The Statement of the Problem

Agriculture is a multi-dimensional and multi-variable complex and dynamic economic activity occupied a pre-eminent place in the economy of most developing nations. The development and optimisation of agricultural resources is central to all discussions of problems and policies of agriculture in these countries where agriculture form crux of the regional economy. The ever-increasing pressure of population, decreasing man-land ratio and increasing demand for food resources i.e., demand on one hand; and the improvements made in socio-economic and agro-technological environments i.e., supply on the other hand have been interacting and activating upon optimisation of available agricultural resources for the benefits of the mankind and the nation as a whole.

The significant characteristic feature of agriculture is its great diversity of practice, products and organisation (Grigg, 1969).
As a result, regional disparities in the level of agricultural development are becoming commonplace especially in the developing world (Gleave, 1982). Undoubtedly, the bewildering diversity in physical, socio-economic, technological and organisational environments have led to great regional differences in spatial organisation and productivity of agriculture. "Not surprisingly, then, spatial variations in agriculture have received much attention from geographers, partly because of the great areal and occupational importance of the industry, partly perhaps because of geographical methods of study are practically suited to the analysis of agriculture" (Grigg, 1969). Tarrant (1974, p. 14) has also opined that there is such variety in agricultural practice, even over very small extents and distances. These spatial differences are to be recognised at various levels and attempt to explain them. Bunge (1966) has laid considerable stress on the differentiation within geography of the unique from the general and concludes that, although all features of the earth including farms appear unique in many respects, none the less, they have some features in common.

The farming practices and organisation most certainly do not react in the same way with the pressures of the environment, but the fact that they do react and provides a basis for regionalisation as well as for generalisation. In agricultural geography much attention is paid to the nature of spatial variations in varied agricultural phenomena and the recognition of areas of dominance by a particular enterprise or association of enterprises and in culmination leading to the identification of distinctive agricultural
regions. It is also a fact that out of all the approaches used by geographers in the study of the nature of spatial variations in agriculture, the regional approach has the longest history and is in many ways still the most satisfying. In recent years a great deal of attention has been paid by geographers in improving the methods by which agricultural regions may be delimited (Helburn, 1957; Whittlesey, 1936; Kostrowicki, 1964). In the broader perspective and the application of the concept of areal differentiation in the field of geography of agriculture, a great deal of attention has been paid on the fascinating theme of agricultural regionalisation. It is designed with a specific purpose thus probably for the most efficient form of description and delineation of areal differences in agricultural patterns and development.

**Agricultural Regionalization**

Agricultural regionalization is an aggregation of areal units in the form of contiguous in geographic and taxonomic spaces with similar features of agriculture. It is an exercise of constituting agricultural regions based on homogeneity in the selected agricultural characteristics which is nothing but an areal classification of agriculture. It can be said that "regionalization is a process for finding out the homogeneous features of areally dispersed objects, which can be determined or delimited either by clustering the areal classes or by dividing the whole into sub-regions (Singh and Chauhan, 1984, p.4). The same process is called 'a device for segregating areal features' on the basis of some principles of areal
variabilities (Whittlesey, 1954). Grigg (1967, p.461) considered, 'regionalization as a method of investigation.' To understand the complex and diversified nature of agriculture, agricultural regionalization is a procedure for finding out the order of areal variabilities occurring regional properties of phenomena, that may be defined either by partitioning logically the systems of observations keeping in view the regional differences, or by grouping the areal classes on the basis of co-associated phenomenal facts (Amedeo & Golledge, 1975). In one way, the regionalisation of agriculture proceeds with the whole (universe) and divides it into constituent parts on the basis of some criteria with the analytical logic of spatial interactions of agricultural phenomena; on the other way, regionalisation of agriculture synthesizes the areal classes and group them together on the basis of similarity (Grigg, 1976). Thus, the method of agricultural regionalisation is analogous to the stage of classification adopted in the other systematic sciences. The agricultural regions which are constituted through the process of regionalisation of agriculture are the areal classes formed by phenomenal similarity and spatial contiguity.

Agricultural regionalisation is a comparatively recent phenomenon in its strict sense, although different forms or types of agriculture belonging to particular phase of agricultural development has been taken as agricultural regions (Thomas and et al., 1968; Jones and Darkenwald, 1965; and Alexander, 1977). Agricultural regionalisation is not simply on operation of dividing the country into a number of agricultural regions, but it is also
a method of understanding the agricultural patterns and geographic spatial relationships. It represents "the actual method of geographic perception of the entire agro-spatial diversity of a country designed to identify territorial production units or complexes, and these will then become regional units in agricultural planning with which a complete transformation of agriculture of a country may be accomplished" (Jasbir Singh, 1984, p.209).

The investigation and synthesis of spatial properties and the structural forms of agriculture is one way of the classification of agriculture to represent the complex reality of agriculture and all its functional relationships and interdependences. Bunge (1966) develops the thesis that there is no essential difference between the operations of classification and regionalisation. All sciences have, in their history, a classificatory or taxonomic phase and geography is no exception. However, the processes of classification and regionalisation of agriculture can be separated. Classification in agricultural geography does not necessarily lead to regionalisation; regionalisation is simply one way of providing a classification of agriculture.

Agricultural Regionalisation and Agricultural Typology

Agricultural regionalisation and agricultural typology are the dominated and widely used concepts in agricultural geography and they very often confused with each other. Bunge (1966) believes that classification (typification) and regionalisation are synonymous. Though both the concepts are synthesized notions,
but they belong to two distinctive categories. A type is a systematic or taxonomic concept and its identification is essentially based on similarities between individuals. Since individuals characterised by similar attributes may occur repeatedly both in time and space, the same type can be identified in various territories in various periods of time (Kostrowicki and Szyrmer, 1992, p.9). The spatial distribution of agricultural types do not necessarily form any continuous areas but usually are dispersed and intermingled with other types. Contrast to this, a region is a spatial or a territorial concept. It is delimited on the bases of differences between areas, rather than on similarities between individuals. Therefore, a region is a contiguous portion of the earth surface extending within defined and determined limits and characterised by a particular set of phenomena which are spatially related.

In the case of typology, agricultural holding is the basic unit of operation whereas in regionalisation that does not arise other than the areal grouping of the agricultural phenomena. Both type and region are hierarchical in character. Based on their similarities, individual types of lower order are grouped together into types of higher order, irrespective of their distribution on the earth surface, while agricultural regions of a lower order always form a territorial parts of regions of a higher order (Kostrowicki, 1970, p.20). Irrespective of the differences and similarities in the concept and methodology of a 'type' and a 'region', the typification of agriculture will constitute a good basis for agricultural
The concept of region has been, and still is, one of the basic categories and intellectual traditions of geographic thought. The idea of region was first seeded in geography by Mackinder and Herbertson but well defined by Whittlesey (1954) and Hartshorne (1959). The term agricultural region has been used in its traditional sense, but still it does not lose any significance; rather its use is much wider. It conveys that it is a contiguous area having some kind of agricultural homogeneity. The agricultural region, in fact, is a device for selecting and investigating regional groupings of the complex agricultural phenomena found on the earth. Any segment or portion of the earth's surface possessing a distinctive form of agriculture is an agricultural region (Jasbir Singh, 1984, p.176). Therefore, an agricultural region is not a nature given or self determined; but rather a more conceptual one for the purpose of planning and development.

Initially, the concept of region was well expounded by formulating and delineating natural regions (Gilbert, 1960) and then was carried to agricultural regions. There are divergent views regarding the concept of an agricultural region. Many of the problems of definition have arisen more from the nature of the classification employed than from the nature of the farming systems observed (Morgan and Munton, 1971). The idea of agricultural region
was sometimes earlier involved and equated with the idea of the natural region. Earlier writers had perhaps tended to assume that soil type or other terrain differences were of prime importance in the differentiation of agriculture; hence agricultural regions were often assumed merely to mirror physical differences (Grigg, 1969, p.97). But many scholars in the field of agricultural geography have rejected the idea of treating 'natural regions' as 'agricultural regions.' Within the same natural region there could be differences in land use system, crop and livestock associations, productivity levels etc. Agricultural region (Buchanan, 1959; Morgan and Munton, 1971), if it is to be defined at all, should be defined in terms of agricultural elements. Agricultural regions describe essentially the characteristics of agriculture as it is in a synthesized and comprehended manner.

The agricultural regions are the reflection of interaction between biotic and abiotic environments. The most resultant aspect of the interaction of these environments and the most important feature of agricultural distributions were the crops and livestock as well as the agricultural productivity patterns. Hence, a primary basis of basic agricultural regionalisation may be the combination of crops and livestock which are raised. In the recent times, cropping pattern is a significant variable in differentiating agricultural landscape into a set of agricultural regions became a popular approach of the agricultural regionalisation. Dikshit (1973) has opined that crops are the principal index of agricultural typology...
in an area, so much so that agricultural regions are commonly known after the dominant crops. Most systems of agricultural regions lay great stress upon the type of product; in some cases this is highly simplified (Grigg, 1969, p. 114). Earlier, the consideration of single crop or livestock based on their overwhelming dominance had led to the delimitation and delineation of agricultural regions. But what appeared after the quantitative revolution was to delimit not a single crop-regions but crop-combination regions (Weaver, 1954).

It is apparent that in most cases agricultural regions are based on crop and livestock association regions (Scott, 1957; Coppock, 1964). Further, the levels of agricultural productivity, extent of intensiveness in agriculture, degree of commercialisation, degree of subsistence level, types of farming practices, ensemble of farm structures and the diffusion of farm-technology may also be considered as additional criteria for further sub-division within the basic regionalisation (Jasbir Singh, 1984, p.177).

Another view in defining an agricultural region is a unique set of interaction of different variables and finally formed on the basis of results of the rigorous quantitative analysis. Consideration of only one important variable is not the idea that is quite prevalent in the modern time. Mukhopadhyay (1981, p.55) has stated that "an agricultural region is not merely a crop region or, in other words, a region defined in terms of only a few chosen attributes of agriculture. An agricultural region should necessarily be defined in terms of all the attributes of agriculture." Spencer and Harvath (1963) have precisely defined an agricultural region
as an area with a high degree of homogeneity of one or more
criteria. It is not surprising, then, that the agricultural typology
(Kostrowicki, 1980) based on the standardizing several agricultural
criteria on which agricultural regions are delimited at different
hierarchical order may well be a laudable approach. Knowles and
Wareing (1976) opined that the delimitation and delineation of an
agricultural region based on the application and manipulation of
several criteria is difficult due to lack of proper definition of some
of the criteria.

The existence of so many ideas regarding agricultural
region is undoubtedly jeopardising for any attempt to define agri­
cultural region very precisely. One thing is very clear that
agricultural regions should be described and delineated essentially
on the basis of the characteristics of agriculture as it is; but not
the mere reflections of the natural or environmental regions. On
the other hand, the agricultural region shall be defined and designed
either based on single criteria or multi-criteria with a specific
objective and purpose of agricultural regionalisation. The purpose
of the regionalisation of agriculture helps to decide the criteria
to be used. It can be argued, then, that for any given area there
can be number of possible sets of agricultural regions (Grigg, 1969,
p.101), depending on the criteria selected. It is possible to design
series of agricultural regions, choosing different criteria for each
set, for eg.; land use regions, land use efficiency regions,
productivity regions, crop and livestock combination regions. These
regions will not necessarily coincide and such agricultural regions may be called special purpose regions (Grigg, 1969) designed to help in sectoral planning and development of agriculture.

The other alternative view in defining agricultural region is to consider all the attributes or properties of agriculture and fuse the areal units ensuring the maximum degree of homogeneity by employing sophisticated quantitative methods. Such agricultural regions shall be considered as composite entities reveal the agricultural picture of great generality and they may be called as general purpose regions. The factor analysis can produce a system of regions that takes into account all the criteria that could differentiate one area from another; hence, a system of general-purpose regions is possible (Berry, 1961). Nonetheless, the distinction between special-purpose multi-agricultural regions and general-purpose complex single set of uniform agricultural regions is an important one in the exercise of agricultural regionalisation.

Studies in Regionalisation of Agriculture: A Review

Studies in regionalisation of agriculture have gained considerable importance from the first quarter of twentieth century, as is evident from the volume of scintillating researches made by geographers, who sought to identify varied agricultural criteria for the delimitation and delineation of agricultural regions at different levels of study. In the beginning the attempts were made to regionalise the agriculture on the basis of environmental regions. In this regard the work of Hahn (1892) may be quoted where the
world classification of agriculture gives the impression of climatic regions. Englebrecht's (1930) map of the agricultural zones of the earth appears to be little more than a map of climatic types, the names of each region being characterised by the major food crop of the region. Such an approach was attempted by Wood (1931) in delineating the agricultural regions of Scotland. Stamp and Beaver (1971) while delineating the agricultural regions of England and Wales have stated that the basis of regionalisation of agriculture as followed by Wood was appropriate and it does not seem necessary to alter the regional division for the agricultural landscape of Scotland.

The classical work in the regionalisation of agriculture has been made by Baker (1926-32) by delineating the agricultural regions of North America. Baker has considered number of agricultural bases in dividing the agricultural landscape but they are not uniform for all parts of the country. This is followed by the pioneering works of Jonasson's (1925-26) agricultural regions of Europe; Jone's (1928-30) agricultural regions of South America; Van Valkenburg's (1931-36) agricultural regions of Asia; Taylor's (1930) agricultural regions of Australia; Shantz's (1940-43) agricultural regions of Africa; Hartshorne and Dicken's (1935) classification of the agricultural regions of Europe and North America and Hall's (1934) agricultural regions of Asia were noteworthy.

There were several attempts made to classify the world agriculture on the basis of different agricultural criteria in order
to device systems of agricultural regions. Out of all, Whittleseley's
(1936) most widely accepted five-fold criteria comprising function-
ing forms of agriculture in dividing the agricultural regions of the
world was a brilliant attempt in the classification and regionalisa-
tion of world agriculture. On the similar lines but considering
different sets of agricultural criteria, the agricultural regions of
the world were established and described by eminent scholars as
Tummons (1944), Van Royen (1956), Helburn (1957), Kawachi (1957),
Thoman (1962) and Fryer (1965) etc. Rakitnikov (1962) applied his
three-fold criteria to identify agricultural regions of USSR.
Kostrowicki (1964) has introduced new criteria comprising of social
and ownership, organisational and technical and economic factors
have been applied to identify the agricultural regions of Poland.
In the recent times the methodology of agricultural typology of IGU
(Kostrowicki, 1970) has been vigorously applying to establish
typological or type of farming regions.

The regionalisation of agriculture based on crop combina-
tion analysis was scientifically and quantitatively delineated by
Weaver (1954) in his work on crop combination regions in the Mid-
West of USA. Applying Weaver's method, the establishment and
description of agricultural regions of Tasmania by Scott (1957) and
crop, livestock and agricultural enterprise combination region of
England and Wales by Coppock (1964) were praiseworthy works in
this direction. Areal Livestock combinations on Finnish Farms by
Talman (1979) and spatial distributions of livestock in the Republic
Ireland by Gillmor (1970) were also significant.
In the recent times, the application of sophisticated statistical techniques like Wards grouping procedure, cluster analysis, factor or principal component analysis have been advanced to quantify and produce the systems of objective agricultural regions. In this direction, the pioneering attempts were made by several geographers viz., Berry (1961), Nordgard (1977), Clark (1984) etc., Grigg's (1965, 1969) works on the logic of regional systems and the agricultural regions of the world: review and reflections were considered as the commendable works in the studies of regionalisation of agriculture.

Indian geographers also have long been attracted in the studies of regionalisation of agriculture using different criteria and methods at various levels ranging from a district or basin to the country as a whole. Randhawa (ICAR, 1958) has classified the agricultural landscape of India into five major regions on the basis of similarity in climatic, edaphic, vegetative, crop and animal conditions. Taking both physical and agricultural conditions, the Planning Commission of India (1964) has also divided India into 15 agricultural regions and 61 sub-regions. On the basis of relative yield and spread of crops, the ICAR (1972) has classified the Indian agriculture into four broad zones. Sundaram and Tiwari (1968) had carried an interesting work on regionalisation of agriculture in Madhya Pradesh with the help of multi-variate analysis. On the basis of land resources and crop productivity, the agricultural regionalisation of India was attempted by Sharma (1973). Roy (1973) has also made an approach to regionalise the types of farming in
India. Nagpal (1981) has attempted to regionalise the agriculture of Uttar Pradesh by employing Ranking device and Euclidean Distance method.

Dikshit (1973) has made an interesting attempt to delineate agricultural regions of Maharashtra on the basis of similarity of cropping pattern with the help of Spearman's rank correlation method. On similar lines using cluster method and least square method, Vidyanath (1986) has made an attempt on agricultural regionalisation of Andhra Pradesh. Using Ward's grouping procedure, Subbaiah (1981) has done an interesting work on crop-regionalisation in Tamilnadu. It is interesting to mention that a good number of studies have been made in delineation of special-purpose multi-agricultural regions (landuse, crop and livestock association and productivity regions); rather than in institutionalisation of single set of uniform-complex agricultural regions in India. In this direction many Indian geographers like Chatterjee, Prakasa Rao, Bhat, Moonis Raza, Jasbir Singh, Vijaya Ram Singh, Reddy, Ramanah, Majid Hussain, Ali Mohammad, Shafi Noor Mohammad, H.S. Sharma, R.P. Sharma, Mandal, Banerjee, J. Singh, Pathak, Kanchan Singh, Ayyar, H.Singh, Dayal, B.L. Sharma, Kaur and Surendra Singh etc.

The Significance of the Study

The agricultural region is a spatial model which accurately, orderly and rational description and delineation of the agricultural abstractions like structure, content and organisation in
A reality form. It is designed with a specific purpose thus probably for the most efficient form of description of areal differences. The study of agricultural regionalisation may eventually brings to lime light the regional inequalities in the complex nature of agricultural potentials and development possibilities. It is one to guide towards the applied aspects and work on the development and planning strategies, besides of immense significance for comprehensive understanding the complex nature of spatial organisation of agriculture of an area. Thus, the importance of agricultural regionalisation as an exercise for regional agricultural development cannot be overlooked. Agricultural regions in Eastern Europe and the Soviet Union are used as a basis for planning (Saushkin, 1966) and they have been advocated as a suitable device for planning improvements in developing and underdeveloped territories (Lewis, 1952).

Agricultural regionalisation is essential because it is intimately connected with the eradication of agricultural backwardness by rational allocation of new enterprises (Jasbir Singh, 1984) especially in the developing countries like India where agriculture is the main source of economy being predominantly an agricultural country. In view of the practical significance of agricultural regionalisation for understanding the spatial organisation of agriculture and for evolving suitable agricultural policies for sustainable regional agricultural development, the present study on "Agricultural Regions of Andhra Pradesh" is attempted. It is hoped
that this diagnostic study will help to evolve both prophylactic and curative measures ultimately to improve the agriculture economy of the State.

The Study Region

The present study region, Andhra Pradesh is one of the States located in the southern part of the country. It ranks fifth both in terms of area and population among the States of the country. The economy of Andhra Pradesh is predominantly agricultural and the cornerstone of the economic development of the State lies in the development of its agricultural economy. About 70 per cent of the working population of the State depends upon agriculture for their livelihood. Among the four Southern States, Andhra Pradesh is the only State which produces surplus food offsetting or making good off the deficit food production of the other three States. In the country, Andhra Pradesh State is very important both in the production of cereals and commercial crops like paddy, jowar, bajra, ragi, groundnut, tobacco, cotton, castor and sugarcane. The State is also significant for livestock population.

Andhra Pradesh has diversified physical and socio-economic conditions to represent varied agricultural phenomena. More than half of the geographical area of the State is under agriculture. With 41 per cent of the total cropped area under protective irrigation, it has the largest canal irrigated area in the country next only to Uttar Pradesh. Andhra Pradesh is the only
State where three important rivers drain across the State, building two major deltas and one crypto-delta. The drainage basins of these three major river systems namely, the Godavari, the Krishna and the Pennar cover 72.7 per cent of the total areas of the State. In addition, where there are another thirty and odd minor rivers which can be harnessed for developing irrigation and power. It is obvious from the above facts that an enormous agricultural potential as well as diversity of geographical conditions of the State has indeed provided an appropriate setting for the present study.

Objectives of the Study

The present study is made to bring out a systematic account of the complex and diversified nature of agriculture of Andhra Pradesh State through the process of classification and regionalisation. To provide a comprehensive understanding and planning for the development of agriculture of the State, the present study attempts to examine and evaluate the changing spatial pattern of varied agricultural phenomena namely, irrigation, land use, cropping, crop productivity and livestock in their ecological, socio-economic and technological setting.

Agriculturally certain regions in Andhra Pradesh are quite prosperous while certain other regions are deplorably poor. Attempts need be made to find out the regional disparities in varied aspects of agricultural development. To fulfil this objective, an attempt is made to regionalise the agriculture of the State into different forms namely, irrigation orientation regions, land use
regions, land use efficiency regions, crop regions, crop-combination regions, agricultural productivity regions and livestock association regions. Such a detailed classification and regionalisation of agricultural phenomena of the State may help to gain insights into the problems of respective aspects of agriculture and provides the basis of sectoral planning and development.

**Data Base**

The present study is completely based on secondary data collected from different sources particularly from the Government records. The secondary data pertaining to various aspects of agriculture is collected for the year 1990-91 at 'mandal' administrative level (1104 mandals) to delineate the spatial pattern of agriculture as well as to delimit the agricultural regions. Since there was no 'mandal administrative system earlier to 1985, the secondary data pertaining to important variables of agriculture is collected at district level (23 districts) for a period of 30 years i.e., from 1960-61 to 1990-91 to examine the changes and trends in agriculture of the State.

**Methodology**

The regionalisation of agriculture is made with the help of both cartographic and quantitative techniques. Most of the data have been represented by thematic mapping techniques. Kostrowicki's land use orientation, land use efficiency, crop combination, crop diversification and agricultural productivity techniques have been
employed in the study. A number of statistical methods namely, averages, standard deviation, correlation, regression, coefficient of determination and growth rates have also been used in the present study.

The Plan and Design of the Study

A comprehensive plan and design of the study is detailed hereunder:

1. A Perspective on the Research Theme.
2. Locational and Spatial Aspects of Andhra Pradesh.
3. Irrigation Types and Orientation.
4. Land Use Pattern and Land Use Combinations.
5. Agricultural Land Use Efficiency Regions.
7. Crop-Regionalisation and Crop-Combination Regions.
8. Regionalisation of Agricultural Productivity.
9. Livestock Association Regions.
10. Summary and Conclusion.