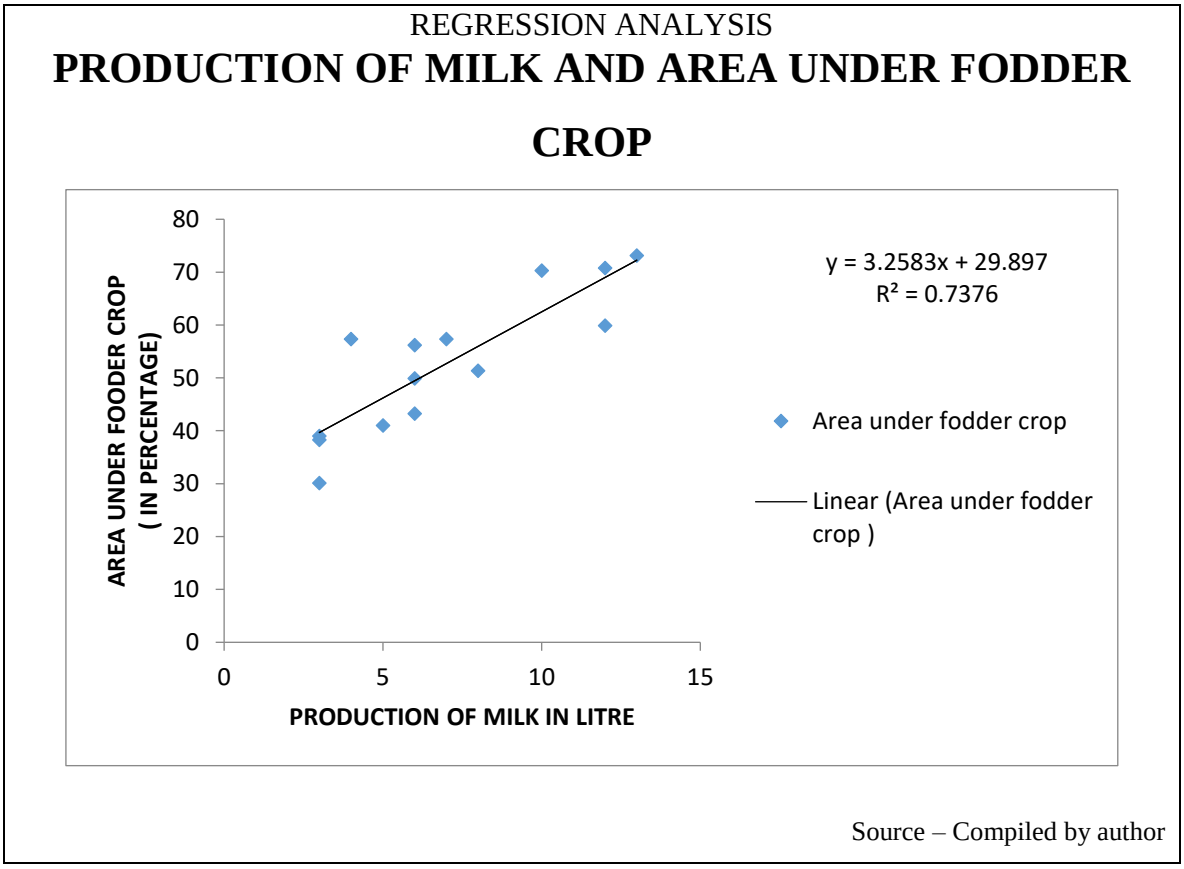


Fig.6.5. Regression analysis of production of milk and area under fodder crop.

It may still be noted that in absence of irrigated land, green fodder is available only for 2 months of monsoon. Hence, cultivation of fodder shows a positive correlation with milk production. Type of fodder directly influences the health of the animals and the daily yield of milk. Hybrid variety of animals need a constant supply of good quality green fodder. Deshi (native) cows may sustain on dry fodder or farms leftovers as well, but the yield of milk drastically falls in such cases.

6.4.7. Effect of Geographical Variables over dairy development

While analyzing the effect of Geographical factors over dairy development and milk production, the prominently observed Geographical variables which showed spatial changes, were rainfall and soil type. Temperature as a geographical factor was not considered, as it remained more or less constant over all tehsils. Average Annual maximum temperature of Ahmednagar district is 29°C, while the Average Annual minimum temperature is 19.5°C. In all tehsils of Ahmednagar, these figures are more or less the same. Since no variation is observed in the temperature conditions, this factor was not included for the analysis. However, average annual rainfall and types of soil show considerable variations, hence, were used for the analysis.

1) Effect of soils over milk production of Ahmednagar district

Amongst the soil types, the prominent ones are deep black soil, medium black soil, coarse shallow soil locally known as “Murum” and red soil. In the primary survey, the percentage area under these soils tehsil-wise, was calculated, averaging the individual responses. These values of area under a particular soil type was subjected to regression analysis.

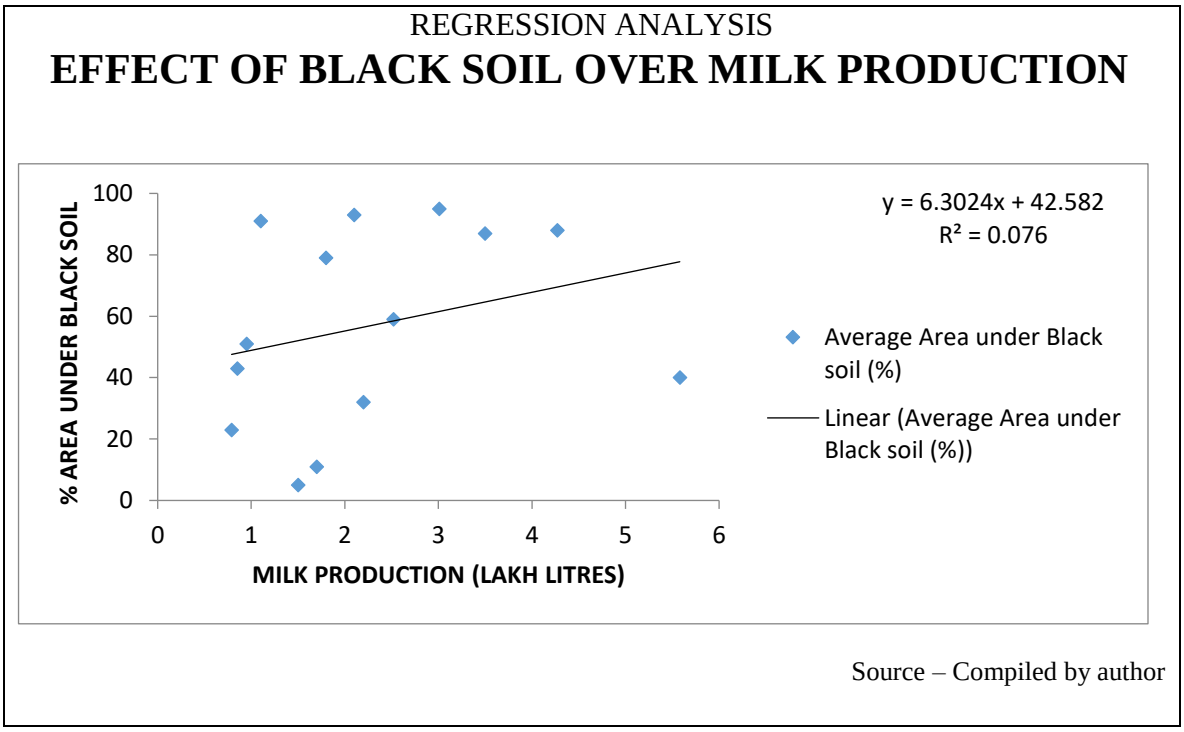


Fig.6.6. Effect of black soil over milk production.

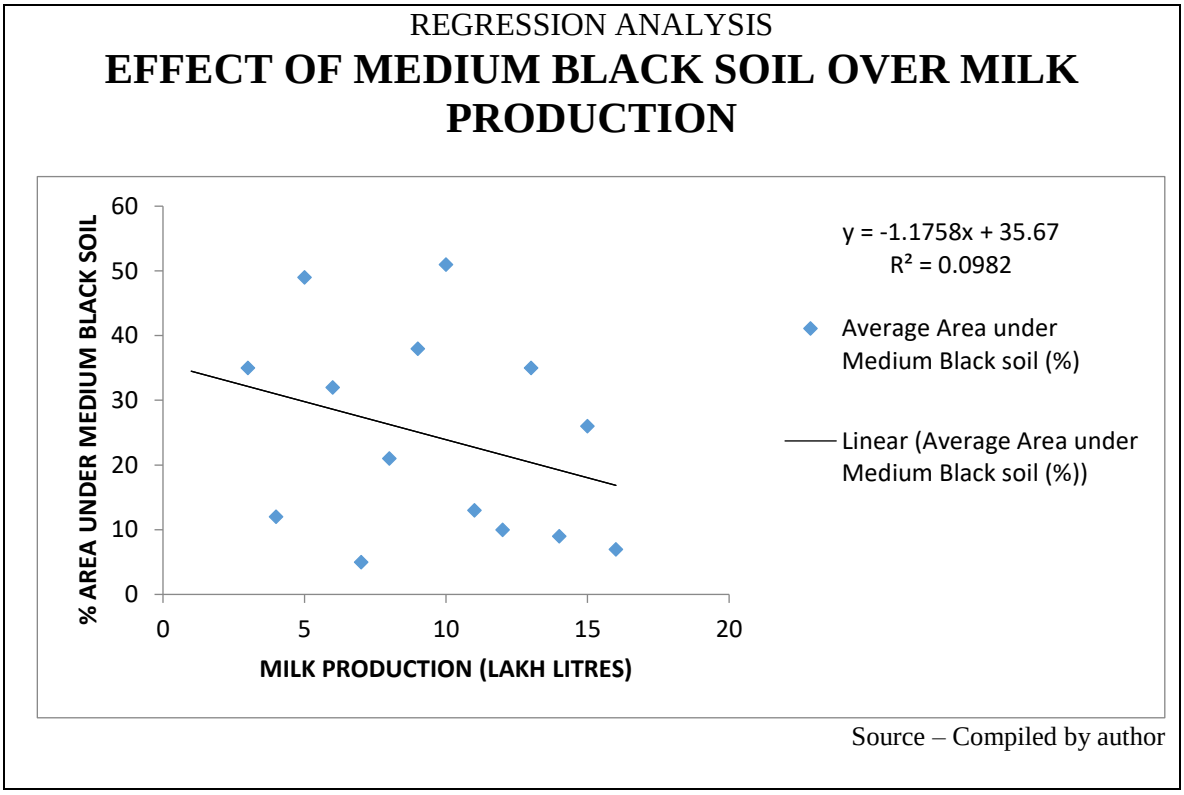


Fig.6.7. Effect of medium black soil over milk production.

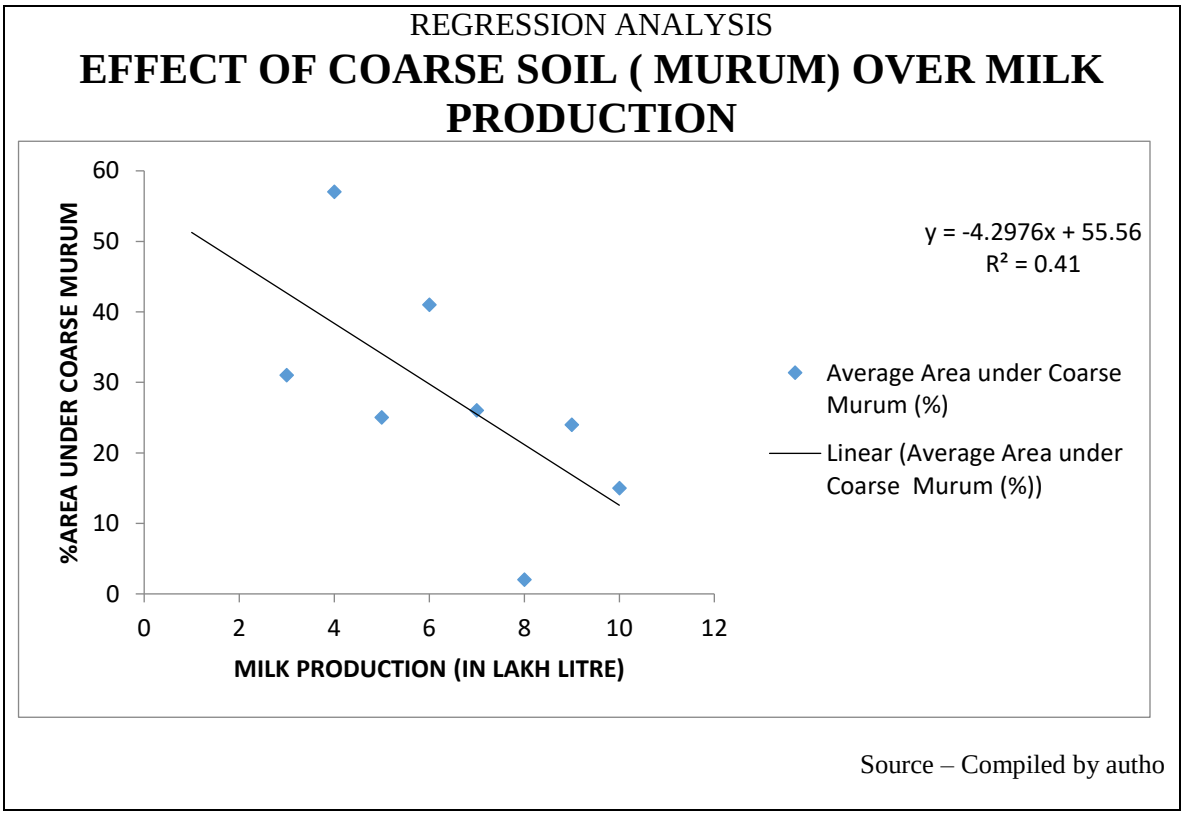


Fig.6.8. Effect of coarse soil (Murum) over milk production.

The results of regression for three soil types (deep black, medium black and Murum) show insignificant values of association with the production of milk. Rather the correlation values are so low that it seems to be having no association at all. The correlation coefficient for deep black soil is 0.076, for medium black soil is -0.098, and for coarse Murum it is -0.41. Such low values of correlation are common for all types of soil. This shows that amount of milk production is not influenced by soil type. In some areas of deep black soil, over-dependence on sugarcane cultivation has resulted in negligence towards dairy activity. Similarly, in some coarse Murum tracts, availability of irrigation and hybrid cows has resulted in high milk production. Thus, the soil quality seems to be totally unrelated to dairy development.

Similarly, another geographical variable, rainfall also shows a very small correlation value of -0.296 with milk production. Such correlation may seem unexpected, since availability of grass and fodder is generally influenced by rainfall amount. Ahmednagar district proves an exception to this universal association, wherein milk production shows almost no correlation with rainfall amount. This has been explained earlier, with respect to other

variables like availability of irrigation and type of animals. These are the two main controlling factors influencing milk production. Even if rainfall is low, but if irrigation is available, dairy activity can be conducted successfully. On the other hand, even if rainfall is high, the region may opt for sugarcane cultivation and does not take up dairy activity.

2) Effect of rainfall over milk production of Ahmednagar district

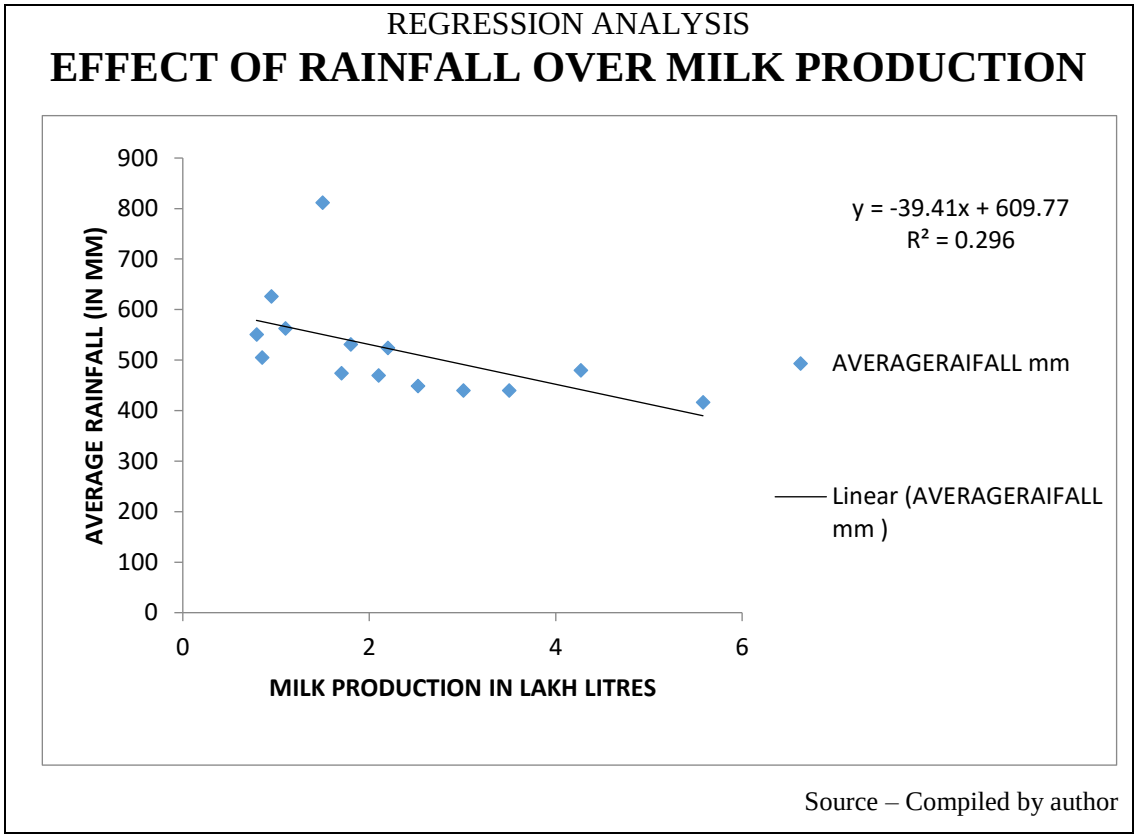


Fig.6.9. Effect of average rainfall over milk production

A positive inference from this correlation can be that dairy development in Ahmednagar district is not controlled by geographical factors. Therefore, all tehsils and all geographical regions of the district have equal scope of dairy development, if the economic and cultural factors are made available.

6.5. Time Series Analysis:

When quantitative data are arranged in the order of their occurrence or historical order, the resulting statistical series is called as time series. (A.V.Deshapande and M.L.Vaidya.).

These are the data related to time, observation taken at specified intervals. The interval may be a year, months or week etc. In present study, we have to study about past few years' milk production and present milk production to assess the development of dairy farming in Ahmednagar districts. In present study, Time Series Analysis is an important to understand past, present and future development of dairy farming of Ahmednagar district.

Components of Time Series:

Time series are affected by a variety of forces. The effects of these forces are separated when we analyse the time series. These types of changes are called as components of time series. (A.V.Deshapande and M.L.Vaidya.).

Components of time series are as follows:

i) Secular Trend –This is long term movement of the series, steady movement over a long period of time. It shows continuous growth, decline or stagnation. In present study milk production continuously increasing in trend, due to rising demand and increasing population, irrigation etc.

ii) Seasonal Variations-These occur regularly every year. These variations occur due to weather. In Ahmednagar district milk production is quite higher in winter season compared to summer and rainy.

iii) Cyclical Variations-These are also certain variations continuing for more than a year are called cycles.

iv) Irregular variations –These variations are irregular and cannot be predicted. Natural calamities like floods, droughts, earthquake etc. are responsible for these types of variation.

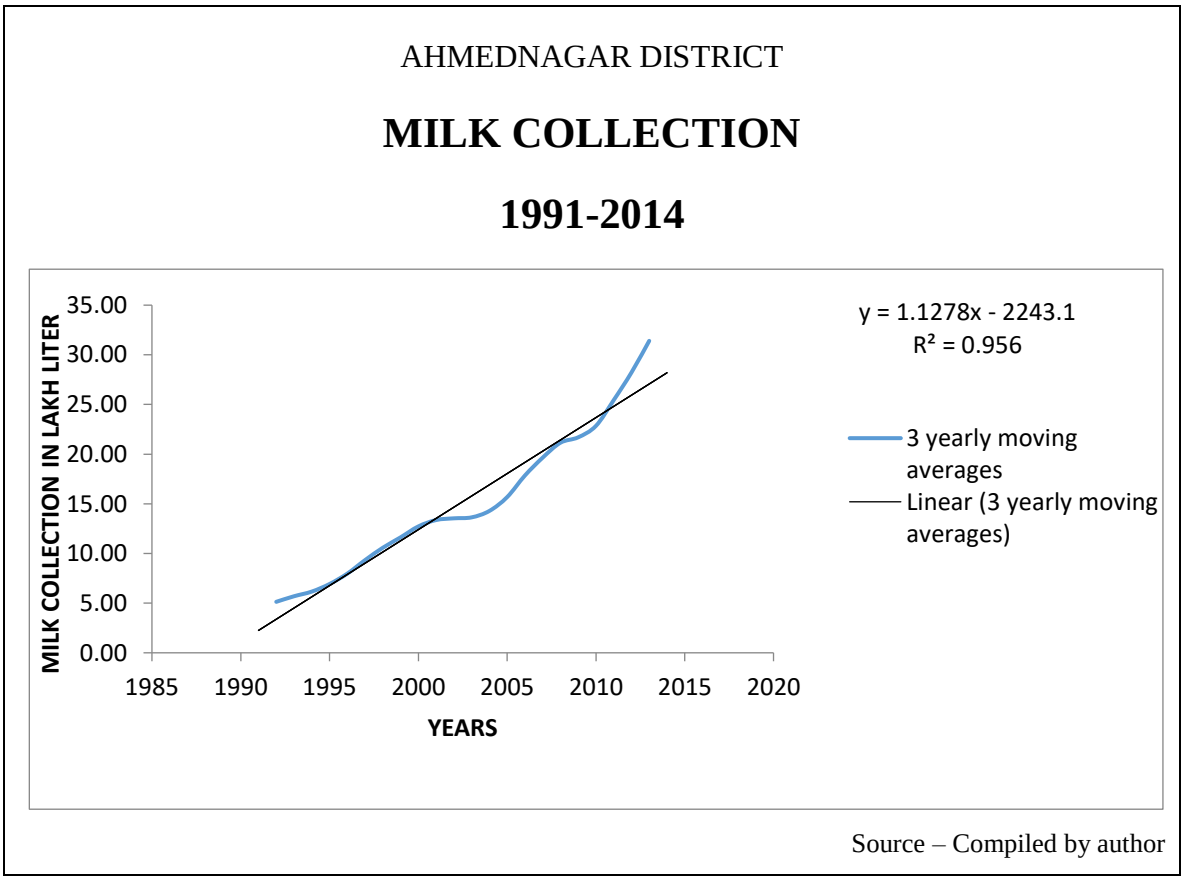
Methods of measuring trend:

In time series analysis having three methods to find out trend. These methods are

1. Freeland method
2. Methods of moving averages and
3. Methods of least squares.

Here we are used Methods of moving averages to analyse time series of the milk production of Ahmednagar districts.

6.5.1. Daily milk collection of Ahmednagar district:



Source – Compiled by author

Fig.6.10.Daily milk collection of Ahmednagar district.

Fig.no.6.10 shows three yearly moving average of daily milk collection of Ahmednagar district. Since last two and half decade milk production of Ahmednagar district continually increased ,after the analysis of data with the help of time series moving

average method. Time series trend line show continues or positive trend of milk production.

6.5.2. Daily Milk collection by Government dairy of Ahmednagar district:

Fig.no.6.7.shows three year moving average of daily milk collection by government dairy of Ahmednagar district. After year 1991 daily milk collection of govt. dairies decline continuously.

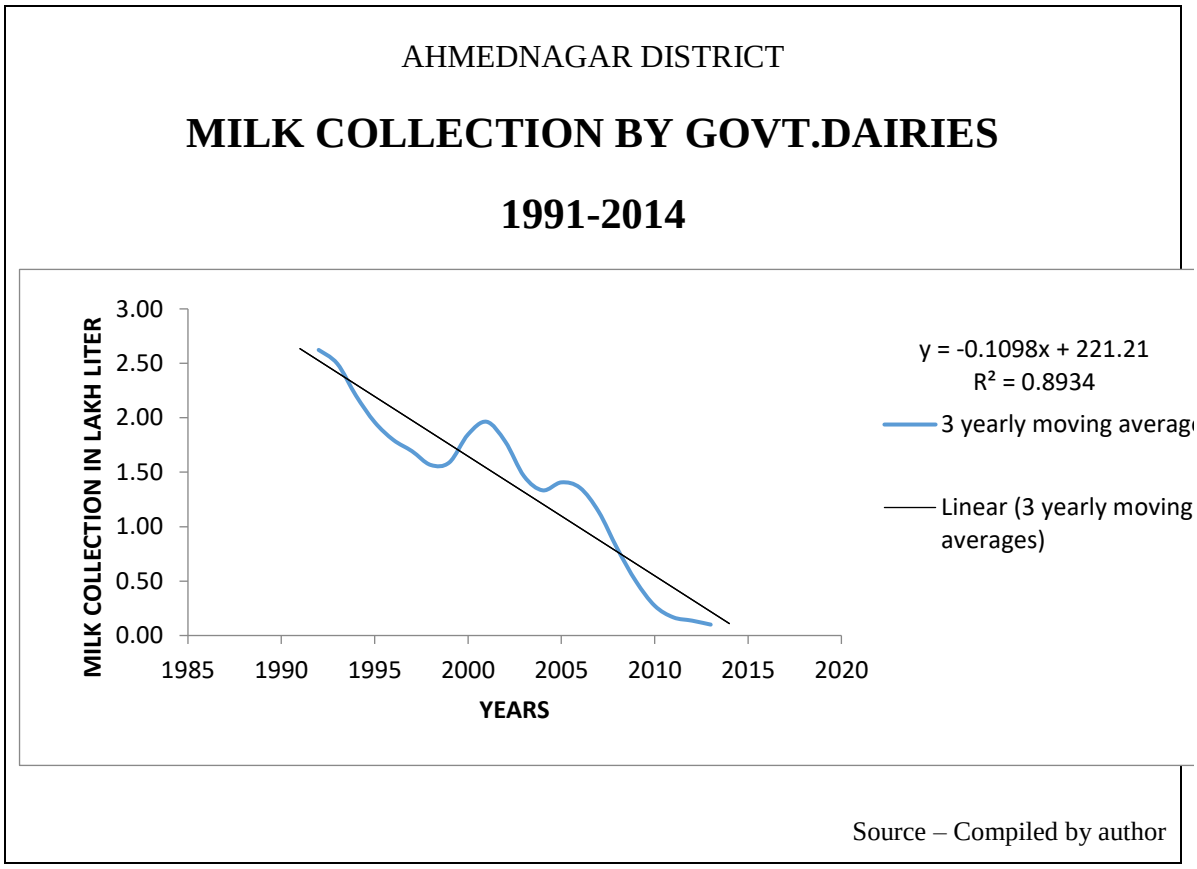


Fig.no.6.11.Daily Milk collection by Govt.dairy of Ahmednagar district. Time series analysis shows negative trend of milk collection by govt. dairies. It is clearly predicting that government going to close their milk collection centre in future.

6.5.3. Daily Milk collection by Co-operative dairy of Ahmednagar district

Fig.no.6.12 shows three year moving average of daily milk collection by co-operative dairies of Ahmednagar district. Time series analysis trend shows positive growth of milk collection for year 1991 to 2005 milk collection continually increase but after year 2005 milk collection declined because of introduction of private dairies in study area.

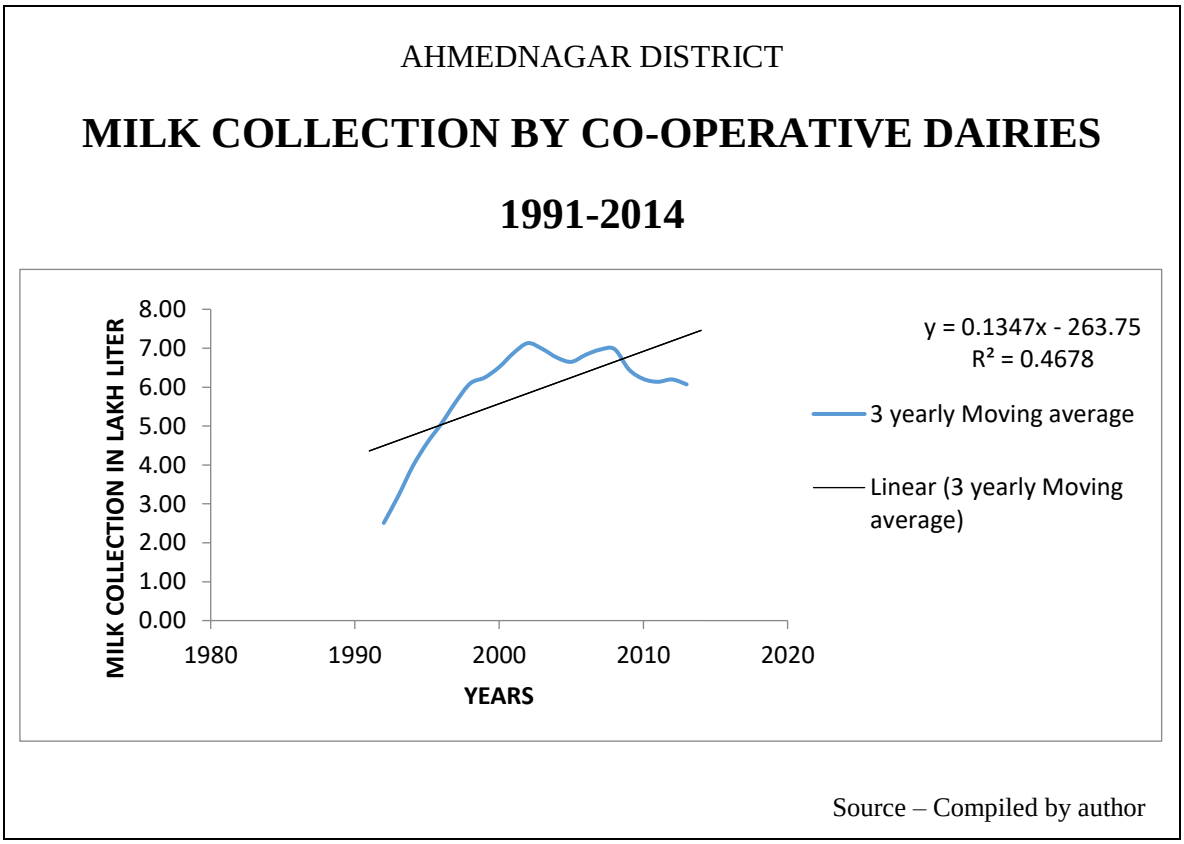


Fig.6.12.Daily Milk collection by Co-operative dairy of Ahmednagar district.

After year 2010 milk collection of co-operative dairies become steady due to the farmer's trust on co-operative sector compared than private sector.

6.5.4. Daily milk collection by private dairy of Ahmednagar district:

Fig.no.6.13 shows three year moving average of daily milk collection by private dairies of Ahmednagar district. Time series analysis trend continuously shows growth of milk collection for year 1994, day by day milk collection of private dairies are increased because maximum private dairies provide initial capital to farmers in study area.

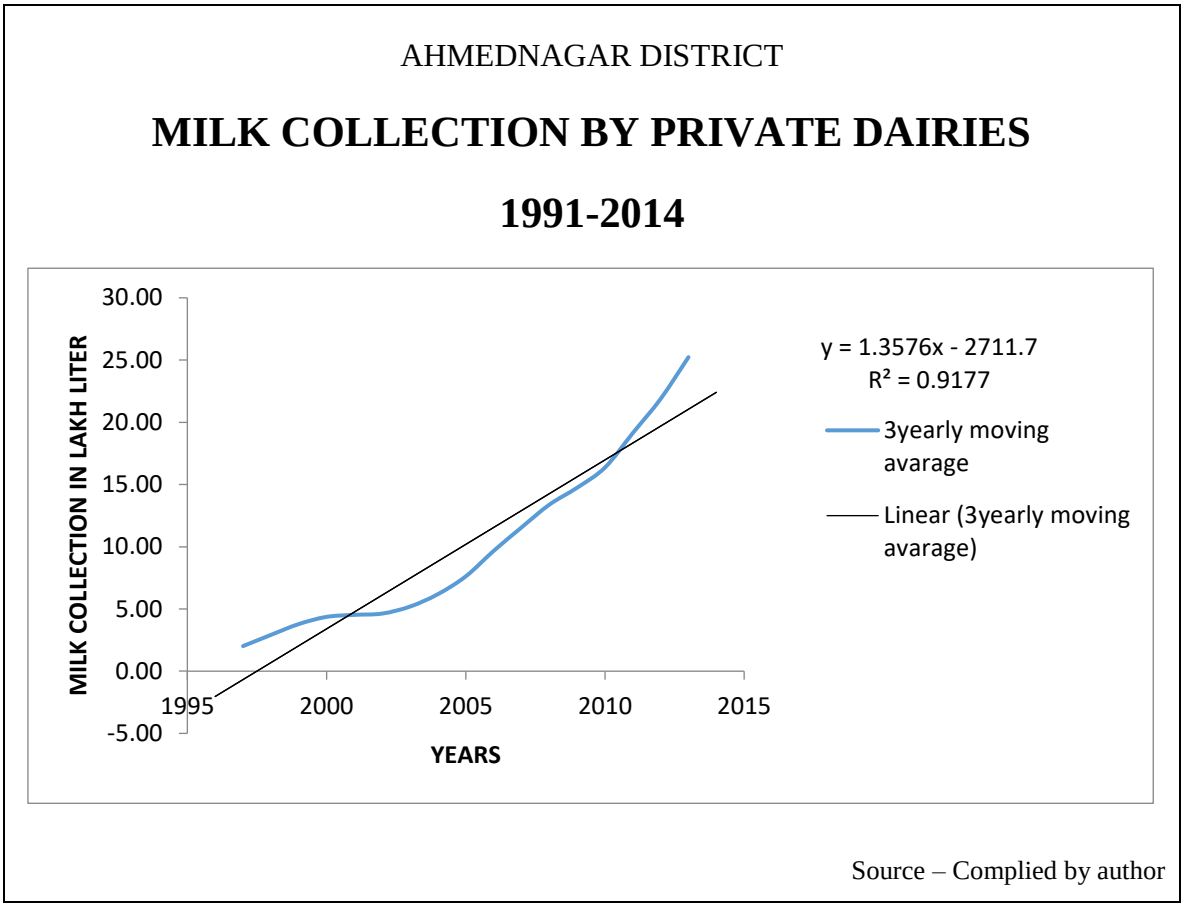


Fig.6.13. Daily milk collection by private dairy of Ahmednagar district.

In Ahmednagar districts, private diaries having healthy competition regarding too rate of milks and other facilities such as bonus, easy loan to milk producing farmers. S.R Throat, Prabhat Dudh pvt ltd., private dairy farm provides good service to milk producer. Time series Analysis trend shows highly positive trend toward ward private dairies in Ahmednagar district.

6.6. Cost benefits analysis:

With the help of interviews of farmer, prepared a data base of provided information of farmer and finally tried to find out whether dairy farming is profitable to the farmer or not. Cost benefit analysis is the simple technique used to find out results of dairy farming.

6.6.1. Concept of Production:

Production is the basic function in any economic activity. Production may be defined as transformation of physical inputs into tangible output, thereby creating utilities. As perFreser (1947), "production means putting utility into". These utilities may be creation of a primary product, or by changing form or composition of the same. The factors needed any of these functions are the input factors. Stigler (1953) observed that "the production function is the name given to the relationship between the rates of input of productive services and the rate of output of product. It is the economist's summary of technological knowledge." This can be mathematically expressed as-

$P = f\{a,b,c,\ldots\ldots n\}$ *where*

P is the rate of output of a commodity and a,b,c, etc are the factor services per unit time.

6.6.2. Concept of cost of production:

Cost of production is an economic expression, usually assuming to be the sum total of all the factors of expenditure incurred during the production process. This cost, apparently, is borne by the farmer alone, hence is called as private cost. A directly visible component of private cost is the various contractual payments made to the factors of production that do not belong to the farmer. These are the explicit costs. However, if some of these factors are owned by the farmer and hence are supplied free of cost, expenditure does not reflect in the cost of production. In order to ascertain these implicit costs, the concept of opportunity costs has to be used. This is an important concept which may be called as an alternative cost or displacement cost. Leftwich (1965) defined opportunity cost as "costs of production of a particular product as the value of the foregone alternative products that resources used in its

production, could have produced. The costs of resources to a firm are their values in their best alternatives." Thus, the opportunity cost of any product is the alternative that has been foregone. The producer chooses among the available alternatives and this decision of sacrificing the next best cost would be the opportunity cost.

Explicit as well as implicit cost is the sole responsibility of the producer himself. Cost or rent of land, capital, interest on capital, wages, cost of raw material, cost and maintenance of requisite machines, transportation, and taxes and other payments made to the government are the explicit costs while the cost of producer's own labour, interest on producer's capital and rent of producer's own land are important implicit costs. Since these costs are borne by the producer, together, these would be the private cost of the producer.

Social costs are not included in the actual costs, since farmer does not pay these costs himself. However, these costs are borne by the society indirectly. If the processes of production results in environmental or health damage, then the cost of loss of environmental quality will be a part of the social cost of the activity. Since market prices of the commodities do not reflect their social value, there is a difference between private cost and social cost. Negligence of social cost or its non-reflectance in the market price has contributed much to environmental degradation and resultant health hazards. In recent times, the practice of quantification of social cost and its inclusion in the market price, is considered as an effective tool for preventing environmental damage. At present, no such inclusion of social or health cost has been made in the present study, due to difficulty in determination of appropriate social cost.

6.6.3 Initial Capital Cost

All such cost which is incurred the before the actual production of milk begin, may be put into initial capital expenditure. As per Samuelson P.A. (1970), "Fixed cost represents the total dollar expense that goes on even when a zero output is produced… It is a sunk cost that is quite unaffected by any variation in Q". In context of the Dairy farming, erection of a Cattle shed is a relatively costly affair which needs a technical expertise and has to be hired.

6.6.4. Human labour

Considering the small scale of activity and need of skilled farm operation, dairy farming essentially becomes a labour-intensive activity. Though mechanization may be of significance in the later stages such as milking, cleaning etc., the actual dairy farming process does not involve much mechanized labour. This skilled labour requirement may be met through a supply of labour in form of trained family members of the farmer himself. While operating on a larger scale and in a corporate framework, the labour demand shall be satisfied by hiring labour, generally on daily or monthly wages. The actual amounts of wages paid to the labourers are included in the variable cost component.

Determining the cost of family labour used for farm activities would involve and indirect estimation of their share of activities, converting the same into wages as per market rates. The actual man-hours put in by the family members multiplied by the wage rates of professional labour can provide an approximate quantification of the family-contributed human labour.

6.6.5. Cost Analysis of dairy farming.

Any production function shall vary as per the variation in the cost. In short total cost is a combination of the fixed and variable components,

Here Variable cost include following factors:

1. Feed cost – It includes artificial fodder cost. The cost of feed is different from their making brand.
2. Labour cost-It includes daily wages of people, who help to developed dairy farming.
3. Veterinary cost-It includes Veterinary doctor fees, medicine cost of animals.
4. Fodder production cost-It includes total production cost of fodder crops like cost of cultivation, ploughing of land harvesting etc.
5. Transportation cost- It includes carrying cost of feeds and transportation cost of cattle and milk.

6. Miscellaneous cost- Miscellaneous cost includes death-loss of animals, damage of equipment etc.

7. Interest of operating Capital- It was calculated on the prevailing bank rate for one year is 10percent per annum of total loan.

Fixed cost includes following factors:

1. Depreciation of cow –shed- It was calculated based on straight line method. The values of cow-sheds were depending on their respective useful life. The useful life of cow-sheds was considered five years for temporary sheds and fifteen years for permanent sheds.

2. Depreciation of cows- It was also calculated based on straight line method. The present value of cow depending upon the productive life of cows. The productive life of the cows was considered nine to ten years.

3. Depreciation of equipment's- The depreciation of equipment's was also calculated following the straight-line method. The value of the equipment's was divided by the useful life of equipment's. The useful life of equipment's considered one year to five years depending upon their nature.

Total cost of production can be calculated as a combined form of fixed and variable cost.

TC=TFC+TVC

If TFC (Fixed Cost) is divided by the number of units produced, it shall give the Average Fixed Cost.

AFC=TFC/n

Since TFC is unchanged in the short run, the variation in the AFC shall be a function only of output. If the unit outputs increase, the AFC shall be decreased, without any actual change in the fixed cost.

The total cost is an addition of TVC and TFC, the average cost is total cost per unit output.

AC=TC/n or

AC= (TFC/n) + (TVC/n)

Over a longer period, certain fixed cost may get converted to Variable cost, ex. Land can be purchased and machinery can be upgraded.

Marginal Cost (MC) is defined as the extra cost of producing one extra unit of production. It is an addition to the total cost caused by producing one more unit of output.

MC=TCn-(TCn-1)

6.6.6. Gross returns and net returns

Calculation of cost of production is a pre-requisite to know the gross and net returns for a dairy farming. The difference between gross returns and the explicit (paid) cost represents gross profit or loss to the dairy farmer. However, inclusion of the implicit and managerial costs into the total cost, and its comparison with the gross returns shall give the net profit.

6.6.7. Input-output ratio

Input-output ratio is an indicator of input efficiency. It is the ratio of output per unit input. In order to earn economic gains, this ratio has to be larger than unity. The value of 1 shall represent a situation of "No profit- No loss". Input-output analysis may be done on various levels, such as-

i) Input-output ratio in context of paid costs

$$\text{Input-output ratio} = \frac{\text{Gross returns (Rs) [per dairy animals]}}{\text{Explicit cost (Rs) [per dairy animals]}}$$

ii) Input-output ratio in context of marketing cost

$$\text{Input-output ratio} = \frac{\text{Gross returns (Rs)}}{\text{Aggregate of Managerial and marketing cost (Rs)}}$$

iii) Input-output ratio in context of cost of production-

$$\text{Input-output ratio} = \frac{\text{Gross returns (Rs) [per dairy animals]}}{\text{Total Cost of production (Rs) [per dairy animals]}}$$

Input-Output analysis in either of the above-mentioned level shall give an idea of the efficiency level of the particular component of production. However, is order to assess and compare the overall profitability, the ratio of Gross returns to Total cost is a conclusive parameter.

In the present analysis, the Input-Output ratio has been calculated as the ratio of the total cost of production and value of total output.

Input-Output Ratio = Value of total production / Total input cost

Average of Farmer Questionnaires data of study atrea														
Tehsils	No's of hybrid Cows	No's of deshi Cows	No's of Deshi Buffaloes	No's of hybrid Buffaloes	Total nos of Cattle	Average per day milk production (per animal)	Average annual milk production (270day)	Market price of milk per litre	Total average anuual income (Rs)	Expenditure for feed and fodder (in 000 Rs)	Expenditure for labour (in 000 Rs)	Expenditure for veterinary services (in 000Rs)	Other expenditure (in 000 Rs)	Total expenditure (Rs)
Ahmednagar	3	2	0	1	6	8	12960	20	259200	60	40	6	30	136000
Akole	2	3	1	0	6	4	6480	19	123120	40	20	5	20	85000
Jamkhed	1	3	1	0	5	4	5400	20	108000	30	20	4	25	79000
Karjat	2	3	1	0	6	5	8100	20	162000	30	25	4	25	84000
Kopergoan	6	1	0	1	8	12	25920	20	518400	62	36	6	40	144000
Nevasa	3	2	1	1	7	6	11340	20	226800	50	30	5	30	115000
Parner	2	3	0	1	6	4	6480	20	129600	40	25	5	30	100000
Pathardi	1	4	0	1	6	3	4860	20	97200	30	25	4	25	79000
Rahata	4	1	0	0	5	10	13500	21	283500	65	40	6	30	141000
Rahuri	5	1	0	0	6	12	19440	20	388800	70	50	7	35	162000
Sangamner	6	0	1	0	7	13	24570	21	515970	75	40	7	25	147000
Shevgaon	2	3	0	1	6	5	8100	20	162000	40	30	5	25	100000
Shirigonda	3	3	0	1	7	7	13230	20	264600	45	25	5	24	99000
Shrirampur	3	2	0	1	6	6	9720	20	194400	50	30	6	25	111000

Source – Complied by author

Table.6.3.Average of Farmer Questionnaires data of study area.

AHMEDNAGAR DISTRICT

SPATIAL INPUT OUT PUT RATIO OF DAIRY FARMING

Tehsils	Total expenditure (Rs)	Total average anuual income (Rs)	In put -out put ratio
Ahmednagar	136000	259200	1.91
Akole	85000	123120	1.45
Jamkhed	79000	108000	1.37
Karjat	84000	162000	1.93
Kopergoan	144000	518400	3.6
Nevasa	115000	226800	1.97
Parner	100000	129600	1.3
Pathardi	79000	97200	1.23
Rahata	141000	283500	2.01
Rahuri	162000	388800	2.4
Sangamner	147000	515970	3.51
Shevgaon	100000	162000	1.62
Shirigonda	99000	264600	2.67
Shrirampur	111000	194400	1.75

Source – Complied by author

Table.6.4. Input output ratio of dairy farming of Ahmednagar district:

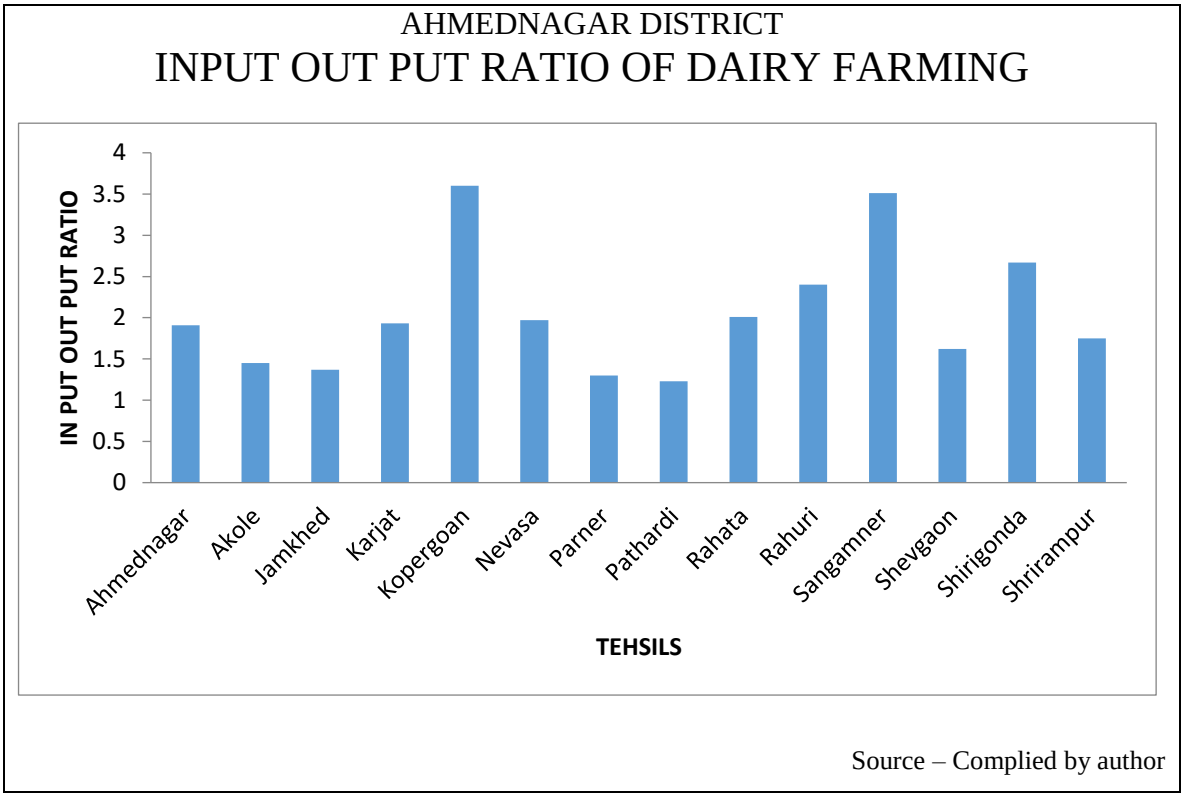


Fig.6.14. Input output ratio of dairy farming of Ahmednagar district

6.6.8. Total production cost (TPC) =VARIABLE COST (VC) + FIXED COST (FC)

Table.no.6.3. show final cost benefit analysis of Ahmednagar district. Small farmer domesticates one or two dairy animal but maximum number of farmer of Ahmednagar district domesticate more than two dairy cattle when we study the dairy farming in economic angle of view than we found that dairy farming is economically beneficial to farmer. As farmer increase number of dairy animals his profit increased. Eighty percent farmers of Ahmednagar district happy with dairy farming, they fill it is a permanent source of income and better substituted for primitive farming. Profit of farmers increased with increase dairy animals because variable cost such as labour cost, transportation cost, Veterinary cost, feed and fodder cost decrease respectively. After personal discussion with farmers, it is observed that small land holder farmer is highly interested to practice dairy farming because compared to traditional farming, farmer get profit in dairy farming. Apart from the general Cost-Benefit analysis for the entire district, tehsil-wise cost-benefit analysis was also attempted. The variables used to compute the total cost of production were-

a) Cost of fodder

b) Cost of labour

c) Cost of veterinary expenses

d) Other costs including interest on fixed cost, transport, maintaining the equipment etc.

The output value was calculated using the actual amount of milk produced, and the average price of milk (per litre). Subtracting the total cost from the total production would give the amount of profit earned by the farmer. Input-Output ratio was calculated by dividing the total output by the total input. The ratio value could exhibit three conditions-

If Input-Output ratio > 1, it would denote a profit to the farmer.

If Input-Output ratio < 1, it would mean that the farmer has incurred a loss.

If Input-Output ratio = 1, it would denote a "No profit-No loss" situation.

For any economic activity to sustain, it is necessary that the Input-Output ration is either 1 or more. Table no 6.14 Shows the Input-Output ratio for dairy farming for all 14 tehsils of Ahmednagar district. All tehsils in Ahmednagar district exhibit an Input-Output ratio of more than 1. Thus, it can be concluded that in all tehsils of the district, milk producing activity is a profitable activity. However, there is a great variation in the amount profit earned. The highest level of profit is earned by the two tehsils of Kopargaon and Sangamner. For these tehsils, the output ratio values are more than 1:3.5, which shows that these two tehsils earn profits more than 3 times their input. Tehsils like Shrigonda and Rahuri earn more than 2.5 times profit as compared the input, while Ahmednagar, Akole, Newasa, Rahata and Shrirampur tehsils earn almost double the profit than the input amount. The lowest profit values are seen in the tehsils of Parner and Pathardi, which are about 1:1.3. Nevertheless, irrespective of the amount of the profit earned, no tehsil reports a loss in the dairy activity.

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CHAPTER VII

CONCLUSIONS AND SUGGESTIONS

6.1. General Introduction:

6.2. Findings and Conclusions

6.3. Testing of Hypotheses:

6.4. Limitation of study:

6.5. Suggestions:

6.1 General Introduction:

These chapters have provided a clear picture about the nature of dairy farming in the study area. It has been assumed that a period of two decades is a sufficient time to assess the relative benefits of dairy farming. The study has focused not only upon the dairy farming but has also deal with socio-economic aspects of the activity.

These also attempt to present an overview of the findings and their inter-relation in a larger perspective.

The hypotheses of the present research have assumed that development of Dairy farming depends on geographical and socio-cultural factors. Dairy farming has shown a continuous rise in Ahmednagar district 2001-2014.

India has a very wide base of agriculture activities. Dairy farming is one of the old agricultural activities. Milk is supposed to be nearly a perfect food both for human beings and livestock. It supplies almost all nutrients required for maintenance body and therefore to meet the requirement of milk, it is important to give more emphasis on production of milk irrespective to its cost of cultivation.

Ahmednagar district has achieved spectacular success in dairy farming through various government milk scheme and Co-operative milk collecting societies, moreover dairying is a main supportive occupation to farmers of the district. It has become an important business activity and an additional source of income as well as employment to the farmers of the study area. Dairy farming basically depends upon various factors such as irrigation facilities, types of fodder crops, types of cows and buffaloes (milch animals). It is important to domesticate high quality of cows and buffaloes to maintain continuous development in dairy farming, it is observed that milk production has increased continuous and help to reduce to control the problem of unemployment in Ahmednagar district.

In the present investigation, an attempt is made to evaluate the development of dairy farming of Ahmednagar district.

The study was undertaken with some major objective like to study the factors responsible for dairy farming, systematically study the increasing growth of dairy farming, and look into the relationship between several physical and cultural factors and dairy development.

The study is based on the micro level information obtained from the dairy farmers of Ahmednagar District. In all the fourteen tehsils having milk collection centers, co-operative milk societies, which provided capital to the dairy farmers. The role of co-operative milk societies is very importance to the development in dairy activities in the study area. Information mainly collected from milk producing farmers, co-operative societies, taluka dairy development officer, District Dairy Development officer Ahmednagar district through personal interviews and visits. The data was tabulated and analyzed with the help of various statistical as well as cartographical methods, such as average percentage, Choropleth method etc. The multivariate analytical technique was also used. The important relationship between irrigated land, area under fodder crops and milk production was identified with the help of Karl Pearson method of coefficient of correlation. Cost benefit analysis method also use to identify whether dairy farming is profitable to the farmers or not.

If all the three hypotheses turn out to be valid, dairy farming would be the best suited activity for Ahmednagar district. The following are the major findings of this study-

6.2: Findings and Conclusions

1. Dairy farming is practiced on commercial scale in all 14 tehsils of Ahmednagar district. Most of dairy farmers have maintained both crossbreed cows and buffaloes as dairy animals.

2. Ahmednagar district in Maharashtra is a leading milk production area. Several talukas of Ahmednagar district practice dairy farming in large scale. In Ahmednagar districts

shows that farmers are shifting to cultivation to dairy farming. The highest change of milk production shows the growth and development of dairy farming in study area.

3. Rural Population of Ahmednagar district has decreased by 1.28 percent and urban population has increased in district. Literacy rate has also increased positively, its increase by 9.7 percent in Ahmednagar district.

4. Daily milk collection of government and cooperative dairies are decreasing and private dairy milk collection increasing very rapidly in Ahmednagar district.

5. Irrigated area of Ahmednagar district shows maximum hybrid variety of dairy animals compared to non-irrigated area. Deshi variety of cows and buffaloes decreased and hybrid variety of cows and buffaloes increased in Ahmednagar district, which help to developed dairy farming in Ahmednagar district. The number of hybrid buffaloes and cow's population has increased in Ahmednagar district since last two decades but in areas with hilly and rugged topography, e.g. Tehsils Akole, Ahmednagar,Karjat etc. still have less number of hybrid cows and buffaloes. On the other hand in tehsils Sangmner, Kopergaon, Rahata, Rahuri and Nevasa, hybrid dairy cattle population has increased and it shows positive impact on development of dairy farming.

6. Irrigation facilities, availability of fodder crops positively impact on dairy farming of Ahmednagar districts. Some tehsils having good irrigation facilities' show high milk production and area under fodder crops. Farmer of Ahmednagar districts used Sugarcane as a fodder for dairy animals.

7. There is a very insignificant seasonal change in production of milk found in Ahmednagar district, winter season contributing a slightly more milk production than summer and in monsoons.

8. Farmers of Ahmednagar district practice dairy farming as a substitute and fixed source of income. Farmer of Ahmednagar district rear cattle only for milk not of meat.

9. The correlation analysis shows that there is a high degree of positive correlation between milk production and number of hybrid animals, availability of irrigation, and cultivation of fodder. Area under fodder crops and milk production are highly correlated to each other in Ahmednagar district. All these are socio-cultural variables, which account for most of the variation in the milk production.

10. Geographical factors do not seem to be affecting the milk production. Variables like type of soil and distribution of rainfall do not affect milk production either positively or negatively. Correlation values of these variables are very poor, when associated with milk production. Rather, the geographical factors remain neutral in deciding the level of dairy development.

11. Amount of rainfall also does not affect milk production. Tehsils producing large quantities of milk are found in high as well as low rainfall regions.

12. No seasonal variation was observed in milk production. This strengthens the observation that physical factors do not play a decisive role in dairy development.

13. There is NO spatial pattern in dairy development.

14. In all tehsils of Ahmednagar district, milk production is a profitable activity, though the margin of profit varies greatly. The lowest input-output ratio is about 1:1.3, while the highest ratio is 1:3.6

15. Temporal analysis of the increase in the number of dairies in Ahmednagar district shows a continuously but smoothly rising curve. There has been a slow but steady increase in number of dairies since 1999 up to 2014. Number of milk collection centers, milk co-operative societies, and chilling plants have also increased with increased milk production in the study area.

6.3: Testing of Hypotheses:

All the above-mentioned conclusions were used to test the hypotheses adopted for the present study.

1. Dairy farming is economically beneficial for farmers in the study area.

Cost-benefit analysis and input-output ratio calculated for all 14 tehsils of Ahmednagar, show that the input-output ratio values for all tehsils are more than 1. The minimum profit earned is 1:1.30, while the maximum profit earned is 1.3.6. There is no tehsil which has reported loss in the dairy farming activity. Therefore the first hypothesis "***Dairy farming is economically beneficial for farmers in the study area"*** is **ACCEPTED.**

2. Spatial development of dairy farming is guided by geographical factors.

Development of dairy farming as exhibited thorough the cost-benefit analysis, or by the actual amount of milk production (tehsil-wise), does not confirm any spatial pattern. Physical variables like type of soil and rainfall distribution also do not show any correlation with dairy development. Thus, it can be said with a fair degree of confidence that geographical variables are ineffective as decisive variables with respect to dairy development. Therefore, the second hypothesis "***Spatial development of dairy farming is guided by geographical factors"*** stands **REJECTED.**

3. Dairy farming is affected by social and economic conditions of the farmers.

The personal interviews with farmers, correlation analysis and tehsil-wise milk production shows that the most influential variables in deciding milk production are the type of animals, number of hybrid animals, availability of irrigation and cultivation of fodder. All these are socio-cultural factors, decided by the economic and social conditions of the farmer. Therefore the third hypothesis "***Dairy farming is affected by social and economic conditions of the farmers"*** is **ACCPETED.**

6.4. Limitation of study:

There were certain limitations noticed while collecting data. Some of the major limitations are as follows

1) Random information is given by dairy farmers. Due to lack of education, dairy farmers and private milk collector do not provide correct and proper information etc.

2) Milk co-operative societies and government officer do not maintain their records properly.

6.5. Suggestions:

As per the conclusion of this study, it is evident that more than natural or physical factors, dairy development is more a function of social and economic factors. It means that irrespective of geographical conditions, dairy activity can be developed in all parts of the district, provided the necessary social and economic factors are made available to the farmers. This leaves a great scope for suggestions to the administrators, planners and governmental agencies, in order to ensure an overall development of commercial dairying activity in Ahmednagar district.

1) Government should develop some dairy development programmes to directly help dairy farmers, like giving a minimum fixed cost to milk and milk products. Facilities such as transportation, cooling facilities etc. should be provided at subsidized rates.

2) The government has make it mandatary to financial institutions such as banks should come forward and create awareness about loan and development of dairy farming, Easy availability of capital to dairy farmers for various purposes such as construction of cattle shed, purchasing of cross-breed cows or buffaloes etc. will be of a great help.

3) Government should provide veterinary facilities in rural area & try to increase awareness among the dairy farmers regarding maintaining health standards of animals.

4) With the help of expert studies about climate of Ahmednagar district, more varieties of cross breed cows and buffaloes should be made available to the milk producer framers. e.g. Rahuri Krishi Vidyapeeth which has developed a new cross-breed cow "TRIVENI" which provides more milk in this climate.

5) Government should develop small milk processing unit which helps to increase the income of milk producer farmers.

6) Proper technique of irrigation facilities be provided in the study area to increase green fodder crops and help to develop dairy farming.

7) Dairy farming of tehsils Ahmednagar, Parner, Karjat, Pathardi and Jamkhed mostly depends on monsoon. Milk productivity of these tehsil is comparatively low so regular training should be provided to the farmers regarding selection of draught-resistant varieties of animals, which can sustain the harsh conditions.

8) In study region, there is need to impart knowledge regarding High Variety cows and buffaloes to the farmers through Mahatma Phule Krishi Vidypeeth, Rahuri, which is located in district.

9) In river basin of Godavri, Pravara and Mula and these canals command area (Rahata, Shrirampur, Nevasa and Rahuri tehsils) sugarcane is predominant crop. It requires high amount of chemical fertilizer and water. The overdoses of chemical fertilizers and over irrigation are responsible for soil degradation in this area. To overcome this problem, use of organic manure, management of fertilizer and irrigation and also selecting alternative suitable crops is the prime requirement in this area.

10) The tehsils viz. Parhardi, Shevgaon, Jamkhed, Karjat, Parner and Ahmednagar have less area under irrigation due to this milk productivity of these tehsils have comparatively low. It is therefore necessary to increase the area under irrigation by constructing minor irrigation projects like small agriculture lake, percolation tanks, check dams and construction of bunds on the farm land.

11) Government should construct proper milk storage and chilling plants to control the wastage of milk. Dairy environment should develop all over the district like tehsils Sangamner, Kopargaon, Rahata and Rahuri.

12) Increase the awareness regarding insurance of dairy animals. The government officers force farmers to take insurance of dairy animals and to get proper benefit.. The persent agricultural system of the study region is highly specilized in crop production but poor in milk production,so dairy enterprises may be encouraged in all tahsils in the district. It is also helpful to increase involvement of female in farming and increase income farmers as well as solve to the problem of unemployment mainly in rural area.

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APPENDIX- 1

DAIRY CATTLE OF AHMEDNAGAR DISTRICT

(According to 18th animal census 2007)

Sr.No	Taluka	Cow categories			Buffalo categories		
		Hybrid	Deshi	Total	Hybrid	Deshi	Total
1	AHMEDNAGAR	56439	39011	95450	20333	9704	30037
2	AKOLE	36938	57754	94692	3202	12113	15315
3	JAMKHED	37892	33550	71442	8154	8704	16858
4	KARAJAT	52591	26663	79254	1545	6139	7684
5	KOPERGOAN	44830	14524	59354	6129	1128	7257
6	NEVASA	79382	61833	141215	31626	6796	38422
7	PARNER	57245	58195	115440	3920	10668	14588
8	PATHARDI	42412	60024	102436	6295	18101	24396
9	RAHATA	56937	7410	64347	2782	2534	5316
10	RAHURI	85907	17111	103018	5690	2253	7943
11	SANGAMNER	118021	47414	165435	6887	2014	8901
12	SHEVGAON	22186	54243	76429	7906	11544	19450
13	SHIRIGONDA	58084	57712	115796	9160	19175	28335
14	SHRIRAMPUR	43256	15387	58643	5224	2389	7613
	TOTAL	735681	511820	1247501	98520	103558	202078

Source-Animal census 2007

APPENDIX- 2

AHMEDNAGAR DISTRICT

MILK COLLECTION IN 1999-2014 (IN LAKHS)

Sr.No.	YEAR	Milk Collection in 1975-2014 (in lakhs)			
		Govt.dairy	Co-opretive	Private	Total
1	1999	1.53	6.4	3.9	11.83
2	2000	1.8	6.05	4.74	12.59
3	2001	2.21	7.09	4.45	13.75
4	2002	1.88	7.49	4.39	13.76
5	2003	1.25	6.81	5.05	13.11
6	2004	1.26	6.64	6.14	14.04
7	2005	1.49	6.83	7.38	1570
8	2006	1.47	6.48	9.34	1729
9	2007	1.11	7.18	12.26	20.55
10	2008	0.83	7.23	13.04	21.1
11	2009	0.45	6.52	14.83	21.8
12	2010	0.21	5.61	16.36	22.18
13	2011	0.16	6.5	17.9	24.56
14	2012	0.13	6.3	23.14	29.57
15	2013	0.12	5.79	24.61	30.52
16	2014	0.05	6.12	27.95	34.12

Source-District Dairy Development officer Ahmednagar district

APPENDIX- 3

AHMEDNAGAR DISTRICT

CROPPING PATTERN AND MILK PRODUCATION

Taluka	Ave Milk Production	Area Under Fodder Crop	Cash Crop	Others
AHMEDNAGAR	207584	110356	17969	14292
AKOLE	111338	42764	6998	9470
JAMKHED	26752	54099	18368	7953
KARAJAT	107365	58522	6172	9643
KOPERGOAN	152188	40775	6356	3753
NEVASA	137240	49783	77521	7452
PARNER	237446	122978	6589	15944
PATHARDI	85675	70387	14528	12489
RAHATA	252916	39143	5183	11459
RAHURI	283871	24945	3641	4649
SANGAMNER	356130	68467	3320	25557
SHEVGAON	24094	47621	2910	3465
SHIRIGONDA	169731	72539	1437	8911
SHRIRAMPUR	151900	28583	18755	3051

Source- Socio economic abstract of Ahmednagar district (1990-91 and 2010-

APPENDIX- 4

AHMEDNAGAR DISTRICT

LAND HOLDING

Landholding in Acres	Ave % of families	Ave.milk producation in %
less than 5 acres	45	50
06-10 acres	23	20
11-15acres	13	12
16-20 acres	11	13
21-25acres	5	3
Above 25	3	2

Source- Ahmednagar district census handbook 2011 (in Acres)

Appendix- 6

CORRELATION MATRIX DATA OF SECONDARY DATA.

Sr.No	Taluka	X1 – Daily Milk production (lakh liters)	X 2 – Irrigated land in percentage	X 3 – Dairy animal in lakh	X 4 – Fodder crop in percentage.	X 5 – Hybrid Buffaloes in percentage.	X 6 – Deshi Buffaloes in percentage	X 7 – Hybrid Cows in percentage	X 8 – Deshi Cows in percentage	X 9 – Crude density of population	X10– Physiological density of population	X 11 – Agricultural density of population	X 12 – Literacy in percentage.	X 13 – Total Workers
1	Ahmednagar	2.2	64.77	1.57	51.36	67.69	32.31	63.12	36.88	456	598	223	78.2	147949
2	Akole	1.5	36.23	1.01	57.36	20.9	79.1	37.12	62.88	194	537	421	67.1	124747
3	Jamkhed	0.95	29.97	0.88	39	28.3	71.7	35.04	64.96	181	691	477	65.2	93062
4	Karajat	0.85	29.21	0.78	38.3	20.1	79.9	29.73	70.27	158	301	295	66.8	121767
5	Kopergoan	3.01	78.3	1.78	59.89	15.55	11.28	75.52	24.48	429	296	291	71.3	180838
6	Nevasa	1.8	36.89	1.12	43.22	82.33	17.67	56.21	43.79	276	279	249	68	125613
7	Parner	1.7	52.01	1.25	56.21	26.87	73.13	49.58	50.5	147	295	232	67.2	124424
8	Pathardi	0.79	30.15	0.66	30.1	25.8	74.2	24.52	75.48	215	265	252	66.6	80954
9	Rahata	3.5	91.5	1.8	70.3	52.33	47.77	85.48	14.52	467	285	257	73.6	127361
10	Rahuri	4.27	89.5	2.1	70.76	71.63	28.37	86.39	13.61	317	198	211	70.5	158323
11	Sangamner	5.58	92.25	2.45	73.14	77.38	22.62	88.87	11.13	291	303	293	71.3	150346
12	Shevgaon	1.1	44.12	0.89	41.01	33.36	67.43	36.87	63.13	226	452	371	64.1	154135
13	Shirigonda	2.52	83.5	1.63	57.32	32.33	67.67	73.76	26.24	197	588	461	67.9	217080
14	Shrirampur	2.1	81.9	1.43	49.9	68.61	31.39	63.03	36.97	568	651	532	73.3	115795

Source- Socio economic abstract of Ahmednagar district

Appendix- 7

QUESTIONNAIRE FOR DAIRY FARMERS

1. Name of the village - ---------- Tehsil – ----------

2. Name of the head of the family ----------

3. Family Details **–**

i.No of member in family **----------**

ii .No of educated members in family (above matriculation) **----------**

iii.No of male /female in family **Male -------- Female ----------**

4. Details regarding the land holding –

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

[B] Irrigated land: _____ (Acre)

5. Irrigation details

Type	Well	Tube well	Canal	River	Others
Area in Acre					

6. Details regarding Annual expenditure (Amount in Rs.)

Sr. No.	Types of Dairy animals	No.s of Dairy animals	Feed and fodder	Veterinary services	Total
1	Deshi Cow				
2	Hybrid cow				
3	Deshi Buffaloes				
4	Hybrid Buffaloes				
5	Others				

7. For how many months green fodder is available ?

3 to 6 months ☐ 6 to 9 months ☐ Year long ☐

8. Details regarding Labour expenditure (Amount in Rs.)

Sr. No.	Types of Labour	No.s of Labour	Daily Wages	Self /Others	Total
1	Skilled				
2	Unskilled				
3	Male				
4	Female				

9. Do you have Cow shed? YES / NO

If yes Permanents / Temporary

10. Daily hours of work… ----------

11. Monthly Income from all sources. ……..

12. How many Days dairy cattle provide milk? Months ……. Days. …….

13. In which season animals develop disease?

1. Summer ☐ 2.Rainy. ☐ 3. Winter. ☐

14. Is there any seasonal variation in milk yield?

If yes how? …….

15. Types of soils in yours field

Black ☐ Red ☐ Brown ☐ Murum (Loose regolith) ☐

16. Area under different types of soil (in acre).

Black --------- Medium black ---------- Red ---------- Murum (Loose regolith) ……

17. Are you aware about cattle insurance? YES / NO

18. Have you taken dairy animals insurance? YES / NO

19. Have you taken Loan from Banks, Moneylenders or other agency?

If yes give details ……

…….

20. Details of markets price (Amount in Rs.):

Sr. No.	Year	Cow milk Per liter	Buffaloes milk Per liter	Year	Cow milk Per liter	Buffaloes milk Per liter
1	2001			2008		
2	2002			2009		
3	2003			2010		
4	2004			2011		
5	2005			2012		
6	2006			2013		
7	2007			2014		

21. Your opinion regarding market price (Amount in Rs.):

1. Fair ……

2. Less ……

3. High ……

22 .Remarks any others:

TYPES COWS OF AHMEDNAGAR DISTRICT

1) Deshi cows of study area.

Plate.no.1. Deshi cows of study area.

2) Hybrid cows of study area.

Plate.no.2. Hybrid cows of study area.

TYPES OF FODDER OF AHMEDNAGAR DISTRICT

1) Green fodder of study area.

2) Dry fodder of study area.

Plate.no.3. Types of fodder of Ahmednagar district.

MILK COLLECTION OF AHMEDNAGAR DISTRICT

1) Milk Collection Centre of study area.

2) Chilling plant of milk of study area.

Plate.no.4. Milk collection of study area.

MAJOR SOIL OF AHMEDNAGAR DISTRICT

1) Coarse soil (Murum) of study area.

2) Black soil of study area.

Plate.no.5. Major types of study area.