INTRODUCTION

Water is the most important input and is a limited resource in agriculture. In arid and semi-arid regions. Availability of water has always been a constraint in crop production. The rainfall is very irregular and erratic which severely affects the Agricultural productivity and development. Maharashtra State has limited water resources in comparison with other states and drought is expected to occur every two or three years, over exploitation of ground water without taking into consideration recharge component resulted in depletion of water levels. In such situation, efficient use of irrigation water is the basic need to increase agricultural production to satisfy the needs of increasing population.

Water is a great resource of humidity. It helps not only in survival but also in making life comfortable and luxurious. Besides various other uses of water, the largest and important use of water is for irrigating lands.

0.2 PROBLEMS, SCOPE & PURPOSE :-

"Irrigation is the artificial application of water to the land in accordance with the crop requirements throughout the crop period, for full-fledged nourishment of the crops". In India the success of Agricultural is completely dependent on the monsoon failures in addition to insurance, today's trend is to consider irrigation as vital input in maximizing the production. Thus the concept protective irrigation has changed
into productive irrigation necessitating application of irrigation water at right time in right quantity.

In India the extent of irrigation is just 30.7 percent and in Maharashtra it is 13 percent. India being a tropical country with vast diversity of climate, topographic and vegetation has to ultimately depend upon irrigation for survival of crops.

Irrigation is generally the artificial application of water to the soil for crop production. It encourages the farmer to adopt scientific techniques and go in for more intensive cropping there by creating new opportunities for gainful employment. Irrigation can't be considered for its protective of insurance against the vagaries of rainfall and drought, but has to study in the content of the adaptation of high yielding varieties, chemical fertilizers and overall development of agriculture as well.

"An Impact of Irrigation On Agricultural Development in Ahmednagar District : A Geographical Survey" this has been selected for the present study, which is predominantly agricultural being the backbone of its economy. The stability and development of agriculture in a region depend on the availability of perennial supply water for plant growth. The spatial differences in irrigation development are common in Maharashtra in general and Ahmednagar district; in particular.

Compare to other regions of the state. The need of irrigation in the region arises in order to the uneven distribution and overall shortage of rainfall.

The aim of the present investigation is to analyses the spatio-temporal development of different modes of irrigation in relation to the physical and demographic setting of the
region. The impact of irrigation and associated inputs on land use, cropping pattern, and yield is proposed to be assessed at micro and macro levels. But it must be pointed out that no attempt is made to examine negative aspects like environmental degradations. For the purpose of this study the impact of irrigation is referred to as spatial change in land use, cropping pattern and also crop yield.

0.3 OBJECTIVES OF THE STUDY:

1) To examine the effect of Physical determinant on irrigation development in the district.

2) To assess the role of demographic factors in the development of Irrigation in the area under study.

3) To analyze the sources, methods, means of irrigation in Ahmednagar District.

4) To review and illustrate the spatio-temporal changes in irrigation facilities.

5) To assess the effect of irrigation on the use of mechanical and biochemical inputs.

6) To review the general and agricultural land use pattern in the study area.

7) To illustrate the impact of irrigation on cropping pattern in general and irrigated crops in particular.

8) To evaluate the overall role of irrigation in the agricultural productivity in the study area.

0.4 HYPOTHESIS:

In light of the above objectives following hypotheses are formulated and proposed to be tested.
1. Physical factors have a vital role in the introduction and expansion of irrigation.

2. There is a relation between the demographic factors and irrigation.

3. There are spatio-temporal variations in irrigation facilities and these are observed more in the scarcity areas.

4. Positive correlation between irrigation and distribution of mechanical and bio-chemical inputs.

6.5 STUDY AREA:

The district of Ahmednagar is located between 18° 2' to 19° 9' north latitudes and 73° 9' to 75° 5' east longitude, is situated partly in upper Godawari Basin and partly in Bhima basin, the interfluves in between farming the extensive Ahmednagar Plateau. The district is very irregular in shape, somewhat resembling a slanting cross with length of 200 km and breath of 210 km. the region covers an area of 17035 sq Kilometers, which about 5.66 percent of the total area of Maharashtra State, It has total population 40,88,077 according to 2001 census which is about 4.23 percent of the states total population, In the state of Maharashtra the district ranks second and fifth with regards to total geographical area and population respectively.

The District Ahmednagar bounded on the north by Igatpuri, Sinnar and Yeola taluka of the Nashik district, on the north-east Vaijapur, Gangapur and Paithan talukas of Aurangabad district. On the east Georai, Beed and Ashti, talukas of Beed district, Bhum and Paranda talukas of Osmanabad district, on the south Karmala taluka of Solapur
district, on the south-west Junnar, Shirur, Dhound and Indapur talukas of Pune district Murbad, Shahpur talukas of Thane district, Ahmednagar is the largest district of the state in area, occupying a somewhat central position of Maharashtra.

\section{Choice of the Region and Topic:}

District Ahmednagar has only 3 large rivers with their small tributaries out of which the Pravara the Mula, and the Mhalungi are considerably supportive to agriculture. Besides well watering and canal watering systems support the irrigations aspects. Irrigation facilities are being well developed in Ahmednagar district, over the last two-three decades. According to 2000-2001 agricultural statistic for taluka comparative figures are available the irrigated area in Ahmednagar district was the highest (26.51\%) in the whole of Maharashtra (17.3\%), the net irrigated area however ranks first in the state.

Almost all the dams or the bandharas were built of mud and found throughout the district especially in Parner, Shrigonda, Karjat, Ahmednagar, Kopargaon, Sangamners, talukas and were built on seasonal streams. To-day the same are practicable, many of bandharas were maintained by group of people in early days and patkari a man who used to arrange the share of water for which he was paid. The well were individually owned but at the same places the stepped well built in historical period were repaired, periodically cleaned and used for irrigation.
A detailed review of the progress of irrigation from the past it is difficult, hence an attempt is made here to investigate regional imbalance in irrigation facilities from the plan period onwards with the advert of planning 1951, many attempts were made to tap the water for irrigation schemes in Ahmednagar District. The Government policies encourage the farmer to utilize surface and ground water resources by giving them financial assistance and subsidies.

Sugar factories, which have been established during the last fifty years, have given impetus to irrigation by making it special in their commercial areas, apart from these factories rapid rural electrification. The awareness in farmers and increasing trend of education has stimulated irrigation developments.

DATA BASE AND METHODOLOGY:

The data collected and used for the period 1980 to 2000 comes both primary and secondary sources. The primary data through different sources for which questionnaire designed, information collected through various offices and farmers. The broad picture of present pattern of irrigation, land utilization of the region is prepared with the help of secondary data, obtained from official statistics from Socio-Economic Review, District Statistical Abstract, District Census Handbooks, Gazetteers, Agricultural Epitomes, Bulletins, Department of Irrigation, Groundwater Survey and Development Agency of Maharashtra State. The information is also obtained from the Bureau of Economics and Statistics, The Zillha Parishad, Ahmednagar certain data like yields per hectare, consumption
of fertilizers, high yielding variety seeds, and insecticides were obtained from Zillah Parishad office. Size of operational holdings and land tenure system, etc. are not available at taluka level. Information pertaining to these aspects has been collected through questionnaires, personal interviews, visits to taluka headquarters, in the study area. It is considered necessary to supplement secondary information by indepth micro-studies at village level. For this purpose one village each from transition and heavy rainfall zone are selected, and two villages are selected from scarcity zone because in this district 92 percentage area covered by scarcity zone. A micro level study includes plot to plot survey of the land, covering information of relevant aspects such sources of irrigation and number of well, their depth and water table, methods of irrigation and problems pertaining to irrigation.

The data thus collected, through primary and secondary sources, were processed and represented by statistical and cartographic techniques. As the study purports to be geographical in spirit the cartographic, methodological description and interpretation of regional patterns revealed through choropleth method, for studying the pressure of population on agricultural land.

For studying the changes in land use pattern five land use categories i.e. Area Under Forest, Area Not Available for Cultivation, Other Uncultivable Land, Fallow Land, Net Sown Area considered. In order to smooth but unusual fluctuations five years average data for the year 1980-85 and 1995-2000 are used. Percentage of area under each categories of land to the geographical area is computed. While index of
diversification is used for studying the crop diversification, Weavers technique is applied for delimiting the crop combination zones in the region. Productivity of individual crops and overall productivity of agriculture is computed by crop concentration and yield index ranking co-efficient method.

REVIEW OF LITERATURE:

For the successful crop production, adequate and timely water supply is a master key. Particularly in the semi-arid and arid tracts where rainfall is erratic and scanty. Irrigation plays a crucial role in the development of Indian agriculture, as rainfall is inadequate and untimely.

The geographical studies on land use and cropping pattern are plenty in India and aboard, but the studies with special emphasis on irrigation are comparatively few in India. It must be mentioned that Geographer, Economist, Irrigation engineers, Agronomists, Administrators, and Policy Makers also study irrigation from different angles. As a result, this subject has acquired interdisciplinary dimensions.

Though the author has tried to refer to most of the available studies on the concerned problems and allied topic yet only certain selected studies has been reviewed here to bring home some gaps in the already available studies to traceout the possible of research for the present study.

Among the few scientific studies on irrigation “Cantor’s (1967)” is the most important. His book includes a systematic outline of the history of irrigation methods and problems of irrigation agriculture etc. impact of irrigation on agriculture in
different parts of the world has also examined by him. A year book of agriculture U. S. A. Namely “Water” (1955)\(^2\) aims to explain the nature, behavior and conservation of water in agriculture and also includes some of the abroad problems, facts and basic principals in it.

“Clark (1970)\(^3\) deals with economics of irrigation, outer works carried out by foreign scholars on method of irrigation, and water management are by Manner (1974), Short (1974), Bengtson (1974), Andreac (1975), Schaffer (1975), Baumann (1975), and Garbrecht (1978)

“India’s Water Wealth” by Rao (1975)\(^4\) is the first of its kind of deal with India’s resources development in a comprehensive and integrated manner. Rao emphasizes the assessment, present utilization problems and future needs.

Fukuda : (1976)\(^5\) has made comparative studies of irrigation and drainage throughout the world, Michael : (1976), in “Irrigation Theory and Practice”, he often a comprehensive and coherent account of water resources, irrigation wells, irrigation pumps, water application methods, and salt problems related to a agricultural irrigation in India.

Kulkarni : (1970)\(^6\) highlights problems of irrigated agriculture as an agronomist.

Nadkarni : (1979)\(^7\) in “Impact of Irrigation”, economic changes are analyzed according to the sources of irrigation on the basis of case studies.

The regional account of irrigation with one or all modes and effects have been studied by different scholars such as Ayyar A. S. (1931)\(^8\), Krishna Swami (1939),\(^9\) David Fireman (1952)\(^10\) Shinha B. N (1954),\(^11\) Uniss Aziz (1962)\(^12\),


Indian council of Agriculture Research, New Delhi, has published some monographs, such as – Irrigation. Structure (1970), Design and Evolution of Irrigation Methods (1972), irrigation with saline water (1972) and water resources their utilization in agriculture in India (1973). These reports have also been referred for the present study.

In the seminar “Role of irrigation in the development of India’s agriculture” arranged by the Institute for Social and Economic papers representing contribution from economists, administrators and engineers were presented. The focus of seminar was on Utilization of existing irrigation facilities, investment in irrigation and return on it and national policy on underground and surface water use.

The committee on plan project (1963), found in Nagpur Irrigation Circle of Maharashtra that in case of minor irrigation reservoirs, utilization worked out to only 34.5 percent. Likewise, actual use from 146 ‘Bandharas’ in various divisions of the State averaged only 38.4 percent. In the Vidharabha region, large quantities of water in reservoirs built at great costs are found to go waste through evaporation because winter cropping is not practiced in the area. In Gujrat
State, the investigation showed that the irrigation potential created through plan and pre-plan projects yielded the utilization percentage of only 36.3

Anand (1960), stated that irrigation introduces positive change in intensity, crop pattern and yields. Simultaneously, it also disturbs the equilibrium conditions in agriculture in a particular command area. The new equilibrium point will fail to reach optimum limits expected from full utilization potential because of several constraints.

Kalhon and Sharma (1963), observed that the facilities for artificial irrigation to supplement the rainwater provided great scope for increasing per acre yields of various crops.

According to Dastane (1965), of all the resources, water is the item, which is at present used on farms most carelessly. The wastage and losses are maximum in this commodity as compared to others, such as fertilizers, seeds etc. If properly utilized, it is possible to double the irrigated area on the farms with the same quantity of water as is available today.

Nath (1965), studied that major irrigation schemes have suffered a set-back because of poor utilization of the new potential created. According to him, the two most important reasons for it lack of co-ordination among agencies and unpreparedness of cultivators to change from dry farming to wet farming.

While suggesting the importance of irrigation, Savale (1966), stated that, irrigation helps the farmers directly as well as indirectly in increasing agricultural production. It permits changes in cropping pattern and introduces more profitable crops. It reduces the uncertainty of depending
entirely on nature for rainfall and permits to accept new technology. It permits intensive use of labor and capital and also aids in capital formation.

The findings of the study conducted by Daulat Singh and Udaichand (1968), revealed that double cropped area, cropping intensity, use of labor on the farms were directly related with level of use of irrigation water.

Khursale and Gandhi (1969), observed that utilization of irrigation potential is not a problem on the old and established irrigation system. Non-utilization of irrigation potential is observed in case of new irrigation system which have been taken up for execution from the beginning of the first Five Year plan. Non utilization of irrigation potential is noticeable particularly in the case of kharip season. It is the general tendency of the irrigators to wait for the rains in the case of seasonal crops and when monsoon fails then rush to the irrigation department for supply of water for kharip season.

Malhotra (1971), in his study conducted in Rajasthan canal project observed that most of the actual irrigation potential available remained unexploited because of non or untimely allotment of lands, shortage of water for irrigation and absence of irrigation canals.

Kadam (1974), examined the extent and causes of under utilization of irrigation resources created under the Ghod project. He concluded that the created irrigation potential in the Ghod project has been underutilized. The causes for under utilization of irrigation potential were the late availability of canal water for Kharip sowing, unsuitability of land for irrigation, mismanagement of irrigation by the department,
lack of infrastructure conductive for adoption of modern technology and lack of marketing and communication facilities in the area.

Reiddinagar (1974), studied the impact of improper distribution of water on crop yields. The views of farmers on existing crop yields. The view of farmers on existing water distribution system in an outlet command and their awareness of water management and willingness to follow a new system were highlighted. He recommended the adoption of warabandi to avoid unequal distribution and achieve benefits of irrigation water.

Gudowski (1978), studied the problems of water distribution in Egyptian agriculture and concluded that the main causes for unproductive use of water and the low efficiency of water conveyance are:

i. Bad organization of distribution and consumption

ii. Poor function of the distribution network

iii. Working over too long a period; and

iv. Inadequate techniques of water utilization.

Patil (1980), examined the soil pH (soil reaction) of Rahuri taluka and concluded that the soils found to be clayey in texture, cal carious and alkaline in reaction. The average value for pH and electrical conductivity were 8.45 and 05.86 mmhos/cm respectively. He also concluded that if the soil pH were more than 7.5-i.e. (alkaline) then it would definitely affect the sugarcane yield.

Biswa and Mandal (1982), studied on farm irrigation water management problems of three irrigation schemes in Mymensingh district of Bangladesh. Some of the institutional
constraints and the poor layout, faulty construction and maintenance and consequent water losses in the canal system were the major cause of low productivity in the three irrigation schemes studies.

Patel and Patel (1983), studied the irrigation practices and efficiency of water use in machu-I irrigation project area in Gujrat. They identified various problems closely related to under utilization of water resources, low intensity of land use in irrigated areas and interterm variations in water use.

Nandani Chatterjee (1995), Studied Irrigated Agriculture : A case study of West Bengal. Author has collected official as well as field survey data. The Main objectives of the studies were (i) to highlight the basic problems that have made irrigation a necessity. (ii) To asses the physical setting of irrigation by a detailed appraisal of the surface and ground water resources as well as their influence on the types of irrigation in the state (iii) To asses the impact of irrigation on land use, cropping intensity, cropping pattern as well as agricultural efficiency macro and micro level analysis.

O.9 ORGANIZATION OF THE THESIS :

The present study has been organized into seven chapters, the details of the organization of the research are given below:
INTRODUCTION:

This chapter deals with introduction, problem, scope and purpose, objectives of the present study, hypothesis, data base, and the methodology, choice of the region and topic, review of literature are considered.

Chapter 1: PHYSICAL DETERMINANTS AND IRRIGATION.

This chapter deals with the physical determinants and irrigation which comprises location, boundaries of the study region, administrative divisions evolution, geology topography, drainage pattern, climate and irrigation, natural vegetation, water resources and soil from the point of view to their, suitability for the development of irrigation.

Chapter 2 – DEMOGRAPHIC FACTORS AND IRRIGATION.

This chapter though light on demographic factors like, growth and density of population, literacy, rural population density per 100 hectares to cultivated areas, rural population density per 100 hectares to irrigated area, agricultural laborers and cultivated areas, cultivators and irrigated area, land ownership tenure and size of land holding, sizes of land holding and irrigated area above subtopics are studied.

Chapter 3.-DEVELOPMENT OF IRRIGATION.

This chapter deals with evolution of irrigation, limitations for irrigation development, methods of irrigation, sources of irrigation, Intensity of well irrigation, density of well irrigation, major and minor irrigation projects, percolation tanks, bandharas, minor irrigation schemes, canal
irrigation, intensity of canal irrigation, over all intensity of irrigation, traditional and mechanical inputs, biochemical inputs are studied in detail.

Chapter 4. GENERAL AND AGRICULTURAL LAND USE.

This chapter is devoted for meaning and importance of landuse in which study of general and agricultural landuse of Ahmednagar district (taluka-wise) are studied in detail.

Chapter 5. - AGRICULTURAL PRODUCTIVITY.

Chapter five through lights on cropping pattern and agricultural efficiency, ranking of crops, crop combination, intensity of cropping, crop diversification, crop concentration, terms of production selected agricultural crops, crop productivity in Ahmednagar district, agricultural efficiency according to Kendall’s method, are studied.

Chapter 6. - CASE STUDIES.

Some of the emerging features and themes are pursued through case studies at micro level, which are incorporated in this chapter.

Chapter 7. - CONCLUSION AND SUGGESTIONS.

Finally chapter seven covers important conclusions, of the study region and specific suggestions to solved them.
REFERENCE


10] Firaman David (1952) : “General Aspects of Geography of Irrigation In India” Geographer Vol. 5, 2 PP 1.11


