Chapter I

Appraisal of the Problem

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Chapter I
Appraisal of the Problem

1.1 Meaning of Agriculture and Agricultural Geography:

The science or art of cultivating soil, growing and harvesting of crops, domestication of animals and raising of livestock is known as agriculture¹. In its broadest modern sense the word 'agriculture' includes not only the domestication of plants and animals useful to man, but also many of the operations involved in marketing them. The word 'agriculture' comes from a Latin term 'Agricultura' which has its origin in the words 'ager' meaning a field and 'cultura' meaning to culture or cultivate. Watson's Longman Modern English Dictionary (1976)² defines the word agriculture as the 'science' in order to produce crops. Agriculture is different from 'pastoral farming' which is the practice of breeding and rearing of certain herbivorous animals. For lack of an appropriate word, agricultural geographers used the word 'agriculture' to cover both cropping and grazing. Humphrey's³ American Peoples Encyclopaedia (1965) mentions under the head 'Agriculture', "the production of crops, livestock and the products. It is in such a broad context that term is used here to include both rearing of animals and raising of crops." The legends of the beginning of cultivation cover a wide range of speculation including divine teaching by the Gods. Many Gods have been worshiped for their power over the weather and over the growth of plant and animal life. Isis in Egypt, Demeter in Greece, Ceres in Rome, Mikael in Palestine and Varun in India are only a few examples of the Gods revered by ancient people.

'Agricultural' in agricultural geography implies the subject matter and 'Geography' gives the ways of viewing or investigating the subject matter. Agricultural geography thus means the "Geography of Agriculture". Etymologically the expression 'Agricultural Geography' has Greek and Latin roots. The word 'geography' is derived from a greek word "Geographia" which stems from two words, namely 'Geo' meaning the earth and "graphia"
meaning to describe. The Etymology and the dictionary meaning of the phrase suggest that agricultural geography is the description of the art of large scale soil cultivation with reference to natural environment and human circumstances.

The study of relationship between economic activities namely, the primary (agriculture and mining), the secondary (industry) and tertiary (services) and their environment was given a special title of the science of 'geonomics' or 'geonom'. Since agriculture is one of the primary economic activities, the study of relationship of agriculture with its environment may well deserve a little, the science of 'geocultura'. The question arises, is agricultural geography a science or an art? Agriculture can be considered a science in view of its techniques of analysis, methods of interpretation and its approaches to the investigation of agriculture. As a science agricultural geography is concerned with the formulation and testing of hypothesis, interpretation of geographic distribution and location of various characteristics of agricultural activities on the surface of the earth and measurement of geographic relationships. Further more, as a science it also seeks to identify, describe and classify the problems of agriculture against a geographical backdrop.

According to Hillman (1911) agricultural geography deals with a comparative study of agriculture of countries and continents. Given in 1911, it is an absolute definition. The basic focus of this definition is to compare the agricultural activities of different countries and continents at a macro level. In reality, the decisions about the cropping pattern and associated activities are taken at the field or micro level. Moreover, this definition does not explain the causes of such spatial variations in agricultural phenomena.

Bernhard (1915) defines agricultural geography as the study of regional variations in agriculture and the factors responsible for them. It is a relatively more rational definition of agricultural geography as it takes into account the regional distribution of agricultural activities. It also attempts to identify the physical and cultural factors which control the spatial distribution of agricultural pursuits.
In the opinion of Reed (1964)\textsuperscript{7}, agricultural geography deals with the description and explanation of regional differentiation of agricultural characteristics. There are numerous agricultural typologies and systems in the world. According to Reed, agricultural geographers should examine, analyse and interpret the main causes of spatial variations in these attributes. For example, the rice region differs from the bajara region in India.

Andrease (1981)\textsuperscript{8} opines that agricultural geography is the science of agriculturally transformed earth's surface with all its associated physical, social and economic interrelationships as reflected spatially. The main focus of this definition is on the point that over the period of last over 12000 years, man by his deeds has formed the natural vegetation.

According to Coppock (1969)\textsuperscript{9}, in agricultural geography agricultural facts are arranged in an orderly manner. He emphasized that the main task of an agricultural geographer is to collect data for the testing of hypothesis and to provide adequate explanation for the spatial distribution of agricultural activities. Coppock, in his definition, has given adequate emphasis on the purpose of agricultural geography and the methodology to be adopted for the formulation of agricultural models, paradigms, theories and generalizations. The primary purpose of agricultural geography is to undertake a geographical enquiry into the regional differences and spatial variations in agricultural formation and geographic associations and it lends itself to a greater quantification in the description of regional distributions.

1.2 Significance of the Study of Agricultural Geography:

Land is the most significant among the natural resources of the country and most of its inhabitants depend on it for their livelihood, yet the average yield of India remains to be one of the lowest in the world. In general most of the villages suffer both from under nutrition and malnutrition. Agriculture includes all plants, poultry, birds and animal products for direct or indirect consumption by humanity. Apart from food, agriculture, meets many other needs of man from cultivation of plants to rearing of animals. So long as the need for such supplies continues to be a problem, man will
continue to seek information on not only how but also from where human requirements are to be met.

Almost all the nations of the world have embarked on agricultural production, with accent on establishing the nature of conditions surrounding that production in specific areas or of the conditions favourable to instituting the same in areas not currently devoted to that purpose. Also, many nations of the world have been acquiring precise information as to where supplies of such agricultural products may be most effectively obtained as can meet their ever-growing domestic needs. Such information can be supplied by an agricultural geographer which in fact highlights the significance of agricultural geography in the present development context.

To sum up, the major objective of agricultural geography is the analysis of the agriculturally structures areas and their natural, economic and social relationship and organizations as reflected spatially. Such agricultural geographic studies are necessary for any transformation activity of man, particularly for planning and development purpose.

The significance of agricultural geography is that it provides help and guidelines for decision makers and is useful for:-

i. The agricultural specialist, who wishes to improve the structure of agriculture.

ii. The food economist, who wishes to increase the production of food stuffs.

iii. The irrigation engineer, who plans to introduce new irrigation schemes.

iv. The regional planner, who is on the look out for the most favourable location for recreation areas.

v. The transportation engineer, who has to lay new rail roads.

vi. The demographic planner, who plans public services and utilities.

vii. The numerous other specialists.
1.3 The Place of Agriculture in the National Economy:

Agriculture occupies an important position in Indian economy. Its contribution to the national income in 1950-51 was up to 57% which declined to about 32% in 1994-95. It provides food, fodder and raw material and thus contributes to overall economic growth. Its good performance over the period of time helps in the generation of more employment, thereby reducing poverty, hunger and malnutrition. The rapid economic development of any state or region without the development of its agriculture is almost impossible.

Comparison can be made between the position of agriculture in India with that in the other countries as regards the share of agriculture in national income. In the United Kingdom, agriculture contributes only 2% of the national income, in U.S.A. it is 3%, in Canada it is 4%, in Australia it is 5% and so on. The more developed a country, the smaller is the share of agriculture in national output. India, having not yet reached the stage of advanced economy, has an agricultural sector which is still the dominant one in the country.

Agriculture dominates the economy to such an extent that a very high proportion of working population in India is engaged in agriculture. According to India's census figures, between 67% to 69% of India's working population is engaged in agriculture. But in the United Kingdom and United States only 2% to 3% of working population is engaged in agriculture, in France the proportion is about 7% and in Australia this is 6%. It is only in backward and less developed countries that the working population engaged in agriculture is quite high. For instance, it is 42% in Egypt, 50% in Burma, 52% in Indonesia, 73% in China, 93% in Nepal, 92% in Burundi, 73% in Angola, 67% in Vietnam and 76% in Somalia.

Indian agriculture has been the source of supply of raw materials to our leading industries. Cotton and jute textile industries, sugar, vanaspati and plantations all these depend on agriculture directly. There are many other industries which depend on agriculture in an indirect manner. Many of our
small scale and cottage industries like handloom weaving, oil crushing, rice husking etc. depend upon agriculture for their raw materials together they account for 50% of income generated in the manufacturing sector in India.

But then, in recent years, the significance of agriculture to industries is going down as many more industries have come up which are not dependent on agriculture. Under the five year plans, iron and steel industry, chemicals, machine tools and other engineering industries, aircraft etc. have been started. However, in recent years, the importance of food processing industries is being increasingly recognised both for generation of income and for generation of employment.

Importance of Indian agriculture also arises from the role it plays in India's trade. Agricultural products like tea, sugar, oilseeds, tobacco, spices etc. constitute the main items of exports of India. Broadly speaking, the proportion of agricultural goods which are exported may amount to 50% of our exports and manufactures with agricultural content (such goods as manufactured jute, cloth and sugar) contribute another 20% or so, and the total comes to 70% of India's exports. This has great significance for economic development.

Importance of agriculture in the national economy is indicated by many facts. For example, agriculture is the main support for India's transport system, since railways and roadways secure bulk to their business from the movement of agricultural goods. Internal trade is mostly in agricultural products. Further, good crops implying large purchasing power with the farmers lead to greater demand for manufactures and therefore, better prices. In other words, prosperity of the farmers is also the prosperity of industries. Likewise, bad crops lead to a depression in business. Generally, it is the failure in the agricultural front that has led to failure in the agricultural front that has led to failure of economic planning. Finally, finances of the Government, especially of the State Governments, depend to a large extent, upon the prosperity of agriculture.

It is clear, therefore, that agriculture is the backbone of the Indian
economy and prosperity of agriculture can also largely stand for the prosperity of the Indian economy. At the same time, it is true that per capita productivity in agriculture is less than in industry. The significance of agriculture in India arises also from the fact that the development in agriculture is an essential condition for the development of the national economy. Ragnar Nurkse argues that the surplus population in agriculture should be shifted to the newly started industries. Nurkse’s thesis is that agricultural productivity will be increased on the one hand and on the other new industrial units would be set up with the use of surplus labour^{12}.

1.4 Agricultural Development in India :

On the eve of the first plan, agriculture was in a hopeless and deplorable condition. Our farmers were generally in heavy debt to the village money lenders. They were having small and scattered holdings. They had neither the money for the knowledge to use proper equipment, good seeds and chemical manures. Except in certain areas they were dependent upon rainfall and upon the vagaries of the monsoons. Productivity of land as well as of labour had been declining and was the lowest in the world. In spite of the fact that nearly 70% of our working population was engaged in cultivation, the country was not self-sufficient in foodgrains but had come to depended on imports of foodgrains. Besides, the country had suffered because of partition in 1947 as it was given more people but less land to support.

I. Objectives of Planning for the Agricultural Sector :

While planning to develop the agricultural sector, the Planning Commission has kept four broad objectives:

a) Increase Agricultural Production :

The aim is to bring more land under cultivation, raise the per hectare yield through intensive application of such agricultural inputs as irrigation, improved seeds, fertilizers etc. and thus bring about increased agricultural production.
b) Increase Employment Opportunities:

Apart from increase in production, the agricultural sector should generate additional employment opportunities and provide scope for increasing the incomes of the poorer sections in our villages.

c) Reduce the Pressure of Population on Land:

Another basic objective of planning in the agricultural sector is to reduce the number of people working on land, on the assumption that there are too many people working on land. The surplus labour on land should be shifted to secondary and tertiary sectors, preferably in rural and semi-urban areas.

d) Reduce Inequality of Incomes in Rural Sector:

The government should remove the exploitation of tenants and should distribute surplus land among small and marginal farmers in such a way that there would be some degree of equality and justice in the rural area.

All these objectives are being followed in all our plans but in practice, agricultural planning has come to mean the increase in production viz. the achievement of the first objective; all other objectives seems to have been ignored.

II. Strategy Used in the Agricultural Sector:

To bring about increase in agricultural production and also increase in employment, the five year plans use various programmes such as, setting up of community development programmes and agricultural extension services throughout the country, expansion of irrigation facilities, fertilizers, pesticides, agricultural machinery, high yielding varieties of seeds and expansion of transportation, power, marketing and of institutional credit.

To reduce the pressure of population on land, the strategy used was to set up agro-based industries and handicrafts in rural area, to promote rural transport and communication and to encourage the movement of people from agriculture to industries and service sector.

Finally, to bring about equality and justice in rural India, the strategy used was land reforms which included the removal of intermediaries, the
protection of tenants through tenancy legislation, ceiling of land holdings and distribution of surplus land among landless labourers, small and marginal farmers.

III. Pattern of Investment in the Agricultural Sector:

The pattern of investment in the different five year plans is summerised below:

**Table No. 1.1 : Pattern of Government Outlay on Agriculture in the Plans.**

<table>
<thead>
<tr>
<th>Plan</th>
<th>Total plan outlay Rs. Crores</th>
<th>Outlay on Agriculture and irrigation</th>
<th>Percent of total outlay.</th>
</tr>
</thead>
<tbody>
<tr>
<td>First Plan</td>
<td>190</td>
<td>600</td>
<td>31</td>
</tr>
<tr>
<td>Second Plan</td>
<td>4600</td>
<td>950</td>
<td>20</td>
</tr>
<tr>
<td>Third Plan</td>
<td>8600</td>
<td>1750</td>
<td>21</td>
</tr>
<tr>
<td>Fourth Plan</td>
<td>15780</td>
<td>3670</td>
<td>23</td>
</tr>
<tr>
<td>Fifth Plan</td>
<td>39430</td>
<td>8740</td>
<td>22</td>
</tr>
<tr>
<td>Sixth Plan</td>
<td>109290</td>
<td>26130</td>
<td>24</td>
</tr>
<tr>
<td>Seventh Plan</td>
<td>218370</td>
<td>48100</td>
<td>22</td>
</tr>
<tr>
<td>Eighth Plan</td>
<td>434100</td>
<td>93680</td>
<td>22</td>
</tr>
</tbody>
</table>

Source: *Various Five Year Plans.*

It would be clear that the total outlay in each plan had increased and correspondingly, the outlay on agriculture and irrigation had also increased. However, the percentage of the outlay on agriculture and irrigation to total plan outlay was the highest in the first plan viz. 31% and was between 20% to 24% in all other plans.

The Planning Commission specified the various programmes for increasing agricultural production such as irrigation, soil conservation, dry farming and land reclamation, supply of fertilizers and manures, better ploughs and improved agricultural implements, adoption of scientific practices etc. The Government gave considerable attention to institutional changes such as the setting up of community development programmes and
agricultural extension services throughout the country, the use of land reforms, expansion of transportation, power, marketing and other basic facilities, improvement of the system of co-operative credit etc. From the third plan onwards, the greatest emphasis was laid on new fertilizer seed technology.

iv. Progress of Agriculture Since 1951:

During the first decade of planning (1951-61) when the first and second five year plans were implemented, the annual rate of growth in agriculture was 3.3%. But during the second and third decades of planning in 1961-71 and 1971-81 the annual average rate of growth declined to 2.2% and 1.7% respectively, mainly because of bad weather and poor monsoon conditions. Despite spectacular progress achieved under the new agricultural strategy and Intensive Agricultural District Programme and High Yielding Varieties Programme, the overall progress in agriculture during this period was dismal. But the conditions improved during the fourth decade of planning (1981-91). The sixth plan itself was a grand success and the growth rate in agriculture during the sixth plan period was 4.2%. The growth rate in the fourth decade was highly respectable (3.8%). The overall compound rate for the entire 40 year period (1951-91) was 2.8%. The rate of growth would have been much better but for the periodic monsoon failures indicating that Indian agriculture is still under vicious grip of unpredictable monsoons.

Area under all foodgrains increased from 23 million hectares to 40 million hectares between 1949-50 to 1994-95. Foodgrains production was increased from 51 million metric tonnes to 191 million metric tonnes from 1950-51 to 1994-95. Oil seeds production was increased by 320%, sugarcane by 352% and cotton production by 300% from 1950-51 to 1994-95.

In any appraisal of the agricultural situation in India since 1950-51, one should not overlook the vigorous efforts that have been made by the Government to impart a scientific temper and to achieve spectacular progress in the use of agricultural inputs.
The irrigated area utilised increased from 28 million hectares in 1960-61 to 86 million hectares in 1995-96. During this period the consumption of fertilizers had increased from an insignificant 0.3 million tonnes to nearly 15.2 million tonnes. Consumption of fertilizers per hectare had risen from less than 2 kgs to 72 kgs. The area under High Yielding Varieties Programme since the mid 1960's marks technological break through in Indian agriculture, this area had gone up from less than 1.5 million hectares to 75 million hectares between 1960-61 and 1995-96. The new varieties have made a significant impact on crop production, particularly in areas with assured irrigation as for example wheat and rice in the states of Punjab, Haryana and Western Uttar Pradesh. There is slow growth in agriculture in India. The following are the causes of slow growth in India:

i. Agriculture, still a gamble in the monsoons.

ii. Limited use of New Agricultural Technology.

iii. Failure of land reforms.

iv. Decline in private investment.

v. Growing exploitation of the tenants.

vi. Failure to control growth of population.

1.5 Place of Agriculture in State Economy:

The present state of Maharashtra or the old Bombay state prior to independence is not a backward state, excepting certain areas in various concerns of the state. Even during the British period, irrigation dams were constructed and irrigation was the single most prime factor which completely transformed the whole landscape from a simple jowar, bajara cropping area into an industrial crop zone i.e. sugarcane. In 1960-61 about 17.9 million hectares of land was under cultivation while in 1994-95 it increased to 18.06 million hectares. It is an increase of about 0.88% from 1960-61 to 1994-95.

During the yhird five year plan Rs. 62.34 crores were spent on the development of agriculture in the state of Maharashtra. During fourth five year plan 196 crores were spent on agriculture and allied services. During seventh five year plan about Rs. 614 crores were spent on agriculture and
allied services. Maharashtra Govt. has also made remarkable agricultural progress through five year plans. During 1991 about 1.85 crores people were engaged in agricultural activities in Maharashtra. In 1961 there were 2319 tractors in Maharashtra while in 1992 the number of tractors increased to 46631 in the state. It means the number of tractors were increased by more than twenty times in the state of Maharashtra. During 1960-61 about 12 lakh hectares of land was under irrigation but now about 17 lakh hectares of land was under irrigation in the state of Maharashtra. During 1961-62 about 1991 metric tonnes chemical fertilizers were used for agriculture while in 1994-95 about 23.99 lakh metric tonnes chemical fertilizers were used in Maharashtra. It means that consumption of chemical fertilizer was increased by 1205 times from 1961-62 to 1994-95 in Maharashtra state. Cereals production was increased from 67 lakh metric tonnes to 98 lakh metric tonnes in the state. Pulses production was increased from 3.86 lakh metric tonnes to 7.1 lakh metric tonnes where as sugarcane production was increased from 116 lakh metric tonnes to 443 lakh metric tonnes and cotton production increased from 17 lakh metric bales to 23.6 lakh metric bales from 1960-61 to 1994-95. Total oil seeds production increased from 6.4 lakh metric tonnes to 18.4 lakh metric tonnes during the period of thirty five years (1960-61 to 1994-95). The western part of Maharashtra particularly district of Sangli, Kolhapur, Satara, Ahmednagar, Solapur have made good progress in agricultural sector.

1.6 Agricultural Development in Marathwada Region:

Marathwada was under Nizam rule from 1724 to 1948, during the period all the fields were neglected. Very few amount was spent on agriculture.

This region is also neglected by the Govt. of Maharashtra as compared to the Western Maharashtra. Marathwada region has good potentials for the agricultural development but there is shortage of water in the entire region. Godavari, Manjara, Marathwada Purna, Bindusura, Manyad, Kham, Penganga, Kaidhu, Lendi, Amrita, Sindhaphana, Saraswati, Ashna, Dudhana etc. are the important rivers of Marathwada but most of the rivers become
dry in summer season except Godavari, Manjara and Penganga. Therefore, there is shortage of water in summer season for agriculture in Marathwada region.

Area under pulses increased from 8.09 lakh to 11.39 lakh hectares between 1960-61 to 1994-95. Area under total foodgrains increased by 22.23%, cotton by 0.97%, total cereals by 16.28% and pulses by 40.79% from 1960-61 to 1994-95 in Marathwada region. 36756 metric tonnes chemical fertilizers were consumed in Marathwada region during 1975-76 while 221507 metric tonnes chemical fertilizers were used. During in 1994-95, 38000 metric tonnes improves high yielding variety seeds were used during 1984-85 while 80000 metric tonnes HYV seeds were used in Marathwada region in 1994-95. At present there are 1316 minor irrigation schemes in the Marathwada region and they have created 2.05 lakh hectares irrigational potential in Marathwada region. There were 2.65 lakh irrigation wells in the Marathwada region during 1995-96. Area under irrigation was increased from 6.61% to 16% in Aurangabad agricultural division where it was increased from 5.14% to 13% in Latur agricultural division between 1970-71 to 1994-95. The production of cereals increased by 33.42%, pulses by 78.76%, sugarcane by 995.48% and cotton by 58.8% from 1960-61 to 1994-95. The production of various crops increased in Marathwada region due to application of modern methods, use of high yielding variety seeds, chemical fertilizers and increase in irrigated area from 1960-61 to 1994-95.

1.7 Choice of the Region and Topic:

The choice of the area and the topic under investigation has been influenced by several considerations:

Firstly, Osmanabad district comprising six tahsils of Maharashtra state has a significant location on southern Maharashtra plateau. Most part of the district is covered by rough topography and remaining part is having flat surface. Balaghat range is found in Bhum, Kallam, Osmanabad and Tuljapur tahsils and other tahsils are completely flat. Some part of the district comes in Bhima valley and some part comes in Godavari valley. Kallam tahsil is
situated in Manjara river basin, while some part of Parenda, Bhum, Tuljapur and Omerga comes under the jurisdiction of Sina river.

The region under study has a major portion under flat topography, hence it support to high concentration of agriculture. As a result, these characteristics make this region a distinct physical entity and homogenous unit for geographical investigation.

Secondly, there are 722 villages in this region. Out of the total villages six villages have no settlement. Entire region comes under the jurisdiction of drought prone area.

Thirdly, Osmanabad district is one of the most backward district of Maharashtra state. Osmanabad district is called as "Problem region" on the basis of population resources, relationship and their capacity to support non-agricultural population, suffers from the problem of less planned utilization of resources due to certain environment, poorly developed transport system and dearth of skilled workers.

Fourthly, the region has 84.21% medium black (between 9" to 36" depth), 11.84% coarse and shallow and 3.95% deep black soils. It means that soils are very rich for the development of agriculture in this region.

Fifthly, out of the total geographical area about 90.11% area was agricultural land during 1990-95 but only 73.77% area was under cultivation. It means that there is a scope to increase agricultural land in the study region.

It is felt that study of the system of agricultural production offers a helpful approach to obtaining a more complete understanding of the problems of agriculture in a region. Moreover, the composite circumstances that contribute to the existing problems facing agricultural activities today have a time and space perspective that may be appreciated.

All these considerations motivates the author to turn his attention to this region and its agricultural geography.
1.8 Aims and Objectives of the Present Study:
   The specific objectives of the present study are:
1. To study the availability of infra-structural and geographical factors on which the development and growth of agriculture depend.
2. To study the population characteristics and its effect on agriculture.
3. To analyse and map the spatio-temporal distribution of irrigation facilities and its effect on cropping pattern.
4. To assess the effect of use of mechanical and bio-chemical inputs on agriculture.
5. To study the role of non-physical determinants in the development of agriculture.
6. To study the general and agricultural landuse and its variation in the region.
7. To assess the trends of production and yield in the study region.
8. To find out agricultural productivity and its variation in the study region.
9. To study the landuse and cropping pattern of selected villages and mark out the agricultural region of the study region.
10. To draw conclusions, and find out the agricultural problems and suggest suitable remedies to solve them.

1.9 Data Base and Methodology:
   As this work has to be done single handedly, author hope the readers will take into consideration its limitations. The data collected and used for the period 1970-71 to 1995-96 comes both from primary and secondary sources. The primary data is the raw data collected through different sources for which special questionnaires were designed and information collected through various offices and farmers. Questionnaires were used for the data collection of sample villages of six tahsils. It was not possible to select various villages from every tahsil, therefore, only three villages from every tahsil were selected for the study.
The broad picture of the present pattern of land utilization, cropping pattern, trends of production and yield is prepared with the help of secondary data obtained from Socio-Economic Review, District Census Handbooks, Gazetteers, Agricultural Epitomes, Periodicals, Season and Crop Reports published by the Department of Agriculture. Data regarding consumption of fertilizers, high yielding variety seeds, pesticides were obtained from Zilla Parishad office of Osmanabad district.

For micro study three villages from every tahsil were selected. Some criteria was applied in the case of selected villages. A micro level study includes plot to plot survey of the land, covering information of relevant aspects such as sources of irrigation, area under various crops, general landuse, population, livestock, agricultural implements and problems of agriculture.

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 chorographic and chorologic methodologies have been adopted. These involve the description and interpretation of the regional patterns revealed through choropleth method. For studying the pressure of population on agricultural land, various land densities such as crude density, rural density, agricultural density, caloric and nutritional densities are computed. These densities are computed by using variables viz. area and population. For measuring the actual pressure of population on agricultural land the relative co-efficient values of over population are computed by taking into consideration the standard hectares namely 0.4047 hectare. Using this as a criteria, the relative co-efficient of over population is computed by dividing the unit of 0.4047 of a hectare by per capita land.

For studying the changes in landuse pattern five measure landuse categories i.e. area under forest, area not available for cultivation, other uncultivable land, fallow land and net sown area are considered. In order to smooth but unusual fluctuations five years average data for years 1970-75
and 1991-92 are used. Percentage of area under each category of land to the geographical area is computed.

For studying the landuse efficiency the index of landuse efficiency is calculated by dividing gross cropped area by net sown area into hundred. For studying the changes in cropping pattern annual area variation of agricultural crops are calculated only for the study region for studying the changes in cropping pattern in the district the five yearly moving averages are considered. The quinquennial average area under different crops and the relative share of each crop in gross cropped area has been deployed for the study of cropping pattern in the study region. The indices numbers of area of the selected crops in the region tahsil level trends in area under different crops are also studied. For the study of trends in area at tahsil level the five years average data for the years 1970-75 and 1991-96 are used. For the study of trends in area at tahsil level compound growth rate is calculated. Weaver's and Doi's methods are used to calculate the crop combination in the region. Bhatia's method is used for index of crop concentration and Jasbir Singh's method is used for the calculation of crop diversification.

Annul average trend rates of production judged by three years 1970-71 to 172-73 and 1993-94 to 1995-96 of selected crops of the district. Annual rates of growth of output of selected crops in the study region from 1970-71 to 1995-96 are calculated for the study of trends in production in the region. The indices of production of selected crop is also computed for the study of trends of production in the region from 1970-71 to 1995-96 (base year 1970-71). For the study of trends of some selected crops compound growth rate is calculated for the period of 1970-71 to 1995-96. For the study of tahsilwise production trends from 1970-71 to 1995-96, the five years average data for the years 1970-75 and 1991-96 are used.

For the study of trends in yields of selected agricultural crops indices for the district are computed. The co-efficient of variation is computed for the study of variability in yields of the selected crop. For study of trends in yield from 1970-71 to 1995-96 compound growth rate is calculated for the
study region. To get a clear picture of productivity and spatial imbalances "the crop yield and concentration indices ranking co-efficient" technique introduced by Jasbir Singh et al (1982) is used.

1.10 Review of Literature:

R. B. Mandal (1969): Studied and has elaborated the Weaver's method in analysing crop combination regions with special reference to North Bihar. He has studied various crops of North Bihar. He used Weaver's crop combination method with modification for the study of crop combination regions of North Bihar.

Majid Hussain (1969): Studied the geographical basis of tube well irrigation in the upper Ganga Yamuna doab. In this paper the geographical factors helpful in the drilling of tube wells in the area have been assessed and the effect of tubewell irrigation on the changes in the landuse pattern have been shown. The paper includes four maps, showing the surface configuration of the area and the area under commands of canals and tube wells. The proportion of the cropped land irrigated by tube wells also have been depicted in a map. The study can be utilized for the further extension of canals and small irrigation projects in the area.

Ali Mohammed (1975): Studied agricultural landuse and nutrition in Kheri, Sitapur and Barabanki district (U.P.). The entire study is divided into four sections, consisting of fourteen chapters. In the first part researcher has endeavoured to make a comprehensive study of the natural environment (physiography, climate and soil) of the region with a view bringing out the extent of influence of these factors on the existing crop landuse. A study has also been made on spatial patterns of general landuse, agricultural landuse and crop combination regions. The principles of the selection of villages for intensive study of landuse and pressure of population have been logically discussed in one chapter. The entire area has been divided into five homogenous strata and representative villages have been selected from each stratum on the basis of the systematic purposive cluster sampling. Part II which is entirely based on field work includes the study of land utilization
and pressure of population in the twelve selected villages of the region. A
certain classification about the selected villages has been studied. A detailed
account of the casting landuse and the selected villages of each stratum as
well as amount of caloric intake per head per day obtained as the basis of
cropped area, yield of crops and the total number of persons dependent on
the village produce. Potential production units calculated on the basis of
land productivity have also been given in each village which show the
extent of agricultural development as attained by the present method of
 technological advancement. The third part deals with the supply of various
elements of diet to the village people, the deficiency of surplus of these
elements and the resulting nutritional deficiency disease. The work provides
a few suggestions for the future development of agriculture and standard of
living in the region as in all the villages unbalances nutritic has played an
adverse role to bring about numerous among the rural population.

Daya Ram (1977)\textsuperscript{16} : Analysed relationship of rainfall, water balance
and crop maturity in western Haryana. The secondary data was used for the
study. Author has calculated correlation co-efficient of seasonal rainfall and
crop maturity, relative variability, correlation co-efficient of monthly
rainfall, seasonal rainfall, relative variability of monthly water balance, co-
efficient of variability of seasonal water balance, correlation co-efficient of
rainfall and crop maturity and correlation co-efficient of water balance and
crop maturity for the study area. Author observed that the seasonal water
balance was more suitable for maturity of bajara and cluster bean than
cotton desi in kharif season. In the rubi season it was more suitable for
maturity of mustard and taramira than gram during the period of
investigation. The crop maturity seems to be directly related not only to
the seasonal rainfall but also rainfall and water balance in certain months of
the related harvested season.

Vats P. C. (1977)\textsuperscript{17} : Examined influence of macro geomorphological
units on landuse and crop-production, a case study of village Dundli. The
study was conducted with the help of aerial photographs of 1:25000 scale
toposheet of 1:63,360 scale and by the subsequent detailed field surveys. The land utilization data and the village maps were collected from the revenue records. A number of soil samples from each geomorphic units were collected and analysed to determine the physical potentialities and limitations of each units. Relationship between landforms and landuse also established.

On the basis of field survey, it was concluded that geomorphology which controls the distribution of soils, surface and surface water, vegetation and cropping pattern has influenced the crop production. Author found that crop production of Dundli village was very low during the period of investigation. The major factors which limit the agricultural productivity were shallow soil, saline soil, presence of carbonate pan at shallow depth, shallow granite rock (weathered at top), mineralized ground water, wind erosional and depositional hazards.

Das M. M. (1981)\(^1\) : Studied landuse pattern in Assam. The objectives of the paper were (1) to analyse the landuse pattern in Assam for 1965-1974 period. (2) to analyse the spatial variation of landuse at the district level in 1973-74. (3) to analyse the volume of change in landuse in different districts of Assam during 1969-1974 by the Weaver's index and to identify the regions of dynamic, semi-dynamic and static landuse pattern.

In order to achieve the above objectives the author was postulated two hypothesis i.e. (1) The scope for physical expansion of areable land is very much limited in Assam. (2) Areas with best soils are dynamic in respect of landuse changes, while those with poor continue to be static.

For the study author has collected landuse data from the official records and Government publications. In order to decipher the spatio-temporal pattern of landuse, two maps were prepared one for 1969-70 and the other for 1973-74. In the second stage, Weaver's index was used to findout the volume of landuse change. The districtwise indices were classified into three categories i.e. dynamic, semi-dynamic and static and were presented in choropleth maps.
Author found that a large proportion of the geographical area of Assam is not suitable for agriculture. What ever land is available for cultivation has already been brought under the plough. Extensive areas of the two hilly districts are not suitable for cultivation due to unfavourable terrain character. Numerous rivers with their ever shifting courses, a bids, swamps, deep forests and scattered hillocks have rendered a large proportion of land in the plains districts unsuitable for growing crops. The first hypothesis was proved, therefore, be laid on intensification of agriculture to increase the productivity of the existing culturable area in the coming decades.

V. S. Datye and S. C. Gupte (1984)\textsuperscript{19} : Studied association between agricultural landuse and physio-socio-economic phenomena: A multivariate approach. In this paper an attempt is made to explain how and to what extent do the factors of physio-socio-economic environment influence the agricultural landuse in Poona district. In order to investigate the association between landuse types on one hand and physio-cultural elements on the other hand. The fourteen variables like net sown area, gross cropped area, rice, jowar, bajara, cash crops, irrigated area, accessibility, owner cultivators, density of population, slope less than $3^\circ$, slope greater than $20^\circ$, distance from crest, distance from major streams were used as dependent and independent variables. First seven variables were used as dependent and next seven variables used as independent variables.

The relationship were studied and analysed by applying quantitative techniques like simple correlation, multiple regression and principle component analysis. The results of the correlation analysis and multiple regression bring out the importance of the factors of physical environment which have a strong influence on the landuse. The principle component analysis also has brought out these relationships more clearly defining seven dimensions of landuse and has further provided a comparatively deeper appreciation of the variation in regional characteristics. In fact, mapping of the component scores for three components have very clearly brought out the validity of the regional frame developed on the basis of relief and rainfall variations.
More K. S. and Mustafa F. R. (1984): Studied irrigation requirements and development in Maharashtra. They were selected three objectives for the study viz. (1) to develop a method by which to quantify the need for irrigation facilities, (2) to identify the areas of varying irrigation facilities and (3) to locate the areas of varying degree of development of irrigation facilities. Their study depends upon three basic factors namely: annual average rainfall, rural population density and percentage of area cultivated. It is largely true that greater the annual rainfall lower is the need for irrigation, simultaneously greater the rural population density and larger the percentage of cultivated area, greater is need for irrigation facilities. The equation was deprived in such a way that it gave a lowest index for areas of minimum requirement and a highest one for the areas of maximum requirement. Authors have used the following equation for the study.

\[
\text{In} = \frac{\text{Pr} \times \text{Ac}}{\text{R}}
\]

Where 
- \text{In} = \text{Irrigation need of the area.}
- \text{Pr} = \% \text{ of rural population.}
- \text{Ac} = \text{Percentage of cultivated area of the areal unit.}
- \text{R} = \text{Annual average rainfall.}

Authors found regional disparities in the requirements of irrigation facilities in Maharashtra. The areas of high requirement (above 48 index value) were recorded in eastern part of Kolhapur, Sangli, Satara and some parts of Solapur and Ahmednagar districts. This was due to high rural population density and high percentage of cultivated area and lower rainfall. They recommended that the areas with greater need and no irrigation facilities must get the highest priority for irrigation development.

Mukherje Sudershan (1985): Studied the role of pumpset irrigation in agricultural practice in India. This paper is just descriptive. Author has considered development of irrigation in the planning era, statewise yield of irrigated and unirrigated principal crops from 1972-73 to 1979-80, pumpset irrigation cumulative position of pumpsets electric and diesel, types of well
upto 1985 for the discussion. Author suggested that in arid and semi arid regions deep tubewells hold potential for agriculture. In over canal irrigated areas like Punjab, pumset irrigation can prevent the danger of rising water table and good land turning into saline. In Bengal deltaic regions this type of irrigation can help to rectify the damage of deranged natural water drainage caused by railway embankments and canal.

Shafi M. (1985)\textsuperscript{22} : Examined, farm power and productivity in Indian agriculture. The paper makes an attempt to examine the productivity of Indian agriculture, deviating from traditional approach of yield per unit area / per unit worker or in terms of monetary or caloric value. It aims to judge the productivity of Indian agriculture in forms of farm power and points out that half the energy in Indian agriculture was supplied by drought animals. Power supplied by human labour was one tenth and only forty percent of the power came from tractors, pumps and machinery during 1970-71. Author concludes that it was not correct to think that with every increase in h/p yield to h/p ratio will increase.

K. S. Bhaskar, Sohanlal, O. Challa and S. H. Madavi (1987)\textsuperscript{23} : Studied agricultural efficiency of Vidharbha region (Maharashtra). The main objective of the study was to assess the agricultural efficiency of the Vidarbha region comprising of Buldhana, Akola, Amravati, Yeotmal, Wardha, Nagpur, Bhandara and Chandrapur (including Gadchiroli) districts of Vidarbha for 15 crops.

Agricultural efficiency of 15 crops viz. paddy, pearl millet, maize, pigeonpea, chicka, wheat, sorghum, barley, blackgram, green gram, cotton, groundnut, finger millets, sunflower and safflower grown in Vidarbha region has been worked out. The following formula was used to calculate agricultural efficiency.

\[
A. E. = \frac{\sum D_i (x_1 + x_2 + x_3 \ldots \ldots \ldots \ldots x_n)}{\sum R (x_1 + x_2 + x_3 \ldots \ldots \ldots \ldots x_n)} \times 100
\]

\(D_i = \) yield in particular district, \(x_1, x_2\) and \(x_3\) are crops grown in the region and \(R = \) Regional total yield of all the crops.
Authors found maximum agricultural efficiency in Chandrapur (18.26%) (including Gadchiroli) district while minimum (8.47%) in Bhandara district. Similarly the maximum location co-efficient (16.62%) was observed in Yeotmal district while the minimum (8.04%) in Bhandara district. Authors have divided Vidarbha region into four divisions on the basis of agricultural efficiency.

High efficiency area was observed in Chandrapur (including Gadchiroli) and Yeotmal districts. Majority of the area has very gently sloping piedmont plain and flood plain which predominantly consist of deep to very deep, brown to grayish soils. Most of the area is under double cropping due to available irrigation facilities by the rivers, wells, ponds and good management practices.

Medium efficiency area was observed in Amravati district (14.07%). The district has very gently sloping piedmont covered by deep to very deep soils, hills with shallow to moderately deep soils and few patches of alluvial soils near streams. The sources of irrigations are comparatively low.

Low efficiency area was noticed in Wardha and Nagpur district where as very low efficiency area was found in Buldhana and Bhandara districts. Agricultural efficiency of Vidarbha region showed a great variation in the range of 18.26% in Chandrapur and to 8.47% in Bhandara district upon soil characteristics and climatic variations in the region. Authors found that there is a great scope in increasing the agricultural efficiency in Buldhana, Akola, Amravati and Yeotmal districts. The efficiency of Wardha, Nagpur, Chandrapur (including Gadchiroli) districts area relatively higher over location co-efficient for total area sown within the region.

**Jagdish C. Kuniyal (1987)**: Studied crop concentration and diversification in Nainital district, U.P. Himalaya. Author has defined the meaning of crop concentration and diversification. Author has used Bhatia's formula for the crop concentration. He has used Jasbir Singh's formula for the crop diversification. Paddy, wheat, maize, pulses, oil seeds, sugarcane, barely and potato these crops are considered for crop concentration by the author.
Author found areas of very high and high rice and sugarcane concentration lying in the patches of Tarai tract. The concentration of rice, pulses and oil seeds in hilly tract was almost negligible (i.e. in low and very low categories). These crops requires large amount of rainfall and water supply. Author concludes that cropping system in the region is primarily dependent upon physical factors and secondarily upon socio-economic conditions.

Author found very high crop diversification in Okhalkanda, Dhari, Kotabagh blocks while high diversification of crops was observed in Ramgarh, Bhimtal, Haldwani, Ramnagar and Bazpur blocks. He found low diversification of crops in Sitarganj, Kashipur, Gadarpur and Betalghat blocks during his study. To get good returns and to maintain crop ecology, hilly farmers should be encouraged by giving priority to the development of horticulture, vegetables and edible and medical plants in place of crop farming. This will inevitably maintain eco-restoration and crop ecology and the goal of achieving self sufficiency in food grains without imbalancing the eco-system of the region may be largely achieved through the policy of diversification of crops in place of mono-cultural activities.

**Varsha Vaid and V. S. Datye (1987)**: Examined influence of some selected variables on agricultural productivity of Maharashtra. Their hypothesis was the productivity is related to some socio-economic variables. This hypothesis is tested by applying correlation and multiple regression techniques. For the years taken into consideration (1961, 1966, 1972 and 1978) they have selected six variables. Authors used data for the period of 1960-61 to 1979-80. They select the following six dependent variables for the study.

- \( X_1 \) -- Bhatia's productivity index (Bhatia 1967).
- \( X_2 \) -- Shafi's modified productivity index (1983).
- \( X_3 \) -- Standard nutrition unit per hectare.
- \( X_4 \) -- Calories per head of total population.
- \( X_5 \) -- Money returns per hectare of crop land.
- \( X_6 \) -- Money returns per agricultural worker.
In 1961 and 1966 the explanatory independent variables were the following.

\[ X_7 \] -- Net irrigated area as a percentage of net sown area.
\[ X_8 \] -- Total annual rainfall in cm.
\[ X_9 \] -- Intensity of agriculture.
\[ X_{10} \] -- Area under non food crops as a percentage of gross cropped area.
\[ X_{11} \] -- Population density per Km²
\[ X_{12} \] -- Urban population as per percentage of total population.
\[ X_{13} \] -- Non agricultural population as a percentage of total population.
\[ X_{14} \] -- Rural literates as a percentage of total population.
\[ X_{15} \] -- No. of animal drawn carts per 100 hectares of net sown area.
\[ X_{16} \] -- No. of tractors per 100 hectares of net sown area.
\[ X_{17} \] -- No. of wooden ploughs per 100 hectares of net sown area.
\[ X_{18} \] -- No. of iron ploughs per 100 hectares of net sown area.

For the 1972 analysis the variables of size holding, tonnes of fertilizers, oil engines and electric pumps were added. Authors have calculated Pearson's product movement correlation co-efficient. Student's 't' test was applied to determine significant 't' value at 0.01 levels of significance.

In conclusion authors told that 'very high' and 'high' productivity regions have a correlation with higher agricultural inputs (high yielding varieties), hybrid varieties of seeds, fertilizers, irrigational facilities, size of holding, percentage of non-agricultural population and the amount of rainfall. These associations confirm to the known reality.

**Sharma S. K. and Jain Ajitkumar (1988)**: Examined diffusion of innovations in the cotton growing tract of Madhya Pradesh: A case study of pesticides. The study was based on farm survey of four district viz. Khargone, Khandwa, Dhar and Ratlam of the western Madhya Pradesh. The study of diffusion of innovations was entirely based on the first hand information collected through the structural questionnaire and interview method. Unlike
fertilizers and HYV, pesticides were sold in towns only. 27 villages were selected for the study.

This survey of cotton growers of the western Madhya Pradesh shows that the knowledge of agricultural innovations had percolated to them. But the channels of arrival of this knowledge and the extent of its utilization vary widely. The size of land holdings had been major determinants. Author found that the improved seeds were brought to the farmers by Government extension department and also by co-operative societies. But the case of pesticides was quite different. Delears of these chemical had came forward as major source of knowledge.

A. Bhatt and J. S. Rawat (1989)\textsuperscript{27} : Studied capacity of channel runoff in the agriculture central lesser Himalayan watersheds. Two micro watersheds with an area of 0.30 and 0.45 km\textsuperscript{2} in the Nana Rosi drainage basin, central lesser Himalayan were employed as natural laboratories for the investigation by the author. To monitor the channel runoff capacity a pigmy current meter was used. Water discharge was monitored in each month at the mouth of the experimental watersheds from Feb. 1986 to Jan. 1988. The rainfall data were obtained from the Daulaghat Meteorological Station for the period of 1986-87. Author found that on an average the agricultural land of the central lesser Himalaya has a capacity to generate water at the rate of 940 m\textsuperscript{3}/km\textsuperscript{2}/ day or 343107 m\textsuperscript{3}/km\textsuperscript{2} annually.

T. Penchalaish and Y. V. Ramanaiah (1992)\textsuperscript{28} : Studied the spatial analysis of rainfall in the drought prone area of Cuddapah district, Andhra Pradesh. In this study an attempt is made to describe the spatial distribution of rainfall, rainfall intensity, rainfall ratio, rainfall variability and rainfall frequency in Cuddapah district on seasonal and annual basis. Rainfall from 1901 to 1988 was taken for nine rain-guage stations for analysis.

Author found that the decadal analysis of rainfall intensity of the winter season was low intensity during 1931-40 and 1951-80. During summer season the decadal variation in rainfall intensity showed an increasing trend in 1910, 1920, 1940, 1950 and 1960. During south-west
monsoon period the trend analysis of intensity of rainfall indicated an increase during 1920, 1930 and 1960. During 1950 and 1970 the intensity of rainfall was low. The decadal analysis of co-efficient of variation of rainfall during winter period has showed higher variability values in the decades of 1910 and 1950. Author found that the values of co-efficient of variability of rainfall were comparatively low during summer period. Low rainfall ratio was noticed in 1920, 1930 and 1940. Moderate rainfall ratio values were found during 1950-70 while in 1980 the ratio value were high.

**Praveen Saptarshi, Parkhe Gulabrao (1993)**: Examined correlation between sugarcane and other crops in Junner tahsil: A micro level study. Authors were used secondary data for the period of 1980-81 to 1989-91. They have calculated correlation and regression between sugarcane and other crops like jowar, bajara, rice, wheat, pulses, fodder crops and oil seeds. Authors found that area under sugarcane has increased from 1980-81 to 1988-89 and due to increase in area under sugarcane agricultural cropping pattern has shown greater change.

**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 assess 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 assess the impact of irrigation on landuse, cropping intensity, cropping pattern as well as on agricultural efficiency by macro land micro level analysis.

Author has used linear regression technique for calculating trends and probability of rainfall in West Bengal. Impact of irrigation on landuse cropping intensity and crop yields have been depicted by the Pearsonian correlation co-efficient. She used Wilconxon ranked pair test to test the significance of change between 1960 to 1980. Author has not only carried out a comprehensive study of the irrigated farming now practiced in West Bengal but also undertaken an indepth analysis of irrigated agriculture in
selected villages of the state. The researcher has considered the problems not only from the physical point of view but also assessed the socio-economic aspects of the problem.

Author found that irrigation potential of West Bengal was not fully utilized. During the period of investigation only 36 percent of gross cropped area was availing irrigation facilities. Author has pointed out that the growth rate of irrigation during the period of 1995 was somewhat sluggish.

Sonwane B. G. (1998): Studied, agricultural transformation in Nanded district (M.S.) The entire work is divided into eight chapters. In first chapter he throws light on meaning of agriculture and agricultural geography, aims and objectives, methodology and review of literature. Second chapter deals with physical setting while third chapter is devoted to non-physical determinants of agriculture. Fourth chapter throws light on general landuse where as fifth chapter explains agricultural cropping pattern in the study region. Sixth chapter is dealt with production and productivity of the various crops while seventh chapter throws light on case study villages. In the last chapter author has draw some conclusions and he has suggested remedies to solve them.

Author has used primary and secondary data for the study. He has used data for the period of 1960-61 to 1991-92. For the study of population characteristics author has calculated various densities such as caloric density, nutritional densities, agricultural densities etc. He has calculated indices, moving averages, volume of change, correlation, regression, compound growth rate etc. for the study of trends of area under various crops, their production and productivity. He used Weaver’s and Doi’s methods for the calculation crop combination.

Author found various problems such as unequal distribution of rainfall, soil erosion, problem of high population pressure, lack of irrigation etc. He has given proper remedies to solve them. Author also found that there is transformation of agriculture from food crops to cash crops in the study region.
1.11 Chapter Scheme:

The present study is divided into eight chapters. In first chapter meaning of agriculture and agricultural geography, significance of the study of agricultural geography, the place of agriculture in the national economy, agricultural development in India, Maharashtra and Marathwada, choice of the region and topic, aims and objectives, data base and methodology and review of literature are considered.

Second chapter deals with location and boundary of the study region, historical background, physiography, drainage, climate, soils and natural vegetation. Third chapter throws light on irrigation, population, livestock, agricultural implements, use of chemical fertilizers, use of high yielding variety seeds, pesticides, primary credit societies, marketing and transport from the view point of their suitability for the development of agriculture.

Chapter fourth is devoted for the study of general landuse in Osmanabad district. In this chapter an attempt is made to study the concept of landuse, landuse classification, tahsilwise trends in general landuse pattern, tahsilwise net sown area, volume of change in landuse and landuse efficiency.

Chapter fifth deals with annual area variation of agricultural crops, index numbers of area of selected agricultural crops, changing cropping pattern 1970-71 to 1994-95, tahsilwise trends in area under different crops, crop combination, crop concentration and crop diversification in the study region. Chapter sixth throws light on growth of production in the region, tahsilwise trends of production and yield, variability in yields, trends of yield of selected crops, crop productivity and overall productivity.

As this is a good indicator of agricultural progress to reach to micro level analysis the agricultural scene in sample villages selected for the case studies from six tahsils have been scrutinised in the seventh chapter. Second part of the seventh chapter deals with agricultural development regions of the study region.

Chapter eight covers conclusions, agricultural problems of the study region and specific suggestions to solve them.
-: References :-


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