

# Physical and Non Physical Features of the Mahendergarh Region

Paper Submission: 02/02/2021, Date of Acceptance: 23/02/2021, Date of Publication: 25/02/2021

## Abstract

Water is called "Blue Gold" which is essential for life and nurtures the life also. It is used for drinking energy production irrigation and other economic activities. Before independence agriculture in the Mahendergarh district was mainly dependent upon rainfall. After creation of Haryana state means of irrigation like canals /distributries /bunds were provided in the district.Mahendergarh is a region of semi-arid climate. The district has no perennial river. Dohan and krishanawati is important seasonal river. Presently the number of villages are 370 in the district.The total area of the district is 1899 sqKM.According to census of 2011 the total population is 922088. The sex ratio is 895 and the literacy rate 67.58 percent.

**Keywords:** Irrigation, Distributries, Canals, Semi-Arid, Sex-Ratio

## Introduction

### Location of Mahendergarh

The study region forms the southern part of Haryana having distinct physical setting and socio-economic background. Hence, it becomes important to understand the physical factors Such as physiographic, geology, climate, natural vegetation, drainage system, nature of soils etc. The components of natural environment such as land, water, and air make certain places more suitable for human habitation. Hence, it becomes important to understand the natural factors having their effects on the human beings. The variable socio-cultural and economic background has its effects on the human life-style which varies from circle to circle and time to time.Mahendergarh is famous for cotton, bajra, Mustured and wheat crops. Its main markets are Narnaul, Mahendergarh, Kanina, Ateli Mandi and Nangal Choudhary.

### Boundaries

Mahendergarh is a district place having lot of blocks as well as district boundaries and forest area also. At east side of mahendergarh there is rewaridistrict and West bhiwani and North dadri and jajar District. There are narnaul, mahendergarh, ateli, kanina, nangal choudhary blocks. Lift irrigation project is major for irrigation. The lift irrigation develop here due to inverse slope of other part of Haryana.

## Subhash Chander

Research Scholar,  
Dept. of Geography,  
RRBMU,  
Alwar, Rajasthan, India



It will help to develop the field of agriculture. There are 357 villages in this district.

#### **Aim of the Study**

In this context, this study attempt to achieve following objectives:

1. To study the physical characteristics, their interrelation and falling in administrative unit of Mahendergarh district.
2. To find out the spatio-temporal changes in land use and land cover and land suitability for different crops at block level.
3. To study the government intervention regarding watershed development programmes in selected microwatersheds. I

#### **History**

It also becomes extremely difficult to trace the successive stages in the historical growth of the region. Possibly it was included in the empire of the Mauryas, the Guptas, the Pushabhutis, the Gurjara-Pratiharas, Tomars, Mughals and Britishers.

After Independence and the consequent formation of the PEPSU in 1948, the three tracts, namely, Narnaul and Mahendragarh from Patiala; Dadri from Jind and Ateli (part of the Bawal/Nizammat) from Nabha were combined into the district of Mahendragarh. On the reorganisation of States, the entire State of PEPSU was merged into Punjab on 1st November, 1956. Mahendragarh became one of the districts of Haryana when it came into existence on 1<sup>st</sup> November 1966.

#### **Physiography**

Mahendergarh district lies in the south of Haryana. The boundary of this district Bhiwani is northside and westside, Rajasthan is Southside and Rewari is east side. The height of the district is 305 metre above sea level. The branches of the Aravali Mountain is scattered in all district. the soil is sandy. The sand dust storm is prevalent in the month of May and June. The level of under groundwater is decreasing continuously in Narnaul and Nangal Choudhary.

#### **Drainage**

There is no perennial river in the district. The general slope of the district is from south towards north in which direction rain fed streams of the district flow. The Dohan and the Kasaunti or Krishnawati are the main seasonal streams of the district running parallel to each other from south west to north east and pass through middle of the district. In the past, these streams flooded the district but now due to construction of large number of bunds in 12 Rajasthan catchment areas, no flooding takes place. Third one, which is also tributary of Krishnawati, is Guili Nadi or GandaNallah which covers about 13 kilometres to join Krishnawati. From Jorasi Dam, this nallah runs from west to east and joins Krishnawati river near Shekhpura village. Three main nallahs entering Jorasi Dam are, first from Basirpur village hills, second from Hasanpur village hills and third from Khalra hills in southern part of the district.

#### **Bhadanti and Dostpur villages**

It covers 31 kilometres upto Dablana village with clear EIABakhrija.pdf bed. After Dablana village, it converts into KasauntiNallah. Passing near Narnaul

town, the stream completes the 49 kilometres course, and then it is not visible as the water flows through depression and ultimately falls into drain number 8 near Ratanthal village of Rewari district. Some small nallahs join it from both sides at different places

#### **Climate**

The district falls in sub-tropical and semi-arid region, lying not very far from Thar Desert. The climate of the district is characterised by its dryness and extremes of temperature and scanty rainfall. The district has a subtropical continental monsoon climate where we find clear-cut seasonal rhythm, hot summer, cool winter, unreliable rainfall and great variation in temperature. Air is generally dry during the greater part of the year. Scorching dust laden winds that blow during hot season render the weather very tiring. Dense fog sometimes occurs during winter months.

Four seasons are observed in a year. Mid-March to end of June is summer season, followed by rainy season from July to mid-September, after which a transition period of two months (autumn) follows, then comes the cold season from mid-November to mid-March. With the start of cold season temperatures begin to decrease rapidly. January is the coldest month when mean daily maximum temperature is about 21.5°C and mean daily minimum at 5°C. Cold waves affect the region in the wake of passing western disturbances and the minimum temperatures drop down to about 1.9° C occasionally. The highest maximum temperature recorded at Narnaul was 48.4° C on June 8, 1966 and the lowest minimum temperature was 0.9° C on December 30, 1965.

Summers are long and arid prohibiting all human activities. With the onset of summer season temperatures begin to rise rapidly. May and June are the hottest months. The mean daily maximum temperature in summer is around 40.7°C. The range of temperatures is astonishingly high. On individual days, the day temperature may occasionally exceed 45°C. Hot westerly winds locally known as 'looh' begin to blow from the month of April. With the beginning of monsoon season, day temperatures drop appreciably whereas nights continue to be as hot as in summer. During rainy season, weather is unpleasant due to increased moisture in the air. After the monsoon season day temperatures remain high but night temperatures go down rapidly.

Rainfall records (2005-09) reveal that average annual rainfall in the district is 571.9 mm. and about 78 percent of the normal annual rainfall in the district is received during June to September, June and July being the rainiest months. Rainfall generally increases from west to 13 east. Rainfall in the month of June is significant mostly in the form of thundershowers. The variation in the annual rainfall from year to year is very large. On an average there are 27 rainy days in a year in the district. The heaviest rainfall in 24 hours recorded at Narnaul was 237.4 mm on August, 12, 1972

Winds are generally light in the district with some strengthening in force during late summer and monsoon seasons. Cloudiness is moderate to heavy during monsoon season, rest of the year skies are

generally clear or lightly clouded. Easterly and south-easterly winds blow during monsoon season but for the rest of year winds are westerly or north-westerly. Air is dry for most part of the year. Relative humidity is generally high in the mornings during monsoon season and from December to February. During summer season relative humidity is as low as 26 percent in the afternoons. Thunderstorms occur throughout the year but the highest incidence is during monsoon season.

#### **Soil and Cropping Pattern**

The soils of the district are mostly sandy loam and sandy which are highly deficient in organic matter. Wind erosion is the most common feature. At many places, the soil is embedded with lime, kankar and rock. Very light soils are sandy and loamy sand (Bagar) and relatively sandy loam is mostly found in the district. Rocky surfaces are also found here and there. The soils as classified by the National Bureau of Soil survey and Land Use Planning (ICAR), Nagpur, the district has mainly Orthids-fluvents, Psammments and Psammmentsfluvents types of soils.

The major kharif crop of the district is bajra. The minor ones include cotton and kharif vegetables. The major Rabi crops of the district include wheat, gram and mustard oilseeds. Minor ones include rabi vegetables and barley.

The district is deficient in irrigation facilities; hence crops requiring smaller quantities of water or barani crops are dominant. It is a dry farming district. The farmers have tremendously changed the cropping pattern from monoculture to multi-culture with the help of 16 of sprinkler and drip irrigation techniques. In this direction some cooperative societies and banks have played an effective role in providing economic help in the district. Cultivation of green fodder like jowar, kasani, barseem, etc. has been started both in kharif and Rabi seasons.

The farmers of those villages which lie near the urban centres have started cultivation of vegetables such as tomato, carrot, cauliflower, ladyfinger, raddish, spinach, methi, etc throughout the season. The farmers have started cultivation of commercial crops also. In the past decades, only subsistence type of agriculture was practised but now-a-days mustard is cultivated commercially over large tracts of land. Due to declining water table, farmers have started cultivating those crops which require lesser water. Cultivation of moong, toria and lobia during kharif season and gram, barley, etc. during rabi season have either decreased to the minimum or totally stopped.

#### **Forestry**

The area under forests is classified according to ownership private and State. Forests owned by corporate bodies and private individuals are included under private forests. The State forests include reserved and protected forests.

#### **Agriculture**

Economy of the district is still mainly dependent upon agriculture as it is the dominant occupation of the working class of the district. Agriculture, still, is an important means of subsistence for the majority of the population of the district. During

2001 Census 65.8 percent of the total workers were engaged in agricultural activities (cultivators and agricultural labourers) whereas this proportion has gone down to 45.6 percent during 2011 Census, a very great decrease of 20.2 percent. Tertiary activities are going up at a faster pace with proportion of 32.0 in 2001 to 42.4 in 2011 Census in the district.

The government is making all efforts to encourage agricultural production by distributing improved seeds, fertilizers, pesticides, providing latest developments in modern techniques, multiple cropping pattern techniques, increasing irrigation facilities, providing easy loans for modern agricultural machinery, etc

Semi-arid type climate of the district is suitable only for traditional crops like bajra, during kharif season and gram, mustard oilseeds during rabi season.

#### **Soil**

It is the natural dynamics body made up from organic substances which Facilitates the requisite factors for growth of plants. It is the natural gift given by the nature in which plants are grown and supplied food for man and all animal beings different type of soil found in the mahendergarh district.

#### **Review of Literature**

The agricultural changes in different parts of India have been studied widely by agricultural geographers at different spatial scales—state, district and village level over different periods in time. A review of the past research would help in identifying, reviewing and analysing the conceptual and methodological issues relevant to the present study. A systematic review of literature has been done keeping in view the objectives of the study. The review is presented under the following broad headings:

1. Land Use
2. Cropping Pattern
3. Crop diversification and Crop Concentration
4. Agricultural Productivity and Crop Intensity
5. Agricultural Workforce
6. Agriculture and Development

#### **Land Use**

Land use has been one of the most researched topics during the last century. Various studies have been conducted on the analysis of land use pattern in different parts of the world. The beginning of land use studies and surveys may be traced to the regional survey where it was purely of general academic interest. The idea of mapping the land use was mooted by Sauer (1919). Tracing the history of land use studies initiated in Great Britain, the first land use survey and mapping was carried out by Geddis (1926). However, practical work on land use was carried out by L. D. Stamp in 1930 and 1931 in the entire Great Britain. The work was titled "The Land Use of Britain: Its Use and Misuse". The works of Hartshorne (1935), Whittlesey (1936), Weaver (1954), were also focused on land use surveys. Khan (1971) in his study examined the changes in patterns of agricultural land use in southern Ontario during the period 1867-1971. Two factors, namely, physical and socio-economic were examined and the drastic decline in the area of farm land was observed to have

occurred during this period. The Ontario farmers also witnessed a very high rate of mechanization during this period. Morgan & Munton (1971) identified the fact that socio-economic factors affected land use patterns considerably and that it was unrealistic to regard agricultural cultivation systems as adaptations to different natural conditions and that cultivation system could be more plausibly explained as a result of differences in population density. Singh, (2003) analyzed the effect of changing land use on the environment of Nepal and observed that man's activities had led to drastic land degradation, large-scale deforestation and consequent ecological imbalance.

As far as India is concerned, Chatterjee (1940) has emphasized the need for a land use survey and Aligarh Muslim University, Uttar Pradesh; Banaras Hindu University, Banaras also conducted land use studies. However, most studies in agricultural land use were done by Indian geographers after 1950.

Chadha (2006) in his presidential address observed that there was a trend of taking away agricultural land for non-agricultural uses in India. The study showed that land under non-agriculture uses had witnessed a continuous increase over time. In many cases it was because of the unwise use of land, mostly due to demographic and economic pressures, usually by the poor and marginal cultivators. Poor rural people also overexploited the land resources mainly by overgrazing or deforestation or by unhealthy cultivation practices. The inadequate or imbalanced use of chemical fertilizers removed soil nutrients and damaged the yield increasing capability of the land. He observed that the expansion of double cropped area 13 under dry farming conditions had not proved to be an effective mechanism for increasing land productivity, employment and earnings. He suggested that the lands in the upper catchments should be rehabilitated first.

Misra and Kumar (2007) in their work on land-use change and food crop productivity in India, a spatio-temporal analysis captured the changing land use during 1950- 51 to 1990-91. A perusal of the land use change in the country revealed that major portions of land devoted to agriculture and the area under agriculture had reached the saturation limit with hardly any chance for further expansion. The waste land, uncultivable land, pasture and groves had already declined.

Kaur (1991) highlighted the changing patterns of land utilization in Punjab since the inception of new farm technology in the mid sixties i.e. from 1966-67 to 1987-88 and revealed that the reported area for land utilization had remained constant. However, the area under forests was not available for cultivation and the net area sown had increased during the period. Due to intensification of agriculture, the gross cropped area and cropping intensity had increased. They concluded that agriculture in Punjab had recorded drastic structural changes since the beginning of the Green Revolution.

Sharma and Pandey (1992) studied the dynamics of land use in different states of India and

revealed a general declining trend in the area under permanent pastures, grazing lands, barren and uncultivable lands. The study has found that the area under non-agricultural uses, cultivable wastes and fallow lands showed a positive growth in most states.

While for area under forest, negative growth rate was observed in the states of Assam, Bihar, Haryana, Himachal Pradesh, Madhya Pradesh, Maharashtra and Tripura while Jammu and Kashmir and Orissa showed negative growth rate for area put to non-agricultural uses. The annual rate of increase in area under nonagricultural use was very high in Gujarat, Tamil Nadu, 14 Rajasthan, Uttar Pradesh, Maharashtra, Karnataka and Madhya Pradesh. Increase was observed in areas under permanent pasture and grazing lands in Bihar, Maharashtra, Mizoram and Uttar Pradesh. Similarly declining trend was observed in the areas under miscellaneous tree crops in Andhra Pradesh, Gujarat, Haryana, Kerala, Orissa, Punjab, Tripura and Uttar Pradesh.

Singh and Kaur (2007) in their study pointed out that land-use change and status of agricultural production in interstate Chandigarh region the major factor in influencing use of land was the constant expansion of urban areas there and focused encroachments on fertile agricultural lands.

Singh (2008) in his study on land use change, diversification of agriculture and agro forestry in north west India has analyzed the land use for the previous 10 years and suggested that Punjab and Haryana had recorded absolute expansion of areas and cultivation with almost 84 percent of the area being cultivated. The cropping pattern in the region underwent a substantial change, with wheat and rice emerging as major crops in Punjab and half of 15 Haryana and the cropping pattern had unnecessarily become energy-intensive while affecting the static balance of underground water resource in the plains of Punjab and Haryana.

Kaushik, Saroj, Sharma and Hooda (2015) in their study have made an attempt to study the changes in land use and land cover of Hisar city of Hisar district of Haryana state. The study was carried out through Geo- Spatial techniques using SOI toposheets, LISS III imagery of 1999 and 2014 and concluded that though there are some changes detected in land use/land cover analysis for the period 1999-2014 but it does not indicate any significant environmental impact on the study area. The urban change detection is happening in Hisar city due to the good trade links with the adjoining areas and its dominance in the field of medical care, education, seed production, horticulture and automobile repair and because of spare parts market. It has been identified as a counter magnet city of NCR to attract migrants and develop as an alternative centre of growth to Delhi. The rapid growth of population has created an extraordinary rise in the built-up area of the city. The total residential and commercial area which comes in developed area has changed from 13.32 sq. kms. to 17.31 sq. kms. and developing area has changed from 7.49 sq. kms. to 12.90 sq. kms.

The following studies on land use mainly focused on the spatial changes of agricultural land

use to non agricultural use during 20th century and after that at different levels; state, districts and village level. These studies concluded that the changes were mainly governed by industrial and residential activities which occupied the agricultural land use.

#### **Cropping Pattern**

Vyas (1966) has argued that the significant changes in cropping pattern in India could be explained in terms of a change in relative prices. Sohal (1993) in his study has found that if India wants to feed its teeming millions then the present state of affairs in respect of cropping pattern and crop combinations should go on. He suggested that both national interest and ecological obligations must work hand in hand in agricultural planning.

Hazra (2001) has studied the changes in cropping patterns at the all India level by considering the area share of crops and crop groups at four time points respectively, the triennium ending average of areas at 1966-67, 1976-77, 1986-87 and 1996-97. The study revealed a shift from the traditionally grown less remunerative crops to more remunerative crops. The crop shift took place due to government policies and thrust on some crops in a given time. Market infrastructure development and certain other price related support also induced the changes in cropping pattern.

Goswami and Challa (2004) have studied the changes in cropping pattern in India for the period 1951 to 1998. The results showed a gradual shift in area from food crops to non-food crops indicating more diversification in recent times. The proportion of area under total cereals to total cropped area reduced from 61.1 percent in 1950-51 to 53.08 percent in 1997-98. Reverse scenario was noticed in the case of total oil seeds where there was almost three-folds increase in area during the period under study.

The study of GyanPrakash et.al (2006) reflected that there was in fact, some deceleration from Pre-Green Revolution period to Green Revolution period in the production of food grains in India, but further it has deteriorated more in the post economic reforms period and the area shrinks four times from pre-Green Revolution period.

Dhindsa and Sharma, (1995) found that the aggregate changes in cropping pattern in Punjab during 1965-66 to 1990-91 in terms of expansion and substitution effect were measurable by total cropped area and elasticity of various crops.

Chand and Haque (1997) in their study have examined the sustainability of rice- wheat crop system in the IndoGangetic Region and have worked out the growth trends and discussed the problems and issues related to the crop system especially in the Gangetic and Trans-Gangetic plains, where rice-wheat farming was widely practiced. Kumar and Singh (1998) have made an attempt to analyze the cropping patterns in North Bihar during the post- Green Revolution period (1970-71 to 1993-94). The study revealed that the cropping patterns of North Bihar were still predominated by cereal crops. The predominance of cereal crops in the cropping pattern was attributed to the food grains scarcity in the project area and

biochemical and genetic innovations in the principal cereal crops during the post-Green Revolution period.

Sihmar (2014), in his study growth and Instability in agriculture production in Haryana a district level analysis has highlighted the growth rate of agricultural production shows changes in spatial pattern of different crops. On the one hand two crops, wheat and rice show a very satisfactory performance in their production in all the three periods (1980- 81, 1989-90 to 1990-91 and 2000-01 to 2006-07. on the other hand crops like Gram, Masar, Mize etc showed unsatisfactory performance in their production. Gram shows highest declining trend. The study finds out that there is a very positive impact of green revolution and new economic reforms on total food grain production. But it has created a wide gap between superior crops such as wheat, rice, sugarcane and coarse cereals such as Bajara, Jowar, Maize and Pulses crops.

The above mentioned studies highlighted the changes in cropping pattern that have been occurred in most parts of the country during 20th century and after that. Most of the studies revealed that with the push given by the new technology, there was a very positive impact of green revolution and new economic reforms on total food grain production. But it 20 has created big gap between coarse cereals and more remunerative crops like wheat, rice, oilseed and fruits and vegetables etc.

#### **Agricultural Productivity and Cropping Intensity**

Shafi M. (1960) has worked on measurement of agricultural efficiency in Uttar Pradesh by applying the ranking coefficient method of Kendall tooling eight food crops grown in each of the forty eight tehsils of the state. Enyedi (1964) has studied geographical types of agriculture in India. He applied new methods of crop productivity. Garg (1964) has worked out the trends in agricultural development with respect to total cropped area, gross irrigated area and food grain production in two districts of Uttar Pradesh.

Chauhan and Sangwan (2007) have found that there has been multi-dimensional progress which had collectively improved the socio-economic conditions particularly in rural areas of India during the Green Revolution. A unique phenomenon was observed in those areas in which the agricultural productivity was high especially in Punjab and Haryana, but in recent years the productivity had declined in the eastern region except West Bengal the productivity was observed to be low mainly due to weak infrastructure.

Ramachandra, et al. (2014) in their secondary data based study have examined the performance of trends of agriculture growth and production in India. And the study has shown that agricultural production has significantly increased from during the last three 28 decades. It also revealed that the major cereals crop have increased over the period of time. An average of 94.49 million tonnes of rice is produced annually which is higher than production of wheat, coarse cereals and pulses taken individually. However, it is less than annually average production of all food grain (227.48 million tonnes). Kumar, Sharma, and Ambammal (2014), have

estimated the impact of climatic and non climatic factors on major food grain crops in India. Cobb-Douglas production function for a panel of 13 states during 1980-2009 has been employed. Empirical results based on PraisWinsten models with panels corrected standard errors (PCSEs) estimation shows that productivity of major crop like, rice, maize, sorghum, and ragi negatively influences with increase in actual average maximum temperature. And predict that a 10 degree Centigrade increment in actual average maximum temperature reduces the productivity of rice, maize, sorghum, and ragi crops.

Godara and Poonia (2011) have made an attempt to study impact of prices on acreage and income from gram in Haryana during 1978-80 to 2008-09. The important findings emerged from the study indicated that the growth rates of area and production during all the study periods have been negatively highly significant. Saha (2014) in his secondary data based study has made an attempt to identify the disparity in agricultural production of Assam. The study concluded that the agricultural production of the state is much below the expectation as compared to the many other states in the country like Madhya Pradesh, Punjab and Haryana etc. Consequently, a disparity in the agricultural productivity of the state with the rest of India arises. Many agricultural inputs as well as government machineries are responsible for it. The study found a regional disparity in the production almost all the crops between the state of Assam and India.

The above mentioned studies have assessed the spatio-temporal variations of agricultural productivity and cropping intensity at different levels during 20th century and after that by using different methods. The studies have shown that after green revolution the growth and production has significantly increased but during 21st century because of the government policies and climatic change the falling growth in productivity has increase the agrarian distress in many of the state of the country

#### **Agriculture and Development**

Gupta and Shangari, (1980) has observed that in the post Green Revolution period wheat-rice crop rotation had emerged in central parts of Punjab due to the developed agricultural infrastructure and the excellent services of the Punjab Agricultural University, Ludhiana. Kainth and Mehra, (1985) in their study on rice production potential and constraints have revealed that the Green Revolution may be taken as a turning point for Indian agriculture and especially for Punjab, which with the push given by the new technology had become one of the most developed states of India. The state spearheads the progress of the Green Revolution and has rightly been called the 'grain bowl' of India.

Sharma (1990) attempted to study the inter-state disparities in growth of agriculture in India from 1966-67 to 1987-88 and observed that four agriculturally developed states viz., Punjab, Haryana, Uttar Pradesh and Maharashtra had a growth rate of food grains production higher than the national average of 2.72 percent. Increased production was

statistically non-significant in Gujarat, Tamil Nadu and Rajasthan states. The remaining states witnessed lower growth rate than the national average. The study also found that cropping pattern change also accompanied with development of the states. He suggested that inter-state disparities minimized by bringing the farmer within the ambit of efficient extension education and training activities, sound government policies and efficient supply network of various inputs.

Bhalla and Singh (1997) in their state level analysis of recent developments in Indian agriculture have made a brief review of the regional patterns of level and development of agricultural output in India since mid- 1960s, in general during 1980-83 to 1992-95, in particular. Singh (1998) has analyzed the post Green Revolution developments in agriculture in Haryana. The study revealed that with the onset of the Green Revolution in midsixties Haryana witnessed a transformation of the traditional, largely subsistence agriculture into a modern commercial one. This is attributed primarily to the development and intensification of agricultural infrastructure base. The state has experienced impressive changes in its cropping pattern with low yield and value coarse cereals being replaced by more remunerative oilseed, fiber rice and wheat.

Chand (1998) studied the effect of trade liberalization on selected crops like rice, maize, chickpea rapeseed and mustard. Estimating the impact on the wholesale and farm level prices studied the effect at national level by estimating the consumer and producer surpluses. The study showed a sharp positive impact on net return following free trade from production of exportable such as maize and rice. The impact was negative for importable 34 such as rapeseeds, mustard etc. Thus, impact of grade liberalization would vary from commodity to commodity.

Alagh, (2007) has studied growth and changes in Indian agriculture since the eighties. The study revealed that agricultural sector was traditionally regarded as having low price responses. Cropping patterns were different in different areas because of economic reasons or technological reasons but the change was slower.

Mythili, (2008) has reported on acreage and yield response for major crops in the pre- and post-reform periods in India estimates supply response for major crops during the pre- and post-reform periods. Estimations were based on dynamic panel data technique using pooled cross-sectional time-series data across the states of India for the period 1970-71 to 2004-05. As expected, the food grains revealed less response than non-food grains. With proper specifications of the price variable, the acreage elasticity increased by about 20 percent to 40 percent post reforms as compared to pre-reforms for all crops, except cotton and groundnut. Yield responses were higher than acreage response for the main cereals, rice and wheat. Treating yield variable as a proxy for non-acreage inputs, the results confirmed that farmers respond to price incentives increasingly by adjusting

non-acreage inputs than acreage for main cereal crops.

The above mentioned studies highlighted the agriculture development that has been occurred in most parts of the country during 20th century and after that. Most of the studies revealed that with the push given by the new technology, with green revolution and new economic reforms also enhance pace of agricultural development in India. Changing patterns of agricultural landscape have been the most staggering feature of the agricultural situation in India as well as Haryana in post-reform period. Many systematic 35 studies are available on the nature of changing agrarian pattern in the Green Revolution region of India. But no attempt has been made to depict a collective agricultural change in terms of various attributes namely land-use, cropping pattern, productivity, crop concentration, crop diversification, cropping intensity and agricultural workforce. Hence the present study had made a humble attempt to fill this gap to some extent by studying the agricultural change in terms of various attributes as mentioned above in the post reform period by taking Haryana as an example.

The present thesis is aimed at examining the change experienced by the state of Haryana in its agricultural sector in the post green revolution period on the basis of thrusts in the sphere of agriculture, its development and sustainability. The changes in the agrarian social structure, impact of agro-technology upon the relations between the landless agricultural labourers and landed agricultural household has also been looked into. This involved an understanding of Haryana's agricultural development particularly in the post-green revolution period encompassing the socio-economic, geographical, political dimensions; an inquiry into agricultural development and its sustainability, the rate of various inputs and land management systems;

1. An examination of trickle down effects of the green revolution and its sustainability during the post-green revolution period: socioeconomic conditions of landed and the landless peasantry;
2. An analysis of employment pattern, wage rates, working conditions, mechanization and irrigation and their changing patterns;
3. An analysis of agrarian prosperity and indebtedness among various agrarian classes;
4. An evaluation of role of government policies for the sustainability of agriculture.

The present research work is an empirical study of the agricultural development and change in the post green revolution period in Haryana. Only limited secondary data could be obtained from sources like the Census of India, Economic Adviser to Government of Haryana. Hence most of the requisite data was collected through personal field work. A questionnaire based household survey of four villages, selected through multi-stage sampling techniques, was conducted to gather detailed information. In this first stage the 16 districts, as per 1991 census, of Haryana were ranked on computing standard scores of the chosen indicators of agricultural development through Z-score

transformation method. The indicators include: Input Indicators (Agricultural Infrastructure)

1. Percentage of gross irrigated area to gross cropped area.
2. Percentage of area sown more than once to net sown area.
3. Percentage of area under commercial crops to total cropped area.
4. Consumption of fertilizers (kgs) per hectare of gross cropped area.
5. Number of tubewells and pumping sets per '000 hectare of net area sown.
6. Number of tractors per 100 operational holdings.

#### **Output Indicators (Agricultural Productivity)**

1. Agricultural produce (kgs) per hectare of gross cropped area.
2. Agricultural productivity per cultivator in rupees.
3. Agricultural productivity per hectare of gross cropped area in rupees. One of the fallout of the new agro technology
4. In the regions is the increasing rate of accidents while carrying out agricultural operations. Most of the victims were invariably hired casual labourers.

During the field work it was observed that the case of accidents were not reported to the police or to the civil surgeon but were hushed up on some payment made by the employer. It was noticed that the overall productivity has increased in the post green revolution period but it has differentially affected the socioeconomic condition of various landed classes in rural Haryana. The farmers with large land holdings benefitted disproportionately to those who had small/marginal holding leading to interclass disparity. The intensification of physical, socio-economic infrastructure has opened up new avenues of employment in the non-agricultural sector. It seems that the non-agricultural occupations have taken over the dependency of rural labour only on agricultural occupations. The sustained growth in agriculture along with diversification reduced the rural poverty. Region with greater occupational diversification has led to greater saving for the agricultural labour sometime even more than the net saving of small/marginal farmers. In the post green revolution period large number of agricultural labour households went into non-agricultural occupations. It seems that sustained growth in agriculture, occupational diversification, and rural infrastructure, upgraded by state government played a key role in the creation of non-agricultural occupation for the rural poor. Thus, the diversification of economy along with increased productivity has initiated the "trickle down" processes and its benefits to reach the rural poor. The various centrally sponsored schemes implemented by Haryana government under Integrated Rural Development Programme for the upliftment of agricultural labour household could not make any dent. Public expenditure on some programmes has been to a large extent a waste of money. However there were indirect benefits to the rural community which flowed to them from the rural prosperity engendered. They have also created an environment for the greater awareness among farmers. Note of Caution With the

implementation of World Trade Organisation, the country shall enter into a still new economic era of 'a buyer's market'. The agreement calls for withdrawal of all subsidies and allows free imports. If the subsidies are curtailed or withdrawn the most affected are likely to be small and marginal farmers. It may lead to a large proportion of them joining the agricultural labour force. Free trade in foodgrain will increase price variations in the economy and adversely affect agricultural production and food security. Those regions which make large investment in rural infrastructure including irrigation, electricity, communication and new technologies, will benefit from the World Trade Organisation (WTO). Similarly large farmers with their greater capability to diversify for exports shall benefit more. Keeping in view the challenges arising from economic liberalisation and globalisation there is need to encourage and educate the farmers on crop diversification, income enhancing crops, for example fruit trees, and economic activities (pastoral agro forestry) that are less water and land intensive; to assure the farmers of protection of their rights to retain and exchange seeds; to strengthen rural infrastructure and promote technology oriented agricultural development strategy such that the impact of vagaries of nature are minimised; promote the growth of agro-business; promote the growth that is based on efficient use of resources, conservation of soil, water and biodiversity. Ultimately a growth that is sustainable technologically, economically, environmentally is the desired goal. Only then can we hope for a prosperous agriculture for the benefit of all sections of the rural society.

#### **Conclusion**

The state of Haryana prior to advent of green revolution was marked by subsistence agriculture, low agricultural productivity and poor agricultural infrastructure. But the state witnessed vast changes in its agriculture ever since it experienced green revolution, which incidentally coincided with its formation in 1966. This was despite the fact that the state is not much favourably placed in terms of its physical resourcebase. Inadequacy of fresh water in general, presence of brackish water over a large part, and low and variable rainfall are its basic problems. The progress on the agricultural front was achieved through (i) introduction of canal irrigation in the northern and western part of the state; which had facilitated reclamation of new agricultural land; (ii) consolidation of land holdings which among other things, promoted tubewell irrigation; (iii) colonisation of new agricultural land; (iv) a rural based political power which gave a high priority to allocation of resources to the agricultural sector under the various plans; (v) rehabilitation of displaced persons from Pakistan who were enterprising and progressive and enriched the human capital of state. All these vital inputs had gone into the agricultural development of

the state before the green revolution ushered in. The basic economy of the state being rural, agriculture and its related aspects were accorded priority. Consequently disparities in agricultural infrastructure such as irrigation, use of fertiliser and adoption of high yielding variety seeds declined in various regions of the state. Agricultural productivity levels improved even in areas which suffered from physical constraints. All this, however, could not ameliorate the disparity situation. Productivity rise was more pronounced in areas which were already at a higher level of productivity assisted by both physical and technical factors. Moreover productivity per cultivator was also observed as having increased over time. Its impact among the different classes of peasantry was examined at the household level through survey. To cope with lowering water table situation the big farmers replace shallow pumpsets by submersible pumps and small farmers who depend on them are exploited in groundwater market. Inland soil salinity and water logging in canal irrigated arid, semi-arid regions of Punjab, Haryana and Rajasthan are other environmental problems. Lowering of water table also causes degradation of groundwater quality like arsenic pollution, fluoride pollution etc. So it's high time to control groundwater irrigation by through dry crop cultivation, conjunctive use of surface water and groundwater irrigation and by strictly following the existing water laws of the country.

#### **References**

1. Ahlawat, S.R. (1998) *'Agrarian structure and social transformation in Haryana', Paper presented at the National Seminar on Social Transformation: The Indian Experience, March 18-19, Panjab University, and Chandigarh.*
2. Ahlawat, S.R. (1988) *'Green Revolution and Agricultural Labour, Deep & Deep Publication, New Delhi.*
3. Bhalla, G.S. and D.S. Tyagi (1989) *Indian Agricultural Development, Institute for Studies in Industrial Development, New Delhi.*
4. Bhalla, G.S. and Y.K. Alagh (1979) *Performance of Indian Agriculture: A Districtwise Study, Sterling Publishers, New Delhi.*
5. Bhalla, Sheila (1995) *'Development, poverty and policy: the Haryana experience.' Economic and Political Weekly, Vol. XXX, Nos. 41 & 42, Oct. 14-21, pp.2619-2633.*
6. *Magnificent havelis of Nangal-Sirohi, The Tribune, 22 June 2002.*
7. *Falling Rain Genomics, Inc - Mahendragarh "Census of India 2001: Data from the 2001 Census, including cities, villages and towns (Provisional)". Census Commission of India Archived from the original on 16 June 2004 Retrieved 1 November 2008*