Agriculture continues to be the most important economic activity and predominant form of employment in the developing countries like India, where more than two-thirds of the working population still depend upon it. In the dominantly rural-based agricultural economy, agricultural resources play a significant role in determining the socio-economic and cultural progress and prosperity of the rural population. Today, with the ever-multiplication of human population pressure and decreasing man-land ratio, the optimum and judicial use of agricultural resources like land, water, soil, crop and animal is central to all discussions of problems and prospects in the Indian agriculture.

In the present stage of economic and technological world and competition between various economic activities, agriculture has also been continuously advancing towards economic and social goals in accordance with the demands of human society and economic advancement. To this end, old and new agro-technologies are being applied to various kinds of agricultural resources for making agriculture an industry and business. Obviously, the Green Revolution technology has brought about a revolutionary change in the scenario of Indian agriculture. As a result, the traditional system of farming is in the process of transformation to modern agriculture and has added new dimensions to agricultural scenario which need to be studied and analysed.

In Agricultural Geography, the core of agro-geographical studies is concerned with the classification, association, distribution and morphology of agricultural phenomena found in a region. The multiplied morphological agricultural phenomena comprise multi-dimensional complex agricultural
systems and sub-systems which are practically dynamic and diversified. The multi-dimensional nature of agriculture has been the result of human conveniences, desires and stresses on agricultural resources. It is largely because of the physical morphology in general and human, socio-economic behaviour and innovative mind in particular. Further, the significant characteristic feature of agriculture is its great diversity of practice, products and organisation (Grigg, 1969, p.195). In a developing agrarian society, the choice of agricultural land use has been much more an independent function of economic forces. And, the nature of land use dynamism depends largely upon the value of return, judgment and capacity of people to adopt to the change. It is a time-bound process which works coupled with the constraints and advancement in socio-economic situation and natural environment (Vijaya Ram Singh, 1991, P.377).

Undoubtedly, the bewildering diversity in physical, socio-economic, technological and organisational environments has led to great areal differences in the spatial organisation of agriculture. These regional disparities in the levels of agricultural development are becoming common place especially in the developing countries (Gleave, 1982). Tarrant (1974, P.14) has stated that there is such a variety in agricultural practice, even over very small extents and distances and the agricultural geographer attempts to recognise these variations at various levels and to attempt to explain them very comprehensively. Grigg (1969) has also highlighted that "the 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". Obviously, it is highly conceptualised that all areal differences and temporal changes in the
distributional pattern of agricultural forms, practices and production systems are a function of complex and combined interplay between physical and non-physical environments and each environment acquires its specific features as components in an interacting system over space and time. In this endeavour, the differences in agriculture are to be examined both at areal and agricultural holding levels. Because, in the present fast pace of agri-technification, the diversity and dynamism of agriculture are to be matched and associated with the diversified and dynamic nature of farmers' behaviour and reactions which is very helpful from the point of micro-level agricultural planning.

In recent times, on the basis of the concept of areal differentiation in the field of geography of agriculture, a great deal of attention has been paid to the fascinating theme of agricultural classification and agricultural typification. The purpose of the theme is to recognise agricultural holdings or the areas of dominance by a particular enterprise or association of enterprises and at culminating to identify the distinctive agricultural types. In this perspective, agricultural typology is being identified as one of the most recent methodological tools and hence, it is devised for comprehensively understanding the composite nature of agrarian landscape and also the changing tendencies in the spatial organisation of agriculture at varied hierarchical levels. To achieve this goal, regional approach is in many ways a viable and comprehensive approach for a good understanding of the mosaic nature of agriculture. "Regional approach would be needed for the preparation of agricultural production plans and in their implementation because the administrative units like the States and the Districts in India are too large and heterogeneous in terms of their physical environment and cropping patterns and there are distinct regional cropping systems or crop-associations which could provide a basis for evaluating crop and livestock
production potentials and in estimating requirements or major inputs and other infrastructural investments" (Prakasa Rao & Bhat, 1972, P.115). Thus the present study examines and evaluates the regional character of agriculture in terms of land use, cropping pattern and agricultural types in Nellore district, Andhra Pradesh, India with a view to provoke more detailed and in-depth consideration of optimum use of agricultural resources for the development of agriculture.

The Concept of Agricultural Typology

The concept of agricultural typology is the outcome of the I.G.U. Commission's final version on the varied types of agriculture. It is a systematic or taxonomic concept with an aim to classify the complex reality of agriculture into more comprehensible forms or types of agriculture. "As far as typology is concerned, it is considered by some theories of classification, in which classes, i.e., types, are not established in advance, but identified in an aggregative way, by grouping individuals around certain cores or models, recognised as the most typical" (Kostrowicki and Szyrmer, 1992, P.9-10). Thus, agricultural typology is some kind of agricultural classification resulting in identification of agricultural types.

The agricultural type here, is defined as an end product essentially based on similarities between individuals of inherent, internal, endogenous attributes of agriculture. They are social, operational, production and structural attributes. The external features, whether natural or exogenous, in which agriculture develops, couldn't be used as a basis of agricultural typology. The external features, such as physical environment; and economic conditions like capital, transport and marketing, the effects of demand and supply on agricultural production, prices and political policies, etc., may certainly play a significant role.
in the formation and development of varied types of agriculture. Albeit, these external elements are taken into account to explain and interpret why and how a particular agricultural type has formed and emerged in a particular area and at a point of time. The involvement of external elements and their study in typology is therefore necessary for both understanding and interpreting the development and spatial distribution of various agricultural types (Kostrowicki and Szyrmer, 1992, P.11).

According to typology concept, agriculture is treated as a complex system in which all elements are interrelated and interconnected and in consequence individual cases of agriculture can be compared and then grouped into types according to their similarity. Like biological classification, agricultural typology is hierarchical and aggregative. It is also synthetic, since it is based upon all essential attributes of agriculture. As per the I.G.U. Commission on Agricultural Typology (Kostrowicki and Szyrmer, 1992, p.10-11), a type of agriculture should be understood as:

1. a more or less established form of crop growing and/or livestock breeding, characterised by a set or association of distinctive attributes (properties, characteristics);

2. a supreme and overall concept, covering all other concepts of agricultural classification, including such partial classifications as systems of land tenure, land use systems, orientations or combinations of crop growing and/or livestock breeding, farming systems, types of farming;

3. a hierarchical concept, comprising types of various orders, from types of identified farms based on the classification of individual holdings, through several intermediate orders, to the types of world agriculture identified, based on various aggregates of holdings;

4. a dynamic concept, that involves changes in an evolutionary or revolutionary way along with a change of agricultural attributes.
Agricultural typology is considered to be a complex and dynamic system. To understand this concept, the agriculture thus understood may be recognised as a system complying with the system approach or the system theory (Kostrowicki, 1976). So far as the system approach is concerned, the concept of agricultural typology should be treated as a highly interrelated phenomena or a complex system (Mandal, 1982, p.186). Szczesny (1981) has described that the typological studies are to be approached dynamically and spatially, the types of agriculture here being treated as a systematic notion, applied in agricultural research as our entity, i.e., it is considered to be a synthesis of properties describing agriculture as a heterogeneous production complex. It emphasizes that any change that takes place in either biotic or abiotic environments that certainly initiates corresponding change in the formation and development of agricultural types.

In typological studies, agricultural types can be identified both on horizontal and vertical scales. On vertical scale, the types could be identified from higher order to lower order i.e., first order, second order and third order types. The first order types are the higher order types or generalised types describing general character of agriculture. While the third order types are the lower order types which specify the character of agriculture at micro-level. On horizontal scale, the identification of types will be ranging from an individual agricultural holding level to global agricultural types. However, at micro-scale, an agricultural holding is to be considered the basic unit in the typological analysis, and it is the only real unit of operation. At the same time, however, despite all its deficiencies, it is permissible to use other units (administrative or whatever convenient) and particularly when dealing with a large number of small-scale holdings for which no separate data are available (Kostrowicki, 1970, p.17). In a developing country
like India, where agricultural holdings are tiny and too many in their distribution, the aggregate agricultural data at holding level are not available and also not being maintained by the Government. In such cases, some detailed systematic sample studies are highly recommended. Sometimes, this typological technique which is empirical may be subjected to some kind of inherent weakness mainly due to the reliability of empirical data.

Agricultural Type and Agricultural Region

Agricultural 'type' and 'region' are the widely used concepts in agricultural geography and they are very often confused with each other. Bunge (1966) opined that classification (typification) and regionalisation are synonymous. Though both the concepts are synthesized notions, they belong to two distinctive categories. An agricultural type is a systematic or taxonomic concept and its identification is essentially based upon 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 areal distribution of agricultural types does not necessarily form any contiguous area but usually is dispersed and intermingled with other types. In contrast to this, an agricultural region is a spatial or a territorial concept. A region can be delimited on the basis of differences between the areas, rather than on similarities between individuals. Thus, an agricultural region is a continuous portion on the earth surface extending within the defined and determined limits and characterised by a particular kind of areally related phenomena. In agricultural typology, an agricultural holding is the basic and real unit of operation, while in regionalisation that does not arise in cases other than the areal grouping of an agricultural phenomena. Both 'type' and 'region' are complex, dynamic and
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 territorial parts of region of a higher order (Kostrowicki, 1970, p.20). On the basis of identified agricultural types and their areal occupancy, agricultural typological regions may be constituted. Thus, it is understood that irrespective of the differences and similarities in the concepts and methodology of a 'type' and 'region', the agricultural typology will constitute a good basis for agricultural regionalisation. Therefore, an agricultural typology is a complimentary tool to regionalisation of agriculture.

The Objectives of Agricultural Typology

Agricultural typology is an empirical model to illustrate the composite nature of agriculture in a simpler form. It is the most recent innovative methodological tool to discern and describe the inherent characteristics of agriculture on a global, continental, national, regional and at the best agricultural holding scale. Resultantly, typology concept holds the key in agricultural planning either at macro or micro levels. Because of it being the end product of a long period of research and discussion, Roy (1986) has opined that "agricultural typology, being a recent field of investigation in geographical learning, tries to manifest the status of man-land participation projecting a composition and growth of an overall picture of arable landscape and agricultural system through classifyable innovations".

Agricultural typology is concerned with an accurate, orderly and rational description and interpretation of real similarities, dissimilarities and interrelationships between different kinds of agricultural systems. This is a
well-suited scientific tool for better evaluation of the present use of natural resources and other conditions of agricultural development by various forms of agriculture, as well as of their future possibilities.

Typological study is a better assessment of agricultural properties hindering the development of individual forms of agriculture and of the other properties that accelerate such a development. As a result, its aim is to identify the weaker as well as prosperous areas in terms of agricultural development. Ultimately, this methodological tool has to seek wide applicability and practical significance over the other synthetic studies on spatial organisation of agriculture.

A Review on Agricultural Typological Studies

Studies on agricultural typology have gained considerable importance in the last two decades, as is evident from the volume of scintillating researches made by scholars of different countries, who sought to identify the types of agriculture as a consequence of agricultural classification. The typology concept was well received and elaborated during 1964-1976 by the I.G.U. Commission on Agricultural Typology, which was based on all earlier experiences, and it is the only one which introduces a completely new approach to agricultural classification. The idea of organising international cooperation in the field of agricultural classification emerged from a lively discussion held on a paper presented by Kostrowicki at the 19th International Geographical Congress in 1960 at Stockholm. The seed which was sown by Kostrowicki on the concept of typology subsequently germinated and developed to create the Commission of Agricultural Typology under the leadership of Kostrowicki. The General Assembly of the International Geographical Union (I.G.U.) approved this commission at its meeting held in the 20th Internal Geographical Congress at
London during July, 1964. The main objectives of the Commission on Agricultural Typology were (i) to establish the principles, criteria, methods and techniques of agricultural typology, (ii) to initiate, promote and coordinate the regional studies aiming at identification of agricultural types of various orders based on criteria and methods recommended by the Commission, and (iii) to work out the typological and regional classification of world agriculture (Kostrowicki, 1970, P.11).

The preliminary scheme on agricultural typology based on a broad classification of principles, criteria, methods and techniques was presented by the I.G.U. Commission in the I.G.U. Regional Conference held in Hungary in 1971 (Kostrowicki, 1971) and then the same was submitted to the 23rd International Geographical Congress held in Canada in 1972 (Kostrowicki, 1972). A new and an improved version of the scheme on agricultural typology was discussed at the 5th Commission meeting held in Hamilton, Canada (Reed, 1975). This new version was taken into account and it was elaborated and published in 1974 (Kostrowicki, 1975). Again there was a discussion on the new version of the scheme at the 7th Commission meeting at Frontenoy-aux-Roses, France in 1976 which has led to the elaboration of further improved version of the scheme of agricultural typology and it was published in 1976 (Kostrowicki, 1976). The results of the application of the improved new version of the scheme in several countries were presented and discussed at the 8th and last meeting of the I.G.U. Commission held in Odessa in 1976 (Kostrowicki and Tyszkiewicz, 1979).

During the twelve years of (1964-1976) Commission's activity, the concept, criteria, methods and techniques regarding agricultural typology were elaborated and tested in number of studies at regional, national and continental

The Institute of Geography and Spatial Organisation of the Polish Academy of Sciences has done an excellent and a commendable job in the field of agricultural typology. This institute has conducted a series of typological studies covering the whole of Poland and neighbouring countries (Kostrowicki, Szczesny, Tyszkiewicz, Stola, Matusik, Biegajlo, Kulikowiski, Szyrmer etc.). In order to examine the transformation in the spatial organisation of agriculture of Poland, typological study was made for different years 1970, 1975, 1976 and 1983 at intensive levels by taking into account the individual holdings.

In this direction, another pioneering work has been done by Kostrowicki and his team for the preparation of typological map of European agriculture. The final draft of the map showing the types of agriculture of Europe
was finalised in April 1983 and presented in 1984 in the 25th International Geographical Congress held at Paris.

Eminent scholars from different countries like Jacqueline Bonnamour and Chantal Gillette (France); B.Dumortier (Ireland); A.Thormodsaether (Norway); Janson (Sweedon); K.M.Jensen (Denmark); Berado Cori (Italy); A.Gatzoyinis (Greece); G.I.Gorbunova (U.S.S.R.); B.Galczynska, R.Kulikowski, W.Stola, R.Szczesny and W.Tyszkieicz (Polish Geographers) were involved and contributed for the elaboration and preparation of agricultural typological map of Europe.

There are number of scholars who have made signal contributions to agricultural typological studies in different parts of the world. Szczesny (1986) has attempted to study the agricultural typology of Alpine areas of Austria and Switzerland. Tyszkieicz (1986) has attempted typological study of Sweedish agriculture. Szyrmer (1986) has made an attempt on the typology of large scale self-managed agriculture in Algeria. Hill (1986) has worked on typology of agriculture of Malaysian region; Shajaat Ali (1986) has worked on agricultural typology of Bangladesh, Nitz (1986) has worked on agrotopes or types of agricultural land and Kampp (1986) has attempted to study on types of farming in Denmark. Agboola (1973) has attempted to study an agricultural typology of Nigeria; Enyedi (1964) on Hungarian agriculture, Gakzynska (1984) on Bulgaria; Greger (1975) on typological view of agriculture in different parts of U.S.A.; and Nordgard (1977) worked on types and regions of Norwegian agriculture. Pulyarkins (1979) has made an attempt to study agricultural typology in the developing countries. Rikkinen (1983) on Finland agriculture; Scott (1984) on Australian agriculture and Troughton (1979) has worked on agricultural typology.
of Canada. The edited volumes of Reeds (1975) and Vanzetti (1975) on Agricultural typology and land use are worth mentioning contributions in this field. It is perplexing to state that the application of the concept of agricultural typology has not been made wide-spread and popular in the studies of agricultural geography of India in general and agricultural classifications in particular. As a result, the Indian geographers have not done substantial work on the concept of agricultural typology. However, quite a few number of geographers have attempted to make signal contributions on agricultural typological studies at different hierarchical levels. In this direction, Vijaya Ram Singh (1975) has attempted to study agricultural typology of India at macro-level and this has helped to identify the general types of agriculture at state level. His edited volume on 'Perspectives in Agricultural Typology' (1986) is a maiden and praise-worthy attempt towards typological studies in India.

L.R.Singh (1975), Jasbir Singh (1983), B.K.Roy (1975, 1986) and B.L.Sharma (1991) have also attempted to study agricultural typology and typological regions in India at macro-regional scale. B.L.Sharma (1983) and Jasbir Singh (1984) have also made an attempt to identify the agricultural types based on the concept of agricultural typology for Rajasthan and Haryana States respectively. Lal (1986) has attempted to study agricultural typology of Central India. He has identified agricultural types at sample holding level for the purpose of micro-level planning. Panda (1979) has made an attempt to study agricultural typology of Madhya Pradesh and Gupta and Khatri (1989) has analysed the typological aspects of agriculture of tribal region in southern Rajasthan. Chendraryudu and Ramanaiaiy (1994) have also made an attempt at micro-level for the identification of agricultural types in Chittoor district of Andhra Pradesh State.
From the above review on agricultural typological studies in India, it is found very clearly that most of the studies have been done at a macro-regional scale by taking State/District as the unit for typological analysis. However, in typological studies, the agricultural holding is the basic and real unit for the purpose of analysis, especially for micro-level agricultural planning. Hence, the wide application of typological concept at micro-scale has long been awaited in the agro-geographic research in India. This unfulfilled need is to be accomplished in the future investigations in the field of geography of agriculture for the purpose of scientific agricultural planning at micro-scale.

Scope and Significance of the Present Research Theme

In the developing nations like India, where agriculture forms the main basis of economy, scientific studies on regional agriculture have gained considerable importance from the point of agricultural planning and development. Such agro-geographic studies at micro-regional scale are designed with a specific purpose for the most efficient form of description of spatial organisation of agriculture and similarities and differences therein. The differences in the levels of agricultural performance over space and time can be explained by area and/or holding levels so that the areas and/or holdings of prosperity, and also parity or poverty may be identified. In this direction, agricultural typology is treated as an important methodological tool for comprehensive understanding of the complex nature of agriculture of a region. It may eventually bring to limelight the similarities and dissimilarities between individuals. It is one to guide towards the applied aspects and work on the development and planning strategies.

In the recent times, there has been a tremendous urge for typological studies at a micro-regional scale for regional agricultural development and
economic planning. Shajaat Ali (1986, p.158) has opined that "not only from the academic point of view, but also from the point of economic development of a country, formulation of agricultural typology of both large and small countries, has tremendous implication in their economic and regional development planning". Thus, in view of the applied significance of regional agricultural typological studies both for understanding the spatial organisation of agriculture and for evolving suitable agricultural policies for stable and sustainable regional agricultural development, the present research theme on "Dynamics of Land Use, Cropping Pattern and Types of Agriculture in Nellore District, Andhra Pradesh" is attempted. It is hoped that this diagnostic study will help to evolve both prophylactic and curative measures ultimately to improve the agricultural economy of the district.

The Study Region

The present study region, Nellore district, is situated in the southernmost coastal part of Andhra Pradesh State in India. The district has a coastal length of 165 Km. The district sprawls over an area of 13,160 Sq.Km. and has a population of 2.392 millions (1991). Administratively, Nellore district is divided into 46 mandals and 1,110 villages.

Agriculture is the most predominant occupation of the rural people which accounts for 68.9 per cent of the total working population of the district. The district is endowed with diversified terrain, climatic, edaphic, vegetative and hydrological conditions which contribute to develop varied land use, irrigation, cropping and crop and livestock production systems and ultimately to form different types of agriculture. It is one of the important districts in Andhra Pradesh, which has been experiencing the impact of natural calamities of both
cyclone and drought on agriculture. The normal annual rainfall of the district is 1041 mm.

About one-third of the geographical area of the district is under cultivation and about 80 percent of the cropped area is under irrigation. The major river which drains the district is Pennar with the formation of delta. The delta and other coastal plains of the district are predominantly known as granery of rice, while the upland region on the west is significant for variety of crops namely, orchards, food grains, oil seeds, tobacco, cotton etc. Modernisation of agriculture has been well advanced which can be seen in the delta and the adjoining irrigated tracts. These diversified agro-geographical conditions of Nellore district provide an appropriate setting for the present study of land use orientation, cropping pattern and types of agriculture.

Objectives of the study

The present study is an attempt to bring out a systematic account of the complex, diversified and dynamic nature of agriculture of Nellore district through the process of classification and typification. It includes the following objectives namely,

i) to examine the dynamics of land use orientation and land use combinations;

ii) to describe the changing pattern of crop regions, crop combinations and crop diversification;

iii) to discern and describe the changing spatial distributional pattern of inherent agricultural characteristics namely social, operational, production and structural attributes;

iv) to identify the types of agriculture at 'Mandal' administrative areal unit level with the help of the methodology as suggested by I.G.U. Commission on Agricultural Typology;
v) to identify the agricultural types at micro-scale i.e., at agricultural holding level by using sample data; vi) to examine the levels of differences in developing different forms of agriculture between areas, size of land holdings and social status of the farming community; and

vii) to identify the weaker areas and/or agricultural holdings in terms of agricultural development in order to provide insights into the problems of spatial organisation of agriculture which ultimately provides the basis for appropriate micro-level planning.

Hypotheses

Considering agriculture to be one of the most multi-dimensional and multi-variable complex and diversified economic activities of the large sections of rural people in the country, the following hypotheses are formulated:

i) There is a variation in the distribution of social, operational, production and structural attributes of agriculture between the component areal units.

ii) The distribution of the most important agricultural variables pertaining to modernisation and production systems which are dependent on social status, size of holding and the geographic location of agricultural holdings.

iii) The specialisation of crop farming is confined to deltas and coastal plains while diversification of cropping to the upland tracts and drought prone areas.

iv) The size of agricultural weaklinks is dependent on social status, size of land holding and geographic location of the agricultural holdings.

Data Base

In the present study, both primary and secondary data are used for the analysis of land use orientation, cropping pattern and typology of agriculture. The secondary data pertaining to various aspects of agriculture is collected at 'Mandal' administrative areal unit level. Owing to changes that have taken place in the Local Government Administration system of Andhra Pradesh state, Mandal

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administrative units were formed during the year 1985-86. Hence, in order to examine the changes in agriculture of the district, secondary data is collected for two points of time namely the base year 1985-86 and the latest year 1992-93.

The primary data is generated at agricultural holding level with the help of sampling techniques. Agricultural holding is the basic and real operational unit of agricultural typological analysis. The selection of sample agricultural holdings is done on the basis of stratified random sampling procedure, taking all precautions and considering all the important agro-geographic parameters like terrain, rainfall, soil, irrigation, land use, cropping, the size and type of land holding and social status of the farmer; there are 264 sample agricultural holdings chosen from all over the district. A questionnaire is prepared and filled up through interview method from each respondent to acquire first-hand agricultural information relating to all 28 agricultural variables for identification of agricultural types at micro-scale.

Methodology

In the present study, both cartographic and quantitative techniques are employed for the analysis of both primary and secondary data. Most of the secondary data have been represented by thematic mapping techniques. The quantitative techniques like Kostrowicki’s method of land use orientation, land use combination; Jasbir Singh’s method of land use dynamics, Doi’s method of crop combination and Gibbs-Martin index of crop diversification are employed. The statistical techniques like ANOVA TABLE (‘F’ test), Chi-square test and sampling methods are employed to test the significance of formulated hypotheses. Finally, the identification of agricultural types both at 'Mandal' areal unit level and agricultural holding level is done on the basis of the methodology.
as suggested by I.G.U. Commission on Agricultural Typology headed by Kostrowicki and his team. Most of the analysis in the study is made with the help of computer programming.

The Plan and Design of the Thesis

A comprehensive plan and design of the present study is detailed here under:

1. A Prologue on the Research Theme.
2. Geographic Profile of the Study Region.
3. Dynamics of Land Use Pattern.
5. Social Attributes of Agriculture.
6. Operational Attributes of Agriculture.
7. Production Attributes of Agriculture.
8. Structural Attributes of Agriculture.
9. Spatial Distribution of Agricultural Types.
10. Types of Agriculture at Micro-Scale: Sample Studies.
11. Summary and Conclusion.