INTRODUCTION

Agriculture in India dates back to the time of Indus Valley Civilization. Ever since it has continued to be the leading occupation and the mainstay of the population of the country. About three fourth of the country's population lives in rural areas and carries out agricultural activities.

The overwhelming importance of agriculture in national economy can not be overemphasized. It contributes about 42 per cent of the country's economy. The underdeveloped conditions of Indian agriculture may be proved from the fact that the per hectare yield of crops in India is comparatively low, which is barely one third or one fourth of the yield of the other agriculturally advanced countries of the world. The low yield per hectare in India is mainly due to the less and improper utilization of land and modern agricultural inputs. The low yield per hectare has a direct influence upon the health, efficiency and nutritional standard of the rural inhabitants. The solution, however, lies in the increased and proper utilization of modern agricultural inputs for which a thorough study of agricultural transformation and impact of modern technology on agricultural transformation is necessary. It is, therefore, necessary to conduct a field to field survey to ascertain the impact of modern agricultural inputs and physical environment on
agricultural transformation. The interpretation of agricultural transformation shall be helpful in determining whether the agricultural transformation is in right direction or not.

The importance of agriculture has further been underlined by the fact that the population of the country is growing very fast and is estimated that by the turn of this century, it will cross one billion. The ever increasing population is exerting a great pressure on land and adversely affecting the man-land ratio. Thus there is a situation where the land has to be used with great care and thought, and where agriculture has to be evolved, taking into cognizance all the technological and institutional factors. Only scientific and intelligent agricultural practices can meet the situation.

Agricultural transformation implies the rational use of land resource through applying a higher degree of modern inputs. Agricultural transformation should be such that it should provide not only the balanced and adequate diet to the entire population, but also the raw materials to the agro-based industries. It is well known fact that prior to onset of green revolution Indian agriculture was backward and there had always been the problem of adequate supply of food in the country. But by the onset of green revolution in
the mid sixties, technological and institutional advancement took place in agriculture which has given phenomenal results. This has changed the entire outlook of agriculture. Traditional agriculture is being transformed into a worthwhile enterprise.

Agricultural transformation depends on the continuous economic adjustment of farm organizations by absorbing improved technological innovations and institutional co-operation on a profitable basis. The process of agricultural transformation has already begun and the recently introduced institutional reforms are paving way for a large scale application of modern agricultural technology. The farmers are conscious of the fact that increased agricultural production can be obtained only by using improved varieties of seeds, chemical fertilizers, better and profitable use of water, improved agricultural machineries, tools and implements and following crop protection practices.

The physical as well as cultural environment of the country is most varied. In view of local variation in physical conditions and uneven distribution of the components of modern agricultural technology, it is not possible to put any single plan of agricultural transformation for the country as a whole. Because a plan suitable for one region may be quite unsuitable for the others. In order to overcome the problems of a region, a detailed study of its local environment is necessary. The importance of such a regional study
led to the author to select lower Ganga-Yamuna Doab for its detailed study of agricultural transformation.

The lower Ganga-Yamuna Doab incorporating Kanpur, Kanpur Rural, Fatehpur and western portion (Sirathu, Kara, Sarsava, Manjhanpur, Kaushambi, Muratganj, Nevada and Chail blocks) of Allahabad district, extended from 25° 16' to 27° 00' N latitudes and 79° 30' to 81° 55' E longitudes (figure 1) has a total area of 12,239 square kilometers and support a population of 60,12,436. It is a flat featureless plain formed by the infilling of the Indo-Gangetic trough during the pleistocene period.

Agriculture shares more than half of the total economy of the lower Ganga-Yamuna Doab and 45 per cent of Uttar Pradesh. It is the mainstay of the people covering about 68 per cent of the region's area and engaging about three fourth of its population to earn their livelihood. Due to great pressure of population the per capita land averages are very low, which has led to fragmentation of holdings. About 60 per cent of the land holdings are below 1 hectare of area which covers a little more than 28 per cent of the total cropped area.

Lower Ganga-Yamuna Doab has a very gentle slope from north-west to south-east following the slope of river Ganga and Yamuna. The region is broader in the north-west and is tapering down towards south-east. The area of the region fluctuates from year to year due to the changing course of
the master rivers, but the loss at one place is more or less compensated by the gain at the other.

The drainage of the lower Ganga-Yamuna Doab discharges itself into the river Ganga. The course of all the rivers and their tributaries follow the general slope of the region. A number of perennial and seasonal rivers are flowing in the area from north-west to south-east. Its monsoon climate characterised by cool winters, hot summer and seasonal rains (annual average 89 cms) is envigorating but more susceptible to drought and famine. The region is gifted with fertile alluvial soils which belong to two river systems — the Ganga and the Yamuna, each consisting of recent alluvium, flat lands, uplands and lowlands.

The present work is an attempt to highlight the regional disparities in agricultural transformation in one of the agriculturally important regions of India, i.e., lower Ganga-Yamuna Doab. The role of changed technological and institutional factors in bringing about variations in the spatio-temporal transformation of agriculture in the region is brought to light and suggestions are proposed to remove the regional imbalances in agricultural transformation of the study region.

The present work has been grouped into four parts consisting of eleven chapters. In the beginning a discussion has been made on the geographical background and the analysis of various complex problems. In the first part there are
three chapters, viz., Structure and relief including drainage, climate and soils of the lower Ganga-Yamuna Doab.

The discussion on physiography and drainage is based partly on field work and partly on the topographical maps. The chapter on climate is based on the data supplied by the Indian Meteorological Department, New Delhi. As the scientific data on the soils of the region is not available, the author had to rely upon the general information of the soils provided in the district gazetteers and settlement reports of the districts of the study region. In this chapter discussion has been made to emphasize the different aspects which have direct bearing on the agricultural transformation of the study region.

Part second is having three chapters viz., Concept of agricultural transformation and planning, technological and institutional factors of agricultural transformation and changing pattern of area, production and yield of major crops of lower Ganga-Yamuna Doab. Chapter IV deals with the concept of agricultural transformation proposed by different eminent geographers and other social scientists. Agricultural planning of the country since the beginning of the first five year plan has also been discussed in this chapter. Chapter V is devoted for the study of technological and institutional factors of agricultural transformation and their spatial distribution in the study region. Chapter VI describes the changing pattern of area production and yield of major crops of the lower Ganga-Yamuna Doab.
Part third incorporates chapter VII to X which make the core of the thesis. Chapter VII deals with the spatio-temporal transformation of agriculture in lower Ganga-Yamuna Doab with special reference to crop productivity for two points of time. Chapter VIII is devoted to the study of pattern of crop land use in the study region and total volume of change during the period of study. Chapter IX describes the impact of the components of modern technology on agricultural transformation of the study region. It also deals with the study of the levels of agricultural transformation in terms of changed cultivated area, changed agricultural production and changed agricultural productivity and their changed technological correlates. Chapter X is devoted for the study of biotechnology as a tool of crop production. In this chapter various beneficial effects of biotechnology on agricultural production have been discussed. It has been estimated that by the application of biotechnology as a tool of crop production including biofertilizers how much production of agriculture is likely to be increased and how much additional persons can be supported by the increased agricultural production. In this chapter it has also been estimated that by the application of biofertilizers, upto what extent the consumption of chemical fertilizers can be curtailed in the lower Ganga-Yamuna Doab.

The fourth part of the thesis relating to conclusion includes only one chapter i.e., Chapter XI of the same name.
which, beside giving conclusion of the work, proposed certain useful suggestions for future transformation of agriculture in the lower Ganga-Yamuna Doab.