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 agriculture\(^1\). The word 'agriculture' comes from a Latin term 'Agricultura' which has its origin in the words 'ager' meaning a field and 'culta' meaning to culture or cultivate. Watson's Longman Modern English Dictionary (1976)\(^2\) defines the word agriculture as the 'science or the art or the practice of largescale soil cultivation' 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's\(^3\) 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."

'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 "geographie" 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 discription 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 'geonomo'. 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 agriculture 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. Furthermore, as a science it also seeks to identify, describe and classify the problems of agriculture against a geographical backdrop.4

Agricultural geography according to Hillman (1911)5 constitutes a comparative study of the agriculture of countries and continents. Bernhard (1915)6 attempts to justify the postulate that agricultural geography is concerned with bringing a light the regional variations in agriculture and the factors responsible for them. Reeds (1964)7 however, sums up by saying that agricultural geography seeks to describe and explain regional differentiations and interrelationships on the basis of agricultural characteristics. Furthermore, agricultural geography is defined by Andreae (1981)8 as the science of the agriculturally transformed earth’s surface, with all its associated natural economic and social interrelationship as reflected spatially.

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. In agricultural geography, facts are arranged in an orderly manner. Each investigation involves four stages (i) Identification of the problem (ii) Collection of relevant data, (iii) Formulation of Hypothesis and (iv) Testing and modification of the hypothesis to provide an adequate explanation (coppock 1969)9

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 villagers suffer both from under nutrition and mal-nutrition. 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 highlight 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 structured areas and their natural, economic and social relationship and organisations as reflected spatially. Such agricultural geographic studies are necessary for any transformation activity of man, particularly for planning and development purposes.

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 lookout 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 and
(vii) The numerous other specialists.

1.3 The place of agriculture in the national Economy:

Agriculture forms the backbone of the Indian economy and despite concerned industrialisation in the last four decades, agriculture occupies a place of pride. Being the largest industry in the country, agriculture is the source of livelihood for over 70 percent of population in the country.

Figures supplied by the National Income Committee and Central Statistical Organisation show clearly that agriculture contributed 57 percent of the national income in 1950-51 but contributed now around 32 percent of the national income. Two important facts must be emphasised here firstly, agriculture contributes even now a major share of the national income in India. Secondly, the share of agriculture in national income, however, has been decreasing continuously and the shares of the manufacturing and service sectors are increasing.

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 percent of the national income, in U.S.A. it is 3 percent, in Canada it is 4 percent, in Australia it is 5 percent 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 in the country. Agriculture dominates the economy to such extent that a very high proportion of working population in India is engaged in agriculture. According to human development report figures, between 62 percent of India's working population is engaged in agriculture. But in the United Kingdom and United States, only 2 to 3 percent of the working population is engaged in agriculture, in France the proportion is about 7 percent and in Australia, this is about 6 percent. It is only in backward and less developed
countries that the working population engaged in agriculture is quite high. For instance, it is 93% in Nepal, 92% in Burundi, 93% in Angola, 75% in Somalia, 67% in Vietnam and 73% in China.

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 depends 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 growing down as many more industries have come up which are not dependent on agriculture. Under the five year plans, iron and steel industry, chemical machine tools and other engineering industries, air craft 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. constitutes the main items of export of India. Broadly speaking the proportion of agricultural goods which are exported may account to 50% 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 export\textsuperscript{13}. This has great significance for economic development of the country.

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 of their business from the movement of agricultural goods. Internal trade is mostly in agricultural products. Further, goods 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 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.

1.4 Agricultural development in India:

With the introduction of economic planning in 1950-51 and with the special emphasis on agricultural development particularly after 1962, the previous trend of stagnant agricultural was reversed: (i) There was steady increase in area under cultivation, (ii) There was a steady rise in average yield per hectare or rise in agricultural productivity and (iii) as a result of the increase in area as well as increase in yield per hectare, total production of all crops recorded a rising trend. Area under all foodgrains increased from 23 million hectares to 40 million hectares between 1949-50 to 1994-95. During the post-green revolution period (1968-95) the annual area growth rate was quite low: (all crops 0.3%) foodgrains 1.2% and Non-food grains 0.7%.

During the period 1968-94, the increase in area under rice was only by 11 percent while the area under wheat rose by 77%. As a result, the annual rate of growth of area under rice was a mere 0.5%, while it was 2.2% wheat. The extention of area under wheat was clearly due to the introduction of bio-chemical technology, but it was the expense of coarse cereals and pulses. There has been a shift in cropping pattern between the two periods. The share of wheat in the total cropped area had gone up from 8.5% to 13.7%; and the share of wheat in irrigated area had gone up from 15% to 38%.

Under nonfood grains, spectacular progress was achieved by potatoes (increase in acreage during this period was by 175% and annual growth rate was 3.9%) and plantation crops (increase acreages by 67%).

With the extension of irrigation and application of intensive methods of cultivation and after the introduction of modern agricultural practices including the adoption of hybrid seeds, there has been a steady and continuous
increase in yield per hectare of all crops. During the pre-green revolution period, rice recorded the most impressive growth rate in yield from 700 kg per hectare in 1949-50 to nearly 1100 kgs by 1964-65. It was increased upto 1920 kgs in 1994-95. The yield of wheat increased from 660 kgs to 2550 k.g. from 1949-50 to 1994-95. The yield of oilseeds increased from 520 k.g. to 850 k.g. from 1949-50 to 1994-95. Monsoon and weather conditions affect average yield per hectare, and therefore, the variation in the yield per hectare reflect not only the effects of improved agricultural techniques but also of the effects of natural factors.

All the five year plans have given considerable importance to the creation of additional irrigation potential. The first five year plan devoted as much as 25% of the total plan (Rs. 450 crores) outlay on irrigation and added 3 million hectares of irrigation potential. Generally, however, between 11 to 12% of the plan outlay has been used on the creation of irrigation potential ranging from 5 to 10 million hectares. During seventh plan Rs. 17530 crores was allotted to the creation of irrigation potential. At the commencement of the Eighth plan in 1992, there were 158 major, 226 medium and 95 Extension, Renovation and modernisation projects carried forward from the previous plans.

Since the adoption of the New Agricultural strategy in the sixties, the consumption of chemical fertilizers has been growing rapidly. During 1951-52 about 70 thousand metric tonnes chemical fertilizers were used in India. During 1995-96 one crores fifty seven metric tonne's chemical fertilizers were used in India. Consumption of chemical fertilizers in India per hectare was 70 kgs in 1995-96. The corresponding figures for some developed countries were: South Korea (400 kgs) Netherland (275 kgs) Belgium (225 kgs) and Japan (340 kgs). Dispite significant improvement since 1950-51 per hectare fertilizer consumption is still very low in India.

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 im-
proved agricultural implements, adoption of scientific practices etc. India has made agricultural progress through five year plans.

The increasing pressure of population on land and rapid industrial development demand greater agricultural production in the country. Agricultural land is very limited resource where as it still plays a significant role in the economy of the country. The greatest problem before India is the decreasing man-land ratio. In such a critical condition land must be properly surveyed and used intensively to its full capacity to maintain the balance between demand and supply of the growing 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 corners 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 third five year plan Rs. 62.34 crores were spent on the development of agriculture in the state of Maharashtra. During fourth five year plain 196 crores were spent on agriculture and allied services. During seventh five year plan about Rs. 614 crores and in Eighth Five year plan about Rs. 1750 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 increases 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 991 matric tonne's chemical fer-
tilizers were used for agriculture while in 1994-95 about 11.94 lakh metric
tonne's chemical fertilizers were used in Maharashtra. It mean that consump-
tion of chemical fertilizer was increased by 1205 times from 1961-62 to 1994-
95 in Maharashtra state. Cereals production was increased from 67 lakh met-
ric tonnes to 98 lakh metric tonne's in Maharashtra. Pulses production was
increased from 3.86 lakh metric tonne's to 7.1 lakh metric tonne's where as
sugarcane production was increased from 116 lakh metric tonnes to 443 lakh
metric tonnes from 1960-61 to 1994-95. Cotton production increased from
17 lakh bales to 23.6 lakh bales from 1960-61 to 1994-95. Total oil seeds
production increased from 6.4 lakh metric tonne's to 18.4 lakh metric tonnes
during the period of thirty five year (1960-1995). The western part of
Maharashtra particularly district of Sangli, Kolhapur, Satara, Ahmednagar,
Solapur have made good progress in agricultural sector.

1.6 Choice of the region and topic:

The choice of the area and the topic under investigation has been influ-
enced by several considerations :-- Firstly, Marathwada region comprising
seven districts & fifty nine Tahsils of Maharashtra State has a significant
location on Maharashtra plateau. Except Ajanta range, Balaghat range, Mahur
range, Jintur range, Nirmal range, the majority part of the region comes un-
der plateau and river basins. Hilly ranges are not useful for agricultural
activities. The region under study has a major proton under flat topography,
hence it support to high concentration of agriculture. As a result, these
characteristics make this region a district physical entity and homogenous
unit for geographical investigation.

Secondly, there are 7994 villages in this region. Vaijapur, Gangapur,
Kannad, Khultabad, Aurangabad, Ambejogai, Paithan, Ambed, Georai, Ashti,
Patoda, Beed, Kaji, Dharur, Ahmedpure, Parenda, Omerga, Bhum, Kallam,
Osmanabad, Ausa, Nilanga, Udgar, Latur and Tuljapur tahsils comes under
the jurisdiction of drought prone area. There is uneven distribution of rain-
fall in the Marathwada region.

Thirdly, Marathwada is one of the most backward region of Maharashtra
State. Marathwada 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 64.79% medium black soil, 12.95% deep black soil and 22.26% coarse and shallow soils. It means that soils are very rich for the development of agriculture in this area. Fifthly out of the total geographical area about 83.5% area was agricultural land during 1990-95 but only 73.83% area was under cultivation. Agricultural land varies from 77.09% to 90% in the districts of Marathwada region. About 69% to 77% areas was under cultivation in Aurangabad, Jalna, Beed, Parbhani, Nanded, Latur and Osmanabad districts during 1990-95. It means that there is a scope to increase agricultural land in the districts of Marathwada region. The pressure of population on agricultural land was more in 1991. During 1991 the per capita cultivated land was only 0.37 hectare. It varies from 0.30 hectare to 0.45 hectare from district to district.

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 motivated the author to turn his attention to this region and its agricultural geography.

1.7 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 asses the effect of use of mechanical and bio-chemical inputs on
agriculture.

5. To study the role of non physical determinant's 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 findout agricultural productivity and its variation in the study region.

9. To study landuse and cropping pattern of selected villages and markout the agricultural regions of the study area.

10. To draw conclusions, and findout the agricultural problems and suggest suitable remedies to solve them.

1.8 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 1994-95 comes both from primary and secondary sources. The primary data is the raw data collected through different sources for which special questionnaries were designed and information collected through various offices and farmers. Questionnaires were used for the data collection of sample villages of seven districts. It was not possible to select various villages from every district, there fore only two villages from every district were selected for the study.

The broad picture of 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 censuses handbooks, Gazetteers, Agricultural Epitomes, Periodicals, Season and Crop Reports published by the department of Agriculture. Data regarding consumption of fertilizers, High Yielding Varieties, pesticides were obtained from zilla parishad offices of seven districts. For micro-study two village from every district were selected. Same criteria was applied in the case of selected villages. A micro level study includes plot to plot survey of the land, cover-
ing information of relevant aspects such as sources of irrigation, area under various crops, general landuse, population, livestock 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 discretion 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 density 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 heactares namely 0.4047 heactare. 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 1990-95 are used. Percentage of area under each category of land to the geographical area is computed. For studing the landuse efficiency the index of landuse efficiency is calculated by dividing gross cropped area by net sown area into hundred. For studing the changes in cropping pattern annual area variation of agricultural crops are calculated only for the 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 agricultural crops are calculated by selecting
1970-71 as a base year for the study of trends of area under selected crops in the region. District level trends in area under different crops are also studied. For the study of trends in area at district level the five years average data for the years 1970-75 and 1990-95 are used. For the study of trends in area at district level compound growth rate is calculated. Weavers and Dio'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 indices.

Annual average trend rates of production Judged by three years 1970-71 to 1972-73 and 1992-93 to 1994-95 to selected crops of the district. Annual rates of growth of output of selected crops in Marathwada region from 1970-71 to 1994-95 are calculated for the study of trends in production in the region. The indices of production of selected crops is also computed for the study of trends of production in the region from 1970-71 to 1994-95 (base year 1970-71). For the study of trends of some selected crops compound growth rate is calculated (from 1970-71 to 1994-95). For the study of districtwise production trends from 1970-71 to 1994-95 the five years average data for the years 1970-75 and 1990-95 are used. For the study of trends in yields of selected agricultural crops indices are computed. The co-efficient of variation is computed for the study of variability in yields of the selected crops. For the study of trends in yield from 1970-75 to 1994-95 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 etal (1982) is used.

1.9 Review of literature :

R. B. Mandal (1969) has elaborated the Weaver's method in analysing crop combination region with special reference to North Bihar. He has studied various crops of North Bihar. He used Weavers 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 from maps showing the surface configuration of the area and the area under commands of cannals 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 extention of cannals and small irrigation projects in the area.

Ali Mohammed (1975): Studied Agricultural land use 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, soil) of the region with a view bringing out the extent of influence of these factors on the existing crop-land use. 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 land use 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 perday 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 or surplus of these elements and the resulting nutritional deficiency diseases. The work is based on a direct survey of the sample households chosen on the basis of economic strata of the household. The work provides a few suggest for the future development of agriculture and standard of living in the region as in all the villages unbalanced nutrition has played an adverse role to bring about numerous among the rural population and means.

**Dayaram (1977)**: Analyzed 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 coefficient of monthly rainfall, seasonal rainfall, relative variability of monthly water-balance, correlation coefficient of rainfall and crop maturity and correlation coefficient 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 clusterbean than cotton-desi in kharif season. In the rabi 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)**: 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) 21: 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 indentity 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. The scope for physical expansion of arable 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 find out the volume of landuse change. The districtwise indices were classified into three categories 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. Whatever land is available for cultivation has already been brought under the plough. Extensive areas of the two hill districts are not suitable for cultivation due to unfavourable terrain character. Numerous rivers with thier ever-shifting courses, bils, swamps, deep forests and scattered hollocks have rendered a large proportion of land in the plains districts unsuitable for growing crops. The first hypothesis was proved valid, he suggest that the main emphasis should, therefore, be laid on intensification of agriculture to increase the productivity on the existing culturable area in the coming decades.
V. S. Datye and S.C. Gupte (1984)\textsuperscript{22} : Studied Association between Agricultural land use and physico-socio-economic phenomena. A multivariate approach. In this paper an attempt is made the explain how and to what extent do the factors of physico-socio-economic environment influence the agricultural land use in poona district. In order to investigate the association between land use types on one hand and physio-cultural elements on the other hand. The fourteen variables like net sown area, gross cropped area, rice, jower, bajara, cash crops, irrigated area, accesibility, owner cultivators, density of population, slope less than 3\textdegree, slope greater than 20\textdegree, 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 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 land use. The principle component analysis also has brought out these relationships more clearly defining seven dimensions of land use 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)\textsuperscript{23} : Studied Irrigation requirements and development in Maharashtra. They were selected three objectives for the study viz. (1) to develop a method by which to quantity 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 depend upon three basic factor 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 cul-
tivated area, greater is need for irrigation facilities. The equation was de-
prived in such a way that it gave a lowest index for areas of minimum re-
quirement and a highest one for the areas of maximum requirement. Authors 
have used the following equation for the study.

\[ Pr \times Ac = In \]

\[ R \]

where

- \( In \) = Irrigation need of the area.
- \( Pr \) = \% of rural population.
- \( Ac \) = Percentage of cultivated area of the areal unit.
- \( R \) = 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 high-
est priority for irrigation development.

Dube R. S. (1984) \(^{24}\) : Examined, Agicultural productivity in Madhya 
Pradesh. This paper Present an interpretative study of the regional variations 
and emergent trends of the agricultural productivity in Madhya Pradesh. Four 
indices have been chosen crop yield index (yang 1965), population support-
ing capacity of farmland (stamp, 1940, shaffi 1960) and price weighted pro-
ductivity index viz. productivity per hectare, (Nangia etal 1967) and product-
tivity per worker (yates 1960). Author used kendall's ranking method for 
regionalisation of the productivity. The emerging productivity patterns have 
been correlated by making use of the spearman's ranking correlation coeffi-
cient method for identifying inter district variations in the level of agricul-
tural development and those of social well being for obtaining an under-
standing of the socio-conomic constraints of the productivity. Kendll's method 
has also been used to ascertain the level of agricultural development for this
evaluation author used irrigation, fertilizers, tubewells, irrigation pumps and tractors as developmental imputs. The level of social well being has been identified on the basis of the average value of 2 scores for the districts in respet of the education, health, economy the living environment, social order. Author identified six productivity region's of madhya pradesh. They are (i) The malwa plateau. (2) The Bundelkhand upland (3) The Narmada valley (4) The Vindyachal Baghelkhand region (5) The Madhya Bharat plateau and (6) The Chhattisgarh region.

He found that the high productivity areas in the state are generally associated with the valleys and upland plains of madhya Bharat plateau the malwa plateau and the southern part of chhattisgarh region. The low productivity areas are generally extended into hilly and dissected areas of the stage.

**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 tube wells hold potential for agriculture. In over cannal irrigated areas like Punjab, Pumpset 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)**: Examined, farm power and productivity in Indian agriculture. The paper makes an attempt to examine the productivity of India agriculture, deviating remtraditional 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 terms 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.

**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 districts 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 questionnarie and interview method. Unlike fertilizers and Hyv, pesticides were sold in tonnes 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 formers by government extention department and also by co-operative societies. But the case of pesticides was quite different. Delears of these chamilical had came foward as major source of knowledge.

**A Bhatt and J. S. Rawat (1989)**: Studied capacity of channel ruoff in the agriculture central lesser Himalayan Watersheds. Two micro watersheds with an area of 0.30 and 0.45 km² in the Nana Kosi 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 month of the experimental watersheds from February 1986 to January 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 m³/ km²/day or 343107 m³/km² annually.

**T. Penchalaiah and Y. V. Ramanaiah (1992)**: Studied the spatial analysis of rainfall in the drought prone area of cuddapah district, Andara
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-gauge stations and analysed.

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 southwest 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 rating was noticed in 1920, 1930 and 1940. Moderate rainfall ratio values were found during 1950-70 while in 1980 the ratio values were high.

**Praveen Saptarshi, Parkhe Gulabrao (1993)**: Examined correlation between sugarcane and other crops in Junnar tahsil: A micro level study. Author's 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 jower, 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 pearsons correlation coefficient. 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 village 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 the 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.

**Budhavant P. R. (1997)**: Studied, critical study of Agricultural development in Solapur District (M.S.). The entire work is divided into eight chapter's. In first chapter he throws light on meaning of agriculture and agricultural geography, aims and objectives, methology and review of literature. Second chapter deals with physical setting while third chapter is devoted to non-physical determinat's of agriculture. Fourth chapter throws light on general landuse where as fifth chapter explains agricultural cropping pattern in the study region. Sixth chapter is deals with production and productivity of the various corps while seventh chapter throws light on case study villages. In the last chapter author has drawn some 85 concusions and he has pointed out some agricultural problems. He also suggest proper remedies to solve the agricultural problems.

Author has used primary and secondry data for the study. Secondary data is colleted regarding general landuse, agricultural land use, agricultural inputs, population, irigetion etc for the period of 1960-61 to 1991-92. For the study of population characteristics author has calculated various densi-
ties such as agricultural density, caloric density, Nutritional density and he has also calculated population pressure on land. 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, production and yields of various crops. He also used weaver's and doi's method for crop combination.

Author found various problems such as unequal of rainfall, soil erosion, problems of saline and alkaline soils, high population pressure on land, lack of irrigation, problem of old machinery, problem of seeds, chemical fertilizers, marketing, problem of bumper sugarcane production etc. He has given proper remedies to solve them. Author found that the index numbers of crops like bajara, Jowar, total cereals, other pulses, cotton, groundnut, drugs and narcotics were fall to the tremendous extent from 1960-61 to 1991-92.

Author found that out of the selected thirteen crops, six crops like wheat, Jowar, Maize, gram, sugarcane and ground have shown 0.67% to 6.24% compound growth rates during the period of investigation. Other crops have shown negative compound (0.92% to 5.31) growth rates in their production from 1960-61 to 1991-92. Author found high level of agricultural development in Malshiras, Pandharpur, Mohol and Mangalweda whereas low level development was found in North Solapur, Madha and Karmala tahsils.

1.10 Chapter Scheme:

The present study is divided into eight chapters. In first, meaning of agriculture agricultural geography, place of agriculture in National economy, agricultural development in India, place of agriculture in state economy, choice of the region, aims and objectives, data base and methodology, review of literature and chapter scheme.

Second chapter deals with location and boundaries 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 varieties, pesticides, marketing and transport from the view point of their suit-
ability for the development of agriculture. Chapter fourth is devoted for the study of general landuse in Marathwada region. In this chapter an attempt is made to study the concept of landuse, landuse clasification, districtwise trends in general landuse pattern, districtwise 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 croping pattern 1970-71 to 1994-95, districtwise trends in area under difference crops, crop combination, crop concentration and crop diversification in the study region. Chapter sixth throws light on growth of production in the region, distritwise 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 microlevel analysis the agricultural scene in sample villages selected for the case studies from seven districts have been scrutinised in the seventh chapter. Second part of the seventh chapter with agricultural development regions of the region.

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

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