PART I

CHAPTER I

CONCEPTUAL FRAME OF AGRICULTURAL GEOGRAPHY
The Agricultural Geography: Its Content and Scope:

Etymologically agricultural geography means the art of cultivation of soil with reference to natural environment and human circumstances. As a science agricultural geography is concerned with the formulation and testing of hypothesis, interpretation of spatial distribution and location of various characteristics of agricultural activities on the surface of the earth and measurement of geographic relationships.

Further as a science it also seeks to identify, describe and clarify the problems of agriculture against the geographic background. Geographers with their usual training and background do cover in their fold the multidimensional facets of the ever widening and interdisciplinary field of agriculture. Agriculture falls within geographic studies not only because of its structural and spatial characteristics but also with its taxonomic character. These have attracted attention of geographers particularly when the tools and technologies have been sharpened recently. Like any other specialist geographers
are also much interested in studying various aspects of agriculture at macro, meso and micro levels. Over the last few decades agricultural geography like any other specialised branch of geography has quite apparently acquired a stable position and has also attracted numerous geographers. The specialists have gradually developed the subject matter of agriculture geography more and more with the help of sophisticated and dependable tools of investigation and analysis. Agriculture geography as a branch of economic geography has its emphasis on the spatial pattern of agricultural activities as well as on the nature of relationships between agricultural activities and biological, economic and cultural elements that influence those activities. In fact these relationships are very complex in nature. Agricultural pursuits as a way of living and as the low source of human energy invites geographers to keep it in the forefront of geographical research. Now, the field of geography is changing from the inventory, narrative and descriptive to an analytical, quantitative, interdisciplinary and predictive science of any item distributed over the surface of the earth. Similarly the agricultural geography has also changed from the inventory to a predictive science of crops and livestock and forecasts about their trend.
Content and Scope of Agricultural Geography:

Agriculture includes land devoted to the production of cultivated plants, crops and rearing of livestock. However, some writers restrict the term agriculture to the growing of crops alone. As such the scope of agriculture geography includes regional agricultural analysis, food and commercial crops, agricultural problems and planning, the ownership of agricultural land, agroclimatology, classification of agricultural region, land conservation, crop combination, crop diversification, crop concentration, agricultural productivity and efficiency, levels of agricultural development and ultimately supply of food in relation to population growth (refer to "model of synoptic view of systematic interrelationship between allied sciences").

The concept of agriculture geography is usually based on following ideas of agricultural economics:

1) The use of resources of environment, space, time, energy, property, goods, techniques and information,

2) The choice of alternative enterprises, farming systems and methods of agricultural practices, transport network and market behaviour of agricultural goods,
MODEL OF SYNOPTIC VIEW OF SYSTEMATIC INTERRELATIONSHIP BETWEEN ALLIED SCIENCES

A synoptic view of the systematic interrelationships among agricultural disciplines vis-a-vis agricultural geography.

Growth Factors of Crop Production
- Crop genetics and breeding
- Crop structures and their functions
- Crop diseases and pests (phyto-pathology)

Agronomic Factors of Crop Production
- Seeds and fertilizers (bio-chemical techniques)
- Man, livestock and mechanical power (bio-mechanical force)
- Crop protection, crop sequence, etc.

Soil Environment of Crop Production
- Soil science, crop-nutrition, soil productivity and potentiality, etc.

Economic Factors of Crop Production
- Land economics (land utilization, land improvement, and land reforms), farm management, and marketing

Geographic Factors and Geography of Crop Production
- Distribution, concentration, diversification, crop combination, etc.
- Geographic relationships and changes therein (spatial and dynamic aspects)

Agricultural Sciences

Crop Production

Agronomy and Agricultural Economics

Agricultural Geography
3) The scarcity of land resources or agricultural commodity on a particular space and time which provides an opportunity for an individual farmer to make the best use of what he has,

4) The exchange of agricultural goods and landed property rights which play an important role in subsistence agricultural economy.

5) Improving the quality of agricultural land.

With the help of these ideas agricultural geographers are studying on two levels:

1) They have been interested in the roads, barren fields, soil characteristics, farms, availability of water, fertilizer, irrigation, cultivation and production of individual crop, marketing of agricultural goods and livestock rearing.

2) Geographers have been concerned with the functional relationships of these structures that give rise to the complex and dynamic character in agricultural practices. Under these two levels of agricultural studies the principles of agricultural geography are (i) Principles of comparative advantage, (ii) Law of diminishing returns (iii) Principles of economic rent,

The Aims and Objectives of Agricultural Geography:

1) To know how different kinds of agricultural systems are distributed over a region and how they function with special arrangements.

2) To understand how particular types of agriculture have developed in a particular area and how they are similar or dissimilar to farming in other areas.

3) To analyse the different systems of farming and their operations and also to know the changes that they undergo.

4) To highlight the volume and direction of the changes (1975-76 and 1985-86) in agriculture of a region.

5) To demarcate the crop regions with reference to crop production and combination or the system of agricultural enterprise.

6) To measure and examine the causes for the levels of agricultural development and the disparities.
7) To identify weaker areas of agricultural productivity and efficiency and
8) To delimit the areas of agricultural stagnation, transition and dynamism. All these fall within the scope of agricultural geography.

One of the biggest established themes in agricultural geography is the study and analysis of agricultural regions. In this regard the work of Whittlesey (1930) is well known. Among the various fields of geography, economic geography, perhaps, more than any other, has experienced and undergone a remarkable change within the past 30 years. "Geography was tended in the past to be the descriptive rather than analytical". Today agriculturists and agronomists are increasingly concerned with the worldwide distribution of crops, animals, types of rural economy and the problems associated with them. Gregor opines that it was only at the end of the eighteenth century that geographic literature on agriculture began to be seen. In the same period Arthur Young of England and J.N.

Schwerz of Germany also thought on the same lines as Gregor contributed significantly to the literature on agriculture. Gregor calls it as old subject and Young field. Combining of crops and other parts of areal agricultural complex is reflected by the use of the word "Painting" by Alexander Von Humboldt in 1807 refers to the 'Natural Paintings' of tropical lands. Serious discussions on the nature of agricultural geography were to await the present century and heralded by Krzymowski's article on the "Scientific Position of Agricultural Geography" in 1911. By 1933, agricultural geographic writings had increased to the point of encouraging Leo Waibel to become the first geographer to devote methodological work to the "problems of agricultural geography". T.H. Engelbrecht (1885) and a host of other young geographers from the U.S.A. and north-western European countries have contributed substantially to the themes.

of agricultural geography. J.H. Von Thunen's (1825) work of isolated farm which was an agricultural location theory was published in German in 1825 but it was not available to the English speaking world till 1960. The works of other distinguished geographers like O. Jonasson (1925), O.E. Baker (1926), L.D. Stamp (1931), D. Whittlesey (1935), J.C. Weaver (1954), Birch, J.W. (1954), Evans, E.E. (1962),

Chisholm, M. (1962), Coppock, J.T. (1964), Kostrowiki (1965), and many others have given dimensions to agricultural geography. In addition to these geographers the following other geographers have also contributed much towards the development of agricultural geography: Hettner, A. (1905), Schluter, O. (1906), Bernhard, H. (1915), Buchanan R.O. (1935), Cholley, A. (1946), Harvey, D.W. (1966) and Reeds, L.G. (1972).

They have not only covered the thematic aspects but also the various salient features of the subject ranging from concept, definition and methodology to the behavioural system and type of general pattern of distribution from macro to micro scales and from hunting to well developed agricultural economy.

Agriculture in India:

Though agriculture in India is basic occupation of more than 70 per cent of the working population of the country, it has been continued in its old traditional form except by a few enlightened farmers and in the irrigated tracts. After the independence of the country in 1947, national development through five year plans launched agricultural development, but the effects were not felt till 1960. Only after 1960 did the country realise that it could get away from the traditional way of agriculture. It was also realised that economic development is not possible unless there is agriculture development. Hence new scientific and technological methods and also mechanisations (wherever possible) began to be applied in agricultural operations. The green revolution in the late 1970's through high yielding varieties of seeds enforced the development of agriculture in India. "Agriculture has an important
role to play in the present stage of the development of economy in India. Though its performance has set a stride in the growth of the economy as a whole, the agricultural sector has been much below its potentials and bearly sufficient to meet the population growth. The green revolution in 1960's and the associated diversification and also the development in Indian agriculture have their relations in agricultural geography as well. The interest of Indian agricultural geographers now goes much beyond the static landuse studies of the earlier times. The themes have very much diversified. Geographers now take greater interest in regional disparities in agricultural development, crop productivity, agricultural income, agricultural infrastructure etc.

The studies on agricultural geography of Karnataka in general and its districts in particular are rarely seen. But so far no comprehensive and exclusive efforts are made towards valuating the agricultural geography of semi-arid and moderately wet area like Dharwad district. Therefore, the present thesis is an objective of spatio-temporal analysis of agricultural geography of Dharwad district.

Indian agriculture as is well known has undergone a revolutionary change in recent years. Agricultural production has increased substantially and the cropping pattern in many areas have witnessed significant structural changes. There are certain districts/river basins/zones that are highly developed in agriculture and some are moderate and still many are very poor in agricultural development. It is this spatial variation which makes geographers to probe the problems. Statistics do not always reveal a complete picture in qualitative terms, but they do indicate, in this context at least, the great strides made with regard to agricultural production in India during the last twenty to thirty years. It is interesting to note that food grain production increased by more than two-fold from 50 million tonnes in 1950-51 to 150 million tonnes in 1983-88 and 160 million tonnes by 1988.

Ever since geography developed as an academic discipline, agriculture has always been a popular theme of geographic studies in India. The early files of the Indian Geographical Journal, the first professional journal in the country, reveals extensive interest of Indian geographers in the spatial pattern

of agricultural activities as early as 1920s. The organisation of the Madras Geographical Association, the fore-runner of the Indian Geographical Society in 1925 and the establishment of University Departments of Aligarh (1931), Madras (1932), Calcutta (1941) and B.H. University Varanasi (1946) have fillip to investigations on agricultural themes. Crop contribution, ecological adaptations, irrigation development, land use and cropping pattern, yields of crops, livestock and various other facets of agricultural economy have received attention of the scholars in increasing measures. The latest review of research in geography bears the level of diversity of themes. Regional studies of Indian Agriculture at macro, meso and micro levels claim more than 39 per cent of the research papers. Agricultural problems and planning account for 18 per cent, agricultural typology and regionalisation 12 per cent and land use and land capability surveys 15 per cent. Although commodity studies have been given maximum attention in yester years, only about 15 per cent of research articles are available in this respect. Attention is paid now to research methodology in agricultural geography. As a matter of fact the level of quantification is the highest in case of agricultural geography as compared to other branches in India.

Apart from the Universities a number of scientific organisations have been engaged in research on agricultural
geography, National Atlas Organisation, Indian Statistical Institute and Central Arid Research Institute, National Atlas and Thematic Mapping Organisation, Calcutta, established in 1956 have brought a number of thematic maps on Indian agriculture. The Atlas of agricultural resources of India (36 plates) and Irrigation Atlas of India (35 plates), incorporate voluminous information on agricultural resource of the country. The Regional Survey Unit of Indian Statistical Institute started in 1956 did the studies of spatial patterns of agricultural land use planning under the leadership of Bhat, L.S., were also taken up. The Central Arid Zone Research Institute Jodhpur has conducted useful studies on land use and agriculture in the arid and semi-arid tracts of Rajasthan. Recently the NRSA at Hyderabad under the leadership of N.C. Gautam and L.R.A., Narayan has also contributed for the development of waste land and agriculture.

**Analytical Approach Towards the Study:**

Land resource play a strategic role in determining man's economic, social and cultural progress as it is evident from the socio-economic history of different nations. Among the land resources, agricultural land resource has played a vital role since time immemorial engaging larger percentage
of inhabitants of the world. It is the duty of the planners in general and agricultural geographer in particular to study the land characteristics in respect of various natural aspects and to suggest the land use under defined management practices for its sustained utilisation. It requires an exhaustive land use survey including all its important elements and decisive socio-economic factors of land utilisation.\footnote{Dziewonski, K., (1959): "Detailed Survey of Land Utilisation in Poland", Proceedings of International Geography Seminar, 1957, Aligarh.}

Information on the rate and kind of change in the use of land resources is essential to the proper planning, management and regulation of the use of such resources. Knowledge about such existing land use and trends of change is essential if the nation is to tackle the problems associated with haphazard and uncontrolled growth. A systematic framework is needed for updating land use and land cover maps that will be timely, relatively inexpensive and appropriate for different needs at national and State levels. The rapidly developing technology of remote sensing offers an efficient and timely approach to the mapping and collection of basic land use and land cover data over large areas. The land-sat imageries are potentially
more amenable to digital processing because the remote sensor output can be obtained in digital format as a more expedient means to map land use and land cover. "Land use data are needed in the analysis of environmental processes and problems that must be understood if living conditions and standards are to be improved / maintained at current level".  

Aims of Classification:

The major aim of the land-use classification system is to provide a frame as broad as possible and would cover all the possible types of land use within the country that could be mapped within certain limitations. The second objective is to see the applicability of land-sat data for delineating various land use, land cover categories through computer analysis as well as visual interpretation technique. The third objective of this classification is to provide standardised land use classification system which is compatible with the present land use classification and which can be used with the satellite imagery available in India at present.

Today, the foremost challenges facing the world in general and India in particular are the appelling increase in population and a corresponding upsurge in demand for food. Food shortage is primarily due to insufficient production of food grains despite the best efforts to enhance the same. The causes are not far to seek. They are unfavourable weather conditions, socio-economic constraints and orthodox methods of farming which together stand in the way of successful application of new farm technology which accelerates farm production. Such constraints inevitably create regional imbalances in the levels of food productivity.

Agricultural productivity is frequently associated with the attitude of farmers towards work, thrift, industriousness and aspirations for higher standards of living. The spatial variations in physical output from the soils are the result partly of natural circumstances and partly of human manipulations of the land resources. The regional differences in yields per unit area indicate the magnitude and the direction of the interplay of a multitude of factor. Furthermore, the level of agricultural productivity is a dynamic concept as any modification in physical and improvement in non-physical factors affect agricultural 'productkunde' per hectare. Hence,
measurement and evaluation of agricultural productivity form basis for planning, evaluating and taking appropriate measures for improving productivity at various levels.

The following are the different techniques adopted for computing the agricultural productivity and efficiency per unit area, or per unit of farm work force, etc.:  

1. Assessing the value of agricultural production per unit area.  
2. Measuring production per unit of farm labourer and man-hour.  
3. Determining output in relation to input or output-input ratio (Khusro, 1964).  
4. Expressing production of agriculture in terms of grain equivalents per head of population, Buck, E.DeVries, Clark and Haswell, (1967).  
5. Considering output per unit area or yields per hectare after grading them in ranking order and thereby deriving the ranking coefficient (Kendall, 1939, Stamp and Shafi, 1960).  
6. Giving weightage to the ranking order of the output per unit area with the percentage share under cash crops(Sapre and Deshpande, 1964, Batia, 1967).
7. Using the carrying capacity of land in terms of population (Stamp, 1958, 1967).


9. Calculating the index numbers of agricultural efficiency by expressing the per unit area carrying capacity (in terms of population) of the component enumeration unit as a percentage of the per unit area carrying capacity of the entire region (Jasbir Singh, 1972, 1974).


11. Involving the area, production and price of each cultivated crop in each of the constituent areal unit of the region and then relating the output in terms of money value of the unit to the corresponding productivity of the region (Hussain, 1975).

12. Delimiting agricultural productivity by computing the intensity and spread indices of three variables i.e., (i) yield, (ii) grain equivalents and (iii) cropping system (Singh, V.R. 1979).
Assessing net income (farm business income) in rupee per hectare of cropped area or per adult-male unit of farm family work force (Jasbir Singh et al., 1982).

Often the term 'agricultural productivity and agricultural efficiency' are used synonymously. In a broad sense, these two terms may be perhaps equated but, there is a subtle difference between them in their profundity as is noted in the respective chapter of the thesis. After considering the merits and demerits of all the above methods, Kendall, Sapre and Deshpande, Ganguli, Singh Jasbir, Yang's, per capita/per hectare yield of agricultural worker, Dayal Edision's labour and price index method and Bhatia's methods have been studied for agricultural productivity. Since Bhatia's method is a modification over other methods the results of his method are analysed in detail. Weighted and transformed standard score method is used to find-out the agricultural efficiency. The results of the method which suit the most to the environmental setting of the district are analysed in detail.

Agricultural development is a fascinating field of study in geography. The geographer's role lies primarily in identification, description and interpretation of regional
variations in the level and the rate of agricultural development. And this must be done in the context of physical resource base, technological advancement, institutional framework and external relations of different areas. Secondly, the spatial diffusion of agricultural development in its nature, intensity and direction, present another interesting field of investigation. The basic geographic query would be as to how the different areas respond to the impulses of development in agriculture. Lastly, geographers can provide a typology of different areas from the viewpoint of agricultural planning. Such a regionalisation must have a multi-dimensional perspective imbibing existing patterns, trends and potentialities of agricultural development.

Agricultural development is unquestionably a multi-dimensional concept of which crop productivity is one of the vital aspects. Implicitly or explicitly agricultural development is equated with the level and the rate of agricultural productivity. Diversification of agriculture should be considered as the second vital aspect of agricultural development. It stands for promotion of dairying, cattle rearing, poultry farming, pig raising, bee keeping and fishing. Commercialisation of agriculture is still another dimension of agricultural
development. The percentage of cropped area under cash crops may be used as a measure of commercialisation of agriculture. The density of market centres per 1,000 Sq.km. of area can also provide a clue to the degree of commercial agriculture. A more reliable indicator would be the share of market arrivals in total production both of which can be computed in terms of their cash value. The development of agriculture is to be judged also from the degree of equity in farm incomes and the nature of agrarian relations. Non-exploitative and tension-free agrarian relations are an essential ingredient of any agricultural development. Above all agricultural development should not produce deterioration in ecological conditions and should not lead to defacement of forests, exhaustion of soil nutrients, depletion of underground water, emergence of water logging conditions and creating waste lands. Conservation of physical resources is an integral part of any agricultural development.

A review of geographical literature covering agricultural development in India reveals that seldom is an attempt made to define agricultural development and to select criteria in the light of any conceptual framework. Criteria are chosen on an ad-hoc basis depending upon convenience of the availability of data. A focus on productivity dimension is dominant.
and only a few studies take into account the matters relating to commercialisation of agriculture. And it also testifies that all the studies take a partial view, in varying degree of agricultural development. Main attention was devoted to the dimension of productivity and its determinants. All the studies were constrained by the problem of data availability, the hunger for data was so voracious that even statistics of marginal values were not spared from usage and that too without any critical evaluation. Therefore, based on the availability of data and after considering their importance in determining agricultural development, 15 indicators have been taken to get the composite index of agricultural levels of development in the present study.

Data Base:

In order to make a spatio-temporal analysis of agricultural situations of Dharwad district the data for two periods i.e., 1975-76 and 1985-86 are taken from the following sources:

1) Talukwaise plan statistics of Dharwad district, District Planning unit, Office of the Deputy Commissioner and the regional planning department, Government of Karnataka Bangalore.

2) Dharwad district at a glance 1975-76 and 1985-86 obtained from district statistical officer, Dharwad.
3) Superintending and Executive Engineers of minor and major irrigation departments of Dharwad district.
4) Principal Agricultural Officer, Dharwad.
7) Assistant Director of Animal Husbandry and District Industrial Centre Dharwad.
8) Office of the Director of Geology and Mines, Dharwad.
9) District Forest Officer Dharwad.
10) Gazetteer of Dharwad district.
11) Village-wise data collection through field work and checking it with published data (to some extent).