Agriculture is main stay of the majority of the people in developing countries of the world like India. For centuries agriculture has been a fundamental occupation of the nation. It has been feeding and is still feeding and will continue to feed the teeming millions of our country. It has also been providing variety of raw materials to the industries and also constitute a large proportion to our exports. Thus contribution of agriculture is really great specially in the development of the economy. Thus over the period of time fundamental changes have been initiated in the agricultural sector with the diversification of crops, changing the combination of crops, the adoption of modern inputs and agricultural techniques. At the same time substantial changes have been recorded in various agricultural aspects including land use pattern, cropping pattern, expansion of irrigational facilities with enhanced and diversified agricultural production together have been transforming the agricultural environment and region under study is not an exception to this. As a result similar attempts have been initiated in the Jabalpur region not only to maximise but also to diversify the agricultural production by ensuring the development and expansion of agricultural activities and other associated activities.

Agricultural transformation is a type of ecological form closely related to the spreading of new ideas and innovations transformation hear refers to the changes in the form of agriculture by adopting the modern inputs, techniques and by orienting and gradually by reorienting it towards commercialization.
Jabalpur region, as a part of upper Narmada Valley represents a rich agricultural region. The regional economy is dominated by agricultural and other allied activities and forms the most important source of employment and revenue. It holds an important place in the economic life of the rural people in the region. In the region 20.41 (2001) per cent of population is being accommodated by rural areas and 53.0 per cent are engaged in agricultural and other allied activities.

There is no doubt that the agricultural occupation in different areas has been successfully transformed especially with the adoption of new innovations and technologies suited to this sector. In the country as well as in the study region significant changes have been made in adopting the agricultural innovations specially includes the contributions of engineering and refers mainly to inputs which have a physiological effects in increasing timeliness of field operations. The introduction of these innovations has at one hand, increased the capital intensity of agricultural production and on the other hand has changed the natural environment as well as socio-economic environment of the region with the expansion of urban territory and expanding urban market for agricultural produces.

Before introducing modern agricultural technology, the productivity has been limited due to the non-availability of chemical fertilizers, irrigational facilities, modern agricultural implements improved high yielding variety of seeds and adequate knowledge of improved agricultural practices.
The pace of urbanization and industrialisation has played a major role in the transformation of agriculture and other associated activities. Urban centres and industries centres have been accelerating the process by providing the modern inputs i.e. electric and diesel pumps, tractors, iron ploughs and threshers to enhance the functioning and the overall agricultural production. Urban centres have played a vital role in the development of modern technology, which is being intensively adopted by the agricultural sector in many ways. High yielding variety of seeds, fertilizers, pesticides, modern inputs and the economic profitability not only has attracted the farmers but has also encouraged towards these improved practices for speedy adoption. With the help of these modern inputs farmers have successfully changed the existing cropping pattern as per the emerging demands of the urban centre they have been motivated them for adopting the market oriented agriculture. Impact of systematic agricultural development and various changes can be seen in the adjoining rural urban fringe of the study region. Urban centre ensures the availability of expanding market and the availability of modern inputs required for the agricultural expansion. As a result available input has largely been used for commercial cropping with help of intensive cultivation.

Transformation of agricultural environment here refers to the changes in the shape and forms of agriculture by using modern inputs techniques and by orientating it towards the commercialisation. The
transformation of agriculture in the developing countries and region has been one of the most spectacular features of the past two decades. The generalisation on emerging changes, however include many complex variations in processes, attitudes, responses and the participation of the rural people representing the sample areas.

During the post independence era, more emphasis has been made to achieve the overall development in agriculture by adopting new and improved modern innovations and techniques to achieve the self sufficiency in food grains. Similar attempts were made in the Jabalpur region and the success of these attempts can be seen from different parts of the region being survey during the field work. Here an attempt has been made to assess the level of agricultural transformation which has taken place with the adoption of irrigation, fertilizers, HYV seeds, modern inputs, soil conservation methods and crop protection methods in the Jabalpur region.

**LANDUSE PATTERN**

Land is one of the most important resources of any region. When man uses the land it is called landuse and its type of distributional panorama is called landuse pattern. Among the land resources, agricultural land resources have always played a vital role since time immemorial engaging the largest proportion of the inhabitants of the world. (67, Husain, 1982, p.92).
The economic status and the progress of a region and/or a country can be gauged to a great extent, that how its land is being used and maintained. The land of a region is considered as a fixed resource and as extensive assets with many uses, which yields diminishing returns in the long run. Thus the land usage should be in an optimum way by any progressive region and/or country and it becomes possible in a planned was rather than in a free society (147, Rao, 1989, p.28). The main aim of the landuse study is to understand the distribution of land under various uses in the specific geo-physical and socio-economic environmental conditions, and also to improve the cultivation of land, based on scientific methods and techniques without creating conditions causing environmental degeneration.

It has been observed that changes in the landuse pattern of a rural-urban fringe area is a reflection of the changes being made in natural, economic, social and cultural structure of the study region. Rapid technological changes being adopted have created new needs which demand more land as well as new modes of land utilization. In last 25 years land utilization in the region has witnessed a major changes alongside the growth of population and diversification and expansion of industrial and other related economic activities. Thus with the marginal adjustment between the land resources and expanding economic activities has caused widespread environmental degeneration in various parts of the region.
The history of resources being used clearly indicates, that with the increasing number of people along with the diversification of needs and their enhanced capabilities with the adoption of advanced technology initially the best land has been used for cultivation. But with the growing pressure due to the population and economic development, not only the pressure on the available land has increased even the marginal lands too are cultivated with the induction of modern scientific and technological innovations. As a result use of agricultural land have been gradually but intensively diversified to a higher level. There is another notable factor, which has affected the agricultural land, considering the changing scenario the small, even marginal farmers of the region too have start adopting the recent technical knowledge and the use of modern inputs in agricultural activities. Thus the study of landuse pattern provides the guidelines to maximise the use of available land in the area/region in optimum conditions.

With the study of landuse pattern, one can know the distribution and use of land in different categories. Land utilization in the region too has witnessed similar changes with the growth of population, and activities related industry, dairy and poultry. This has struck the transformation of environment.
Changing pattern of Landuse

To find out the expanding effects of Jabalpur city on the nature and composition of agricultural landuse and production, data related to agricultural activities were collected as per the questionnaire designed for the purpose from the villagers residing in the sample villages. Data related to net sown area under various crops during 1981 to 2001 has been presented in the table no. 5.1 and have helped in gauging the impact of the land use pattern in the region.

Table no. 5.1 clearly shows that total agricultural area owned by the selected respondents representing the sample villages of the region come to 7714.63 Hectares. 62.41 per cent of this lies in Bargi, Kathonda, Khursi, Pipariya, Maharajpur, Umariya Choubey, Deori, Urduq Kalan and Saliwara villages while 19.62 per cent area is shared by Nimkhera, Bahoripar, Chhitri khurd, Pindrai and Badaiyakheda villages. The remaining 17.97 per cent lies in remaining seven villages. A part from this only 4.05 per cent of the total area belong to the category of fallow land and surprisingly only Chhitrikhurd and Khursi villages account 3.17 per cent area is under forest. This clearly shows the non-availability of natural vegetation among the sample villages.

Out of the total available land (7714.63 Hect.) in the villages 50.62 per cent (3905.36 Hect.) is used for cultivation and belongs to net sown area. Umariya Choubey, Bargi, Kathonda, Deori, Urduq
Kalan, Bahoripar, Kukrikheda and Khursi villages share 64.10 per cent of the total net sown area whereas only 13.85 per cent lies in Umariya, Chhitri khurd, Pipariya and Nimkhera villages and the remaining 22.05 per cent of net sown area is shared by nine sample villages of the study area.

During 1981 and 2001 the proportion of net sown area has increased only in Aamanala, Bargi, Deori, Umariya, Kukrikheda, Mehgawan, Nimkhera, Pindrai, Bahoripar and Kathonda sample villages with 10.98, 6.03, 5.45, 3.83, 1.87, 1.15, 0.88, 0.83, 0.09 and 0.07 per cent respectively. In these sample villages the main reason behind the increase of net sown area is due to the availability of sufficient facilities for agricultural activities. On the other hand Maharajpur, Umariya Choubey, Pipariya, Kungwa, Badaiyakheda, Urduakalan and Sehora villages the per cent of net sown area have declined in varying proportion from -27.51, -21.09, -19.29, 15.82, -9.11, -8.61 and -8.21 per cent respectively while in the remaining four villages the decline rate is very low.

The main reason behind the declining of net sown area in Maharajpur, Pipariya, Kungwa is the conversion of agricultural land to be used for other non-agricultural purposes. Due to the nearness of these villages with the city residential colonies and shops have been developed along with the poultry farm, dairy farm units are being established on the agricultural land as a result agricultural land have been declined.
The analysis of the agricultural data collected and compiled during the field survey clearly shows that 41.26 per cent of the net sown area is also cultivated more than once and belong to the double cropped area. Urdu Kalan, Bargi, Deori, Kathonda, Umariya Choubey and Bahoripar villages share more than 54.60 per cent of the double cropped area of the sample villages in the region while Chhitrikhurd, Kukrikheda, Nimkhera, Matamar, Saliwara, Aamanala and Maharajpur villages together account for 28.92 per cent as double cropped area. While the remaining eight villages have only 16.48 per cent of the total double cropped area in the region. Changes in the proportion of the double cropped area has been continuously made to meet the increasing demand of commercial crops and also due to the required modern inputs along the availability of adequate electricity. Gradually efforts have been made to brought single cropped area under cultivation as double cropped area.

As a result the proportion of the gross cropped area among the selected sample villages clearly indicates systematic the transformation of the available agricultural land under multiplication of use as well as changing the combination of crops grown in the villages to meet the changing requirement of various market oriented crops by the Jabalpur city.

The maximum increase in the gross cropped area has been recorded by Matamar, Urduakalan and Chhitrikhurd sample villages during 1981 to 2001. While 49.0 per cent of the total gross cropped
area lies in Bargi, Deori, Kathonda sample villages. The increase became possible with the availability of irrigational facilities, availability of modern inputs and demand of commercial crops in nearby Jabalpur city.

Minimum changes in the gross cropped is being recorded by Pipariya, Saliwara, Maharajpur villages and they together account for about 8.39 per cent of the total gross cropped area due to use of agricultural land in non-agricultural activities i.e. for developing residential colonies, schools, shops, dairies, poultry and other commercial purposes.

Proportion of land not available for cultivation among the sample villages in the region has increased from 18.43 in 1981 to 22.43 per cent in 2001. 65.07 per cent of the total land not available for cultivation lies in Bargi, Maharajpur, Saliwara, Nimkhera and Umariya Choubey villages whereas 18.84 per cent belongs Deori, Matamar, Bahoripar, Kathonda and Sehora villages. And only 16.09 per cent area lies in the remaining 11 sample villages of the study region. The main reason for these changes has been due to the increasing proportion of non-agricultural activities such as development and expansion of industrial and commercial activities, settlements, canals and road network, etc.

In the study region 20.35 per cent of the area belongs to cultivable waste land. About 54.45 per cent of total cultivated waste land lies with
in the territories of Pipariya, Maharajpur, Khursi, Badaiyakheda and Bargi, villages followed by 23.67 per cent shared by Saliwara, Nimkhera, Kukrakheda and Kathonda villages. While in 12 sample villages the proportion of cultivated wasteland is only 21.88 per cent.

**CROPPING PATTERN**

It is the cropping pattern, which is easily susceptible to change along with the changes being recorded in agricultural methods, techniques and even the objectives for initiating the modernisation of agriculture. The cropping structure, specially the cropping pattern in a particular region is determined by the soil fertility, soil texture, structure, components of climate, temperature & moisture and also due to changing composition of the socio-economic variables like land tendency, size of holdings, availability of irrigational facilities and the use of modern inputs and the distance from the market centre.

Without considering the agricultural characteristics like cropping pattern, agricultural planning cannot be formulated. It is a dynamic phenomenon and is changeable, with the induction of modern technology and the changing requirements of the urban society. In fact no cropping pattern is good and stable for all times to come (65, Hussain, 1989, p.116). This is also applicable for the region under study.

The Green Revolution in India has been associated with a large-scale technological transformation and consequential socio-economic changes to accommodate the emerging shifts in the core areas of the
agricultural sector. These technological and institutional changes have brought drastic shifts in the cropping practices. The new agricultural strategies being adopted in the mid sixties have brought some significant fascinating changes in the diversity of the cropping pattern in various parts of country mainly includes changes in cropping structure, cropping pattern, crop combination and crop diversification have gone under transformation (67, Husain, 1982, p.20).

The characteristics of landuse and cropping pattern are influenced by the industrial activities to a large extent. There have been two types of changes in agricultural environment due to expansion of non-agricultural activities i.e. establishment of industries, expansion of commercial activities and urban landuse in the region. One of these is the conversion of agricultural land into non-agricultural uses, and the other is the shift from food crops in to cash crops. Similar changes have been recorded in various sample villages representing different parts of the Jabalpur region. Increasing use of modern inputs like irrigational facilities, chemical fertilizers, HYV seeds, pesticides and improved agricultural implements together have played an important role in transforming the cropping pattern in the region. Here efforts have been made by the researcher to analyse the village level data available from 21 sample villages for a varying period of 1981 and 2001 to understand the emerging spatio-temporal changes and study the changing composition if crops in the study region as has been presented in the table no. 5.2.
### Table No. 5.2

**Jabalpur Region: Changes in Production of Crops**

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Sample Villages</th>
<th>Food crops (per cent of total production)</th>
<th>Cash crops (per cent of total production)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>1981</td>
<td>2005</td>
</tr>
<tr>
<td>1</td>
<td>Aamanala</td>
<td>79.82</td>
<td>61.87</td>
</tr>
<tr>
<td>2</td>
<td>Bahoripar</td>
<td>86.91</td>
<td>58.42</td>
</tr>
<tr>
<td>3</td>
<td>Bargi</td>
<td>76.41</td>
<td>61.33</td>
</tr>
<tr>
<td>4</td>
<td>Badaiya Kheda</td>
<td>88.62</td>
<td>70.76</td>
</tr>
<tr>
<td>5</td>
<td>Chhitri Khurd</td>
<td>78.88</td>
<td>69.74</td>
</tr>
<tr>
<td>6</td>
<td>Deori</td>
<td>75.11</td>
<td>61.03</td>
</tr>
<tr>
<td>7</td>
<td>Kathonda</td>
<td>88.19</td>
<td>67.59</td>
</tr>
<tr>
<td>8</td>
<td>Khursi</td>
<td>91.26</td>
<td>76.84</td>
</tr>
<tr>
<td>9</td>
<td>Kukrikkheda</td>
<td>85.18</td>
<td>72.88</td>
</tr>
<tr>
<td>10</td>
<td>Kungwa</td>
<td>81.86</td>
<td>57.54</td>
</tr>
<tr>
<td>11</td>
<td>Mehgawan</td>
<td>97.53</td>
<td>72.71</td>
</tr>
<tr>
<td>12</td>
<td>Maharajpur</td>
<td>81.88</td>
<td>57.37</td>
</tr>
<tr>
<td>13</td>
<td>Matamar</td>
<td>90.84</td>
<td>63.59</td>
</tr>
<tr>
<td>14</td>
<td>Nimkhera</td>
<td>82.37</td>
<td>56.81</td>
</tr>
<tr>
<td>15</td>
<td>Pindrai</td>
<td>88.77</td>
<td>81.28</td>
</tr>
<tr>
<td>16</td>
<td>Pipariya</td>
<td>85.58</td>
<td>70.63</td>
</tr>
<tr>
<td>17</td>
<td>Saliwara</td>
<td>78.71</td>
<td>60.08</td>
</tr>
<tr>
<td>18</td>
<td>Sehora</td>
<td>86.72</td>
<td>73.53</td>
</tr>
<tr>
<td>19</td>
<td>Umaria</td>
<td>78.51</td>
<td>66.67</td>
</tr>
<tr>
<td>20</td>
<td>Umaria Choubey</td>
<td>75.79</td>
<td>48.58</td>
</tr>
<tr>
<td>21</td>
<td>Urduak alan</td>
<td>90.04</td>
<td>60.43</td>
</tr>
</tbody>
</table>

**Source:** Based on Village Questionnaire.
Changes in Crop Production

Areas with maximum change

Due to urbanisation maximum changes in the composition of crops and their production in the region has been recorded during 1981-2001 period. To meet the growing demands of non food crops due to urbanisation, the proportion of food crop hectarage and their production has recorded a declining trend. According to the table no.5.2 in Umariya Choubey, Urdu Kalan, Bahoripar, Nimkhera, Maharajpur, Kungwa and Mengwan sample villages 25.0 to 35.0 percent. The main reason for this substantial decline in the food crop area and production has been to meet the increasing demand of diversified area. It has been reported by cashcrops by the industrial established in the area. It has been reported by the farmers of the sample villages that over the period of time gradually food crops have been replaced by the market oriented crops due to better returns as well as expanding demands. It has been noticed that due to improved accessibility with the adjoining villages along with the increased frequency of dependable transport network has also played an important role.

Areas with medium changes

On the other hand in Saliwara, Kathonda, Aamanala, Badaiya Kheda, Bargi, Deori, Pipariya, Khursi, Umariya and Sehora sample villages have also recorded the decline in the proportion of food crop
area and production. The proportion of decline ranges from -15.0 to 24.0 per cent. The main reasons for this decline in food crop area and production has been due to the gradual increase in the demand of vegetables, other cash crops and fodder production. Most of the villagers from the sample villages after assessing the trend of demand, better financial returns and increasing transport connectivity with villages systematically the food crops have been replaced by market oriented crops.

**Areas with low changes**

The areas recorded the changes of negative decline of -15.0 per cent in food crops and their production are located in Kukrikheda, Chhitri khurd and Pindrai villages. The reason behind less decrease in food crop production and low increase in cash crop production is due to the concentration more scheduled tribe households are financially weak and have failed in making the large scale investment to cultivate the cash crops. As a result the pace of decline in the food crop production as well as a lower increase in cash crop production has been noticed in these villages (Plate no.5.1).

**Cash Crops**

Number of reasons have favoured the increase in area and production of Cash crops as has been tabulated in the table no.5.2 is the growth of urbanisation and diversification activities in the study
region at Jabalpur has been responsible for the wide spread transformation in the composition of cash crops.

**Areas with High Changes**

Maximum increase in cash crops and their production has been more than 150.0 per cent noticed in the Mengwan, Matamar, Urdua Kalan, Bahoripar, Kathandu, Khursi and Badhaiya Kheda sample villages during 1981-2001. The main reason for this substantial increase has been due to the availability of transport facilities, adequate cheap labour from nearby areas, more returns against cash crops as compared to food crops, increase in the irrigation facilities, increase in the industrial activities in the area etc. are some of the major factors supported the increase in cash crop area and production and a decline in the production of food crop.

**Areas with medium changes**

During the 1981-2001 substantial increase of 100.0 to 150.0 per cent cash crops area production has been noticed in comparison to food crops specially in the Nimkhera, Maharajpur, Kungwa, Umariya Choubey and Pipariya sample villages. Most of these villages are located very close to Jabalpur city and are accessible through developed transportation facilities, getting more financial returns against the production in comparison to food crops. Due to the expansion of the construction work in nearby villages agricultural land is being converted for the construction work and area of
agricultural land has reduced. However these changes have forwarded the growth of cash crop production in last three decades.

**Areas with low Changes**

Lowest changes in cash crop production has been recorded in Sehora, Kukrikhera, Aamanala, Pindrai and Chhitri khurd sample villages of the study region during 1981-2001. With the increasing area and distance from the city the increase in cash crop production has been less in these villages. In Bagri, Deori, Saliware villages of the study region changes in cash crop production is continued in last three decades and due to expansion of the construction activities and the increasing use of agricultural land in other non-agricultural activities in these areas changes in cash crop production has lowest.

Because of high cost of agricultural land near the urban areas high yielding variety of crops are sown under intensive cultivation to ensure the maximum returns, many include vegetables, fruits, spices and horticultural crops. These crops are grown intensively specially in the villages near to the urban areas include Maharajpur, Saliwara, Nimkhera, Kungwa, Umariya Choubey and Pipariya villages and their relative significance of other sample villages gradually declines with the increasing distance from the city. On the other hand Deori, Bahoripar and Bargi villages have start producing cereals, oil seeds and pulses. Over the period of time the production of commercial crops has increased substantially in the
adjoining villages of the region. Some of these crops are regularly used as raw materials by number of dal, flour, sugarcane and other agro-based industrial units. Vegetables are produced in and around the urban centre because of the nearness of expanding urban market and constantly increasing demand. The expansion of the improved transport facilities has positively favoured the production of vegetable and fruits in the region.

Wheat, gram and jowar are the main food crops produced in most of the sample villages. Besides these tuar, urad, moong, paddy and maize too are largely produced. Wheat is practically produced in all villages. While the area of rice/paddy is mainly confined to Maharajpur, Saliwara, Nimkhera and in Kungwa villages that too in small fields. During the field work it has been noticed that in the remaining villages only one or two farmers are producing paddy that too in a small area mainly to meet their own requirements.

Wide variation in per hectare yield too has been recorded among the sample villages of the region. Higher yields have been found mainly in Maharajpur, Saliwara, Nimkhera, Pipariya, Umariya Choubey and Kungwa villages as most of the farmers are educated, trained and are aware of the agricultural innovations. Most of them belongs to upper caste and are owning big landholdings. The Agricultural Research Centre, and the extension services of Jawaharlal Nehru Agriculture University, Jabalpur have been organising Krishi mela at regular interval to provide the detailed
information about the changes and development to the farmers of the region. The farmers have been getting the information about the availability, utility and the procedure to use of modern inputs, i.e. use of fertilizers, pesticides, plant breeding and weeding of plants etc. Because of these information farmers of the adjoining villages of Jabalpur urban area have successfully achieved the better yields and have been able to control or minimise the side effects of the fertilizers and pesticides.

In last two decades Soyabean has emerged as the main commercial crop in the region and continued increase in its area as well as in the yield too has been recorded. In the recent years considering the better economic returns and high yields more than 45 per cent of the total cropped area soyabean has been placed and has emerged as the main crop among the sample villages. Lentil, linseed, groundnut and gram are the other important commercial crops successfully cultivated in the region.

About 60.00 per cent farmers of the sample villages are mainly cultivating wheat, gram, paddy and jowar alongwith vegetables, fruits and some other crops. In last twenty years gradually the area under commercial crops has increased as most of the farmers have gradually replaced the food crops with horticulture and other commercial crops.

With the encouragement and technical knowledge provided by the Agriculture Research Centre, farmers have also start cultivating
the medicinal plants and aromatic plants such as tulsi, isabgol and vanila in the sample villages. Along with the other commercial crops the area and production of spice and condiments i.e. sanuf, dhania, jeera, laung, dalchini and elaichi too has increased in the region.

**IRRIGATIONAL FACILITIES**

Irrigation is said to be the oldest applied science used by men across the world. However in the recent past it has emerged as one of the most important component of modern agriculture. It has been accepted that among the modern inputs essential for agricultural development gradually irrigation has become indispensable. The use of irrigation is conditioned by several variables, while low rainfall and its vagaries necessitate the development of artificial means of water supply. Irrigation also becomes essential to take the maximum benefits of the chemical fertilizers, and to some extent, high yielding variety of seeds. On the otherhand, the supply of water is conditioned considering the nature of terrain, availability of adequate water resources, and above all the prevailing socio-economic-political situation in the region.

However, with the continued improvement in the irrigational methods and the expansion of irrigational network, the relative importance and the hectarage of rainfed agriculture has gradually declined with the development of irrigational facilities, enhanced frequency and their intensity. The traditional irrigational technology
has undergone a process of transformation. Irrigational facilities attempt to make agricultural production safe against drought by providing the required quantity of water as and when required. From the less effective to the inanimate energy sources, traditional means of irrigation, like tube wells, diesel or electric pump sets and canals. Increasing improvement in the nutritional standards and the rapid growth of population and multiplication of secondary production the requirement of food production and agricultural raw materials has increased steadily. It became necessary to introduce some new hybrid crops in order to achieve the objectives of rural development and successfully raising the agricultural growth. The changing objectives necessitate that the modern irrigation technology needs to be adopted.

Because of ensured improved and modern irrigational facilities cropping pattern in and around sample villages of the study region has successfully been commercialised. Being an important input irrigation also provides some sort of insurance against the failure of rains in the region. Some of the villages in the region normally, produce only one crop in a year due to the non-availability of irrigational water. In the region high percentage of agricultural land is mainly irrigated by wells and tube wells, and is owned by the farmers.

The main objective of the study is not only to examine the relationship but also to gauge the impacts of urbanisation on the development of irrigational facilities and also to understand and study the changes being made by the agricultural environment.
Numbers of analytical studies have been concluded that still substantial increase in agricultural area and production to a large extent can be achieved in our country, if adequate and greatly assumed dependable irrigational facilities are made available in respective areas considering the intensity of demand. In addition to this, assumed irrigation encourages the adoption of certain agricultural innovations like chemical fertilizers and manures, new varieties of seeds and plant protection chemical etc. These innovations certainly require assured and high doses of irrigational water, and the region under study also has the similar conditions.

The main two sources of irrigation are available in the study region include surface water and the supply of ground water and their frequency mainly determined by the rainfall regimes, topographic features, terrain and the type and nature of soil. The study region is rich in surface water as well as ground water. Narmada river and its tributaries provide adequate water for irrigational purposes. The completion of various projects i.e. Bargi project, Pariyat project certainly has ensured the supply of adequate water for irrigational requirements.

The table no. 5.3 clearly shows that study region has dependable irrigational facilities. As compare to 1981 the irrigated area has recorded an increase of 178.97 per cent in 2001. Pipariya has emerged as the leading village considering the per cent change in irrigated area with more than one with 471.37 per cent during 1981-2001. The
increase in irrigated area more than once symbolized that an area is well developed in irrigational facilities.

Table No. 5.3

Jabalpur Region: Changes in the Irrigated Area

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Sample Villages</th>
<th>Per cent of Total Area</th>
<th>Per cent change</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Aamanala</td>
<td>36.08</td>
<td>51.99</td>
</tr>
<tr>
<td>2</td>
<td>Bahoripar</td>
<td>39.47</td>
<td>46.42</td>
</tr>
<tr>
<td>3</td>
<td>Bargi</td>
<td>28.02</td>
<td>40.42</td>
</tr>
<tr>
<td>4</td>
<td>Badaiya Kheda</td>
<td>17.18</td>
<td>52.37</td>
</tr>
<tr>
<td>5</td>
<td>Chhitri Khurd</td>
<td>12.96</td>
<td>63.02</td>
</tr>
<tr>
<td>6</td>
<td>Deori</td>
<td>25.01</td>
<td>47.66</td>
</tr>
<tr>
<td>7</td>
<td>Kathonda</td>
<td>18.69</td>
<td>35.23</td>
</tr>
<tr>
<td>8</td>
<td>Khursi</td>
<td>25.58</td>
<td>27.95</td>
</tr>
<tr>
<td>9</td>
<td>Kukrikheda</td>
<td>21.01</td>
<td>39.09</td>
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<tr>
<td>10</td>
<td>Kungwa</td>
<td>5.18</td>
<td>42.06</td>
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<tr>
<td>11</td>
<td>Mehgawan</td>
<td>1.83</td>
<td>20.61</td>
</tr>
<tr>
<td>12</td>
<td>Maharajpur</td>
<td>21.51</td>
<td>69.05</td>
</tr>
<tr>
<td>13</td>
<td>Matamar</td>
<td>0.84</td>
<td>63.25</td>
</tr>
<tr>
<td>14</td>
<td>Nimkhera</td>
<td>16.18</td>
<td>54.68</td>
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<tr>
<td>15</td>
<td>Pindrai</td>
<td>3.67</td>
<td>16.23</td>
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<tr>
<td>16</td>
<td>Pipariya</td>
<td>5.59</td>
<td>31.94</td>
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<tr>
<td>17</td>
<td>Saliwara</td>
<td>20.11</td>
<td>71.12</td>
</tr>
<tr>
<td>18</td>
<td>Sehora</td>
<td>3.15</td>
<td>18.05</td>
</tr>
<tr>
<td>19</td>
<td>Umaria</td>
<td>-</td>
<td>27.84</td>
</tr>
<tr>
<td>20</td>
<td>Umaria Choubey</td>
<td>1.29</td>
<td>26.59</td>
</tr>
<tr>
<td>21</td>
<td>Urdukal kalan</td>
<td>-</td>
<td>59.81</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td><strong>14.79</strong></td>
<td><strong>41.26</strong></td>
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</tbody>
</table>

Source: Based on Village Questionnaire.

In Jabalpur region, with the advancement of the technologies, developed road and rail network, establishment of agricultural university and its research centres, and the development and expansion of agro-based industries, region has emerged as one of the agriculturally developed region of M.P. Prior to the introduction of new technologies, the farmers of study region mere forced to depend
on the nature. Today the modern technologies have enabled them with adequate facilities to irrigate the crop area as and when it is needed.

Irrigated area in the region has recorded an increase of 178.97 per cent in 2001. Village-wise changes in the proportion of irrigated area clearly shows that Matamar sample village has recorded the highest change with + 7429.76 per cent followed by Umariya Choubey, Mehgawan, Kungwa, Sehora, Pipariya, Pindrai, Saliwara, Nimkhera Chhitri khurd and Maharajur villages with 100 to 1962 per cent and remaining ten villages with an increase of + 9.26 per cent only. Expansion of the irrigational facilities have supported the expansion of double and triple cropped area and has proved to be helpful in raising the efficiency of the agricultural land.

Wells, tube wells, canals, rivers, tanks and streams are the main sources being for irrigation in the region. Irrigation by wells ranks first with a major share in the region followed by tubewells, tanks, river and canals. Source-wise irrigational analysis clearly explains that an increase in the irrigated area has been mainly due to the increase in the number of wells and tubewells (Table 5.4). Wells are the major and traditional source of irrigation. With the electrification of villages the use of electric pumps in irrigation has recorded a significant increase. In this concern the region has recorded an increase of 18.73 per cent in the area irrigated by wells. As compare to the other sample villages Umariya Choubey has recorded the highest change in the area being irrigated by wells, with
+ 907.26 per cent followed by Saliwara, Sehora, Kungwa, Mehgawan, Pindrai, Chhitri khurd, Nimkhera, Kathonda, Pipariya Bargi and Deori villages with 100.0 to 900.0 per cent while in remaining five villages the change ranges from 3.55 to 99.0 per cent.

Changes in the proportion of total area irrigated by wells in the region again, Deori village ranks first with highest per cent 49.11 in 1981 and again with 98.26 per cent in 2001, followed by Umariya Choubey and Badaiya Kheda villages Umariya Choubey villages has recorded 7.16 per cent of total well irrigated area in 1981, and rose to 71.12 per cent in 2001. Badaiya Kheda is the only village where the decline in irrigated as has been recorded from 27.21 per cent (1981) to 17.50 per cent in 2001. While minimum increase has been recorded by Khursi village (Plate no.5.2).

**Tubewells**: Tubewell based irrigation has been developed to exploit the available ground water and has many advantages over the surface irrigation through canals. As it does not involve, expenditure on the storage of water and on its distributional network. Tube well irrigation does not involve the loss through submergence of large areas of valuable land as reservoirs or creating disturbances as well as the ecological imbalances as are caused by large scale irrigation projects. It is so because private tube wells serve on small areas of land and the farmers who bears the operational cost and opts to use the system when water is really required for the crops.
From the farmers point of view the use of ground water through the tube well irrigation is certainly a better option than the surface irrigation because this entirely remains under their own control. Through the tube well water is placed at the disposal of the farmers and same can be used as and when it is required. That is why shallow tube wells owned by the government. Tube wells also save the agricultural land due water logging, mainly caused by excessive surface irrigation.

Region under study has recorded an increase of 41.30 per cent in the tube well area. The changes are lower as compare to the wells. Even than it has emerged as the main source of irrigation. Village-wise changes in irrigated area clearly explains that Pipariya village has recorded the highest change with 2,295.00 per cent followed by Kungwa, Chhitri khurd, Maharajpur, Pindrai, Bargi, Sehora, Nimkhera, Kukrikheda, Saliwara, and Kathonda villages with varying proportion ranging from 100.0 to 596.0 per cent. In the remaining four villages the change ranges from 2.16 to 63.00 per cent due to declining use of canal and ponds as the irrigation source. These source are commonly used whereas most of the tube wells are private to meet the need of additional supply of water as has been felt in the Pipariya, Maharajpur, Nimkhera and Saliwara villages and this appears as the main reason for recording the substantial changes.

**Canal** : Irrigation through canals is adopted where sufficient ground water as well as surface water is not available to meet the irrigational
needs. It is a major activity and is out of the reach of an individuals, that is why government has been developing and maintaining the canal based irrigation system to ensure the supply of water to farmers as per their requirements. Various irrigational schemes have been implemented, where the surface water is stored in rivers, streams, tanks, ponds or in other sources. The supply of water, to demand areas, or to those areas where distribution is possible through the canals. Canals are the main source in distributing the water in the region. However the terrain of the area has been controlling the construction of canals to a great extent on the otherhand. It can not reach to every field area/region.

With the expansion of the canals, the irrigated area has increased in the Jabalpur region. Region has recorded a minimum increase of 12.47 per cent as compared to other sources. A village wise change in irrigated area, clearly explains that Bargi and Bahorpar villages, where canal facilities, are available. While the remaining 19 villages do not have the facilities of canal irrigation.

Bargi, Bahoripar and Saliwara have recorded the highest change. This is mainly because Bargi and Bahoripar have the developed river system. Narmada and its tributaries, have been playing major role in promoting the irrigational system. On the otherhand Bargi dam which is still playing an important role in the identification of Jabalpur as a developed region in water resource, has been providing adequate water for irrigational purposes.
Other sources: The other source available for irrigation include river, streams, tank and rain water (including stored). In case of use of other sources for irrigation the region has recorded decline of 5.88 per cent change. Among sample villages Matamar village has recorded the highest change with 542.52 per cent followed by Saliwara and Kathonda villages of + 177.61 and + 46.63 per cent respectively. As most of the farmers in the region belongs to marginal and small farmers class considering the size of their land holdings, find it difficult to spare the money for developing their own sources of irrigation in the form of tube well and/or dugwell. Normally they prefer to store the rainy water in the adjoining areas and thereafter pump this water at the time of need using the diesel pumps.

The above study clearly shows that the region enjoys the availability of dependable irrigational facilities. As compare to other sources, wells and tube wells have emerged as the main sources of irrigation. Most of the farmers own wells and tube wells. With the increasing need of irrigation and the advancement of agricultural technology the traditional methods of water lifting too have gradually been transformed. The process of water lifting becomes operational with the use of electric and diesel pumps, and their number too has recorded a sizable increase.
MODERN AGRICULTURAL IMPLEMENTS

During the post independence era, the application of mechanical power in agriculture has emerged as a major technical development. Although mechanisation simply refers to the use of various devices such as power operated electric pump sets, diesel pumps, iron ploughs, threshers, sprayers and tractors etc. Through mechanisation multiple cropping and per unit farm performance of agricultural land has successfully been increased. Mechanisation has also led to the proper utilisation of inputs, like fertilizers, pesticides and water.

With the introduction of high investment, intensive agriculture and multiple cropping system, it has become essential to ensure that schedules of the farm operations are followed to ensure maximum production with quality which can only be achieved by using efficient and well developed agricultural machinery and implements. Mechanisation in agriculture is one of those factors, which is responsible for variations in the level of productivity. It has resulted in three types of advantages. The process of systematic and planned agricultural development has been able to enhance the areas under cultivation, in the larger areas double cropping also became possible. And the overall agricultural production has successfully been increased.
This is a known fact that the development of agriculture has become possible with the use of HYV seeds, chemical fertilizers, irrigational facilities and modern farm implements. With the diffusion of agricultural technology, gradually traditional methods of agriculture have been replaced by the improved and efficient modern agricultural practices. Along with the use of selected traditional farm implements, in the recent years agriculture has been modernised with the use of tractors, threshers, iron ploughs and electric/diesel pumps etc. The impact of technology has positively helped in enhancing the agricultural production. The changes has also being recorded in the life style and living standards of the people living in the rural areas of region. There is a perceptible change in the pattern of land use and from the traditional agriculture, where mostly crops are grown for local consumption to market oriented commercial agriculture. As a result of this in the recent years most of the farmers are inclined to grow market oriented crops with higher value. Earlier to the application of improved technology, the farmers were entirely dependent on nature. These changes have become possible with the use of modern inputs and can be noticed in various parts of the region. Decadal changes in farm implements recorded in the sample villages of the study region have been tabulated in the table no.5.5.

**Adoption of Modern Inputs**

To gauge the transformation, which has taken place in the study region, detailed survey has been conducted in the month of
July, August, September and October to find out the nature and direction of changes, brought out as a result of the implementation of science and technology for the development of agriculture and also to assess its multiple effects on the rural environment. The socio-economic changes in the region have become possible mainly with agricultural development and increased production. The available modern inputs have been systematically adopted by the farmers of the region.

The available modern methods have gradually replaced the traditional methods of agricultural being practiced in the region. The iron ploughs and/or tractors have replaced the wooden plough alongwith a pair of bullocks. The increasing number of threshers, harvesters and seed drills are being frequently used over the period of time and the adequate supply of water for irrigation in reference to the changing requirement has become the reality of the day across the region. Considerable increase in the use of modern farm implements too has been noticed, throughout the region, in last 20 years. Some of the industrial units, located within the region are also producing some of the modern machineries being widely used by the farmers, too have played and are playing important role in transforming the agricultural activities of the region.

In the region one of the major technical development during the post independence period has been the application of mechanical power in agriculture. Although mechanisation in region simply was
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referred with the use of tractors, power-based pump sets, tube wells, threshers etc. and their impact in improving the agricultural production as well as per unit of agricultural land has been considerable. Mechanisation has also lead to the proper utilization of inputs, including fertilizers, pesticides and adequate supply of water through irrigation. Because of these facts attempts has been made to gauge the role of various agricultural implements, being adopted by the farmers in the region.

Wooden and/or Iron ploughs are widely used for ploughing the agricultural land and region is not an exception to this. Most of the ploughs used in the country as well as in the region are wooden ploughs due to the availability of required wood in different areas. However with the development of mechanisation wooden ploughs are replaced by the iron ploughs and has recorded a remarkable changes in their frequency. Iron ploughs are more durable as compare to the wooden plough and the ploughing of the harder lands to more depth becomes possible. That is why iron ploughs have become more popular due to their reliability and capability among the farmers of the region. This is one of the main agricultural implement widely used throughout the region.

Iron plough has recorded a change of 232.18 per cent, whereas wooden plough has recorded a negative change with – 47.18 per cent. The village wise study presented in the table no. 5.5 clearly shows that the highest changes in use of iron plough has been recorded in
Khursi village with 600.00 per cent followed by Bargi, Saliwara, Maharajpur, Deori, Pindrai, Matamar and Bahoripar sample villages ranges from 201.0 to 425.0 per cent. While in the remaining eleven villages the proportion of change ranges from 100.0 to 200.0 per cent.

Pumps are the main equipment used for lifting the water. Electric and diesel pump sets are being used intensively in the region for regulating the distribution of water into the fields. With the electrification of the villages the use of electric pumps has increased substantially. With the availability of free electricity and/or on subsidise rates being provided by the government. As a result electric pumps, have gradually replaced the diesel pumps. However in last few years due to the non-availability of adequate supply of electricity at the time of requirements farmers are forced to maintain the diesel pumps also to ensure the supply of water in time and to ensure the production as well as the quality. The region has recorded an increase of 272.22 per cent in electric pumps. While a negative change with –52.08 per cent has been recorded in the use of diesel pumps. With slight changes one finds the similar trends being emerged at village level and are presented in the table no. 5.5.

Frequent use of tractors has positively helped in the ploughing of the hard agricultural lands with increased depth. During the green revolution induction of tractors on large scale has become main instrument transforming the agricultural land. Tractors are costly as
compared to other agricultural implements that is why only farmers with large landholding opted to use tractors. On the otherhand the use of tractors normally depends on the nature and size of the land holdings.

The study region has recorded an increase of 231.03 per cent in references to the use of tractors. Among the sample villages Deori has recorded the highest increase with 566.66 per cent followed by Bargi, Pindrai, Maharajpur, Saliwara, Bahoripar, Matamar and Khursi villages with 309.09, 300.00, 283.33, 283.33, 266.6 per cent respectively. While in the remaining twelve villages the increase ranges from 100.0 to 200.0 per cent.

**High Yielding Variety Seeds**

Adoption of high yielding varieties of seeds, chemical fertilizers, pesticides and insecticides mainly depends upon the availability of irrigational facilities and the application of irrigational water. Better and assured returns from the HYV seeds depends on the efficiency of the irrigational system. The HYV seeds require more irrigational water as compared to traditional seeds. Hence adequate water must be made available at various stages of plant growth e.g. germinisation, milk farming, tilling, flour formation and grain filling to achieve the best quality with optimum yield. The HYV seeds give the desired results even if fertilizers are not applied, but have to be supported by proper irrigational facilities. This is how without irrigation the use of other modern inputs becomes ineffective.
With the expansion of the urban activities the composition of agricultural practices too has changed. Industrialisation has helped in transforming agricultural activity as the commercial and scientific agriculture. With the application of modern improved technologies, the existing traditional methods of agricultural practices have gradually been replaced by the commercial agriculture supported by modern inputs. New modern agricultural technologies include the use of increased number of farm machineries and other agricultural implements, virtually are the outcome of the speedy industrialisation and urbanisation. The modern agricultural practice includes the introduction of high yielding variety of seeds, chemical fertilizers, pesticides irrigation and mechanisation with improved working.

The soul of the green revolution was the miracle seed, often called High Yielding Variety of seeds. It was proclaimed when it was introduced, that yield would increase four to six folds with the use of these seeds. However these seeds could not fascinate the farmers of the study region and of the M.P. state, as was the case of Punjab and Haryana.

It is a known fact that seeds are an essential input of agriculture. Without some technical knowledge there is hardly any difference between the HYV and local (traditional) seeds. More technical knowledge is required for using the HYV seeds, supported by fertilizers, pesticides, irrigation and modern implements. Thus, the use of HYV seeds is controlled by socio-economic factors as well as by
the environmental factors. The acceptance of HYV is the result of the interaction between man, his Geo-physical, socio-economic and cultural environment.

Among the economic factors, which to a extent influences the use of HYV seeds include the hi HYV seeds are costly than the local seeds that is why the pace adopting HYV by the small and marginal farmers has been very slow. Among the social factors, education, awareness and technological knowledge are the main controlling factors. The educated farmers have adopted the improved seeds in the areas where facility of irrigation exists and agricultural land is textile.

Considering the ranking of various areas in the state on the basis of adaptation of HYV seeds, Jabalpur region placed in the lower order. This is mainly due to the non-availability of adequate irrigational facilities in the Jabalpur district. Some of the areas have adequate irrigational facilities while most of them do not have irrigation, while this is the most important ingredient in the package and practices for adopting intensive and efficient cultivation of the high yielding varieties. Without adequate irrigation the farmers failed to use chemical fertilizers, which are costly.

**USE OF MODERN INPUTS**

In the study region high yielding varieties of seeds for the first time were introduced in 1965-66 and has recorded a substantial increase in the hectarage and production of food-grains in the region.
With the adoption of high yielding varieties of seeds irrigation becomes the first and the foremost requirement as the main supportive input, which requires a systematic and scientific water management. Dependency on ground water and canals too has increased. With the availability of electricity it has been made easy with the use of electric pumps. If adequate water is made available for irrigation alongwith all other required inputs i.e. chemical fertilizers, insecticides and pesticides are important inputs collectively helps in enhancing the total production of crops in the area.

Table no. 5.6 clearly shows that only 69.57 per cent of the total farmers used the high yielding varieties of seeds for the first time when it was introduced in 1965-66 and has recorded a substantial increase in its hectarage and production of the food-grains in the region. In high yielding varieties of seeds irrigation becomes the first and the foremost requirement as the input and have which requires systematic water management. Dependency on ground water and canals has increased. With the availability of electricity it has become easy with the use of electric pumps. Using electric pumps Maharajpur ranks first with 90.90 per cent followed by Saliwara and Umariya Choubey, with 87.15 and 83.33 per cent. On the other hand Kungwa, Pipariya, Nimkheda, Urduakalan, Bargi, Bahoripar the frequency of use varies from 55.07 to 75.0 per cent and in the remaining twelve villages this proportion is 40.0 to 50.0 per cent.
Table no. 5.6 clearly shows that only 69.57 per cent farmers are using high yielding varieties. Among the sample villages practically 100.00 per cent farmers of Maharajpur village have start using the HYV seeds of different crops irrespective of fodder or commercial crops. On the other hand only 40.0 per cent farmers with minimum proportion from Badaiya Kheda village are using HYV seeds. While more than 51.02 per cent farmers are using HYV seeds are mainly from Maharajpur, Matamar, Kathonda, Kungwa, Mehgawan, Bargi, Umariya Choubey and Umariya villages. Similarly only 30.60 per cent farmers so far are using HYV seeds are concentrating in Urdua Kalan, Bahoripar, Deori, Nimkhera, Saliwara, Pipariya and Aamanala villages due to closeness with the Jabalpur city, Jawahar Lal Nehru Agriculture University, Jabalpur is availing HYV seeds is having availability of banking facilities and subsidies. Finally in the remaining six sample villages the proportion of farmers using HYV seeds with 19.38 per cent is lowest in the region due to lower income and distance from Jabalpur city.

During the field survey, which was conducted during October 2006 it has been found, that 55.57 per cent of the total net sown area in the region is placed under high yielding varieties of seeds. More than 54.07 per cent of the area under high yielding varieties in the region belongs to Maharajpur, Saliwara, Bargi, Kungwa, Umariya Choubey, Pipariya, Matamar, Bahoripar, Deori and Kathonda villages.
While in the remaining 11 sample villages the proportion is less than 50.0 per cent of the total net sown area.

**Use of Chemical Fertilizer**

Use of chemical fertilizers in agriculture has emerged as an essential component irrespective of the availability of irrigational facility. Organic fertilizers like sewage treated material and cow dung are used even without proper irrigation. The use of chemical fertilizers like Urea, Super phosphate and D.A.P. in last few decades certainly has helped in enhancing the production but requires dependable supply of water through developed irrigational network. Thus the frequency and intensity of their use mainly depends on the availability of water. High yielding varieties of seeds require both adequate availability of water and fertilizers at a proper time and in adequate quantity. Hence the use of chemical fertilizers is either restricted to the crops grown during the rainy season or where irrigational facilities are available during the Rabi season.

During the field investigation it has been found that the respondents use fertilizers like urea, super phosphate, Gromor for the wheat crop during the Rabi season. It has also been noticed that in Maharajpur, Saliwara, Bargi, Bahoripar, Nimkhera, Deori and Umariya Choubey villages chemical fertilizers are frequently used due to the availability of irrigational water. D.A.P. is mainly used in the gram the main crop of the Rabi season produced in Bahoripar, Matamar, Kathonda, Urdu Kalan and Pipariya villages. Super
phosphate is also used for sunflower, vegetables and Barseem (green grass) crops mainly produced in Maharajpur, Umariya Choubey, Matamar, Kathonda, Saliwara, Nimkhera and Bahoripar villages.

During the Kharif season mainly groundnut, rice and soyabean are cultivated in the region, Gromor is commonly used for groundnut mainly in the Bahoripar, Bargi, Deori, Kathonda, Maharajpur, Matamar, Saliwara and Umariya Choubey villages. The respondents of Bahoripar, Bargi, Kathonda, Deori, Maharajpur, Pipariya, Matamar, Urdu Kalan and Umariya Choubey villages expressed that they normally use DAP and urea while urea is mainly used for soyabean in these villages.

Availability of these chemical fertilizers in the spot and/or nearly villages in time is the main serious problem being faced by the farmers. In the entire region, Bargi, Maharajpur, Saliwara and Kungwa are the only villages where farmers get required fertilizers within a distance of 0-5 kms. Otherwise the respondents from Aamanala, Chhitri khurd, Khursi, Pindrai, and Sehora villages have to travel for about 5 to 15 kms to procure the required quantity of fertilizers.

**LAND POLLUTION AND DEGRADATION**

With the growing population and to meet the increasing demands for food and other requirements pressure on the agricultural land too has been increasing. To have the maximum from the available agricultural land, available modern inputs and technologies
have been successfully adopted by the people. However, over the period of time certain environmental problems too have emerged in various parts of the region. The rich agricultural land has gradually been polluted and/or degenerated and at places even degraded due to the excessive use of irrigation, the increasing use of polluted water for irrigation, imbalanced and excessive use of chemical fertilizers and pesticides and improper and intensive use of modern machinery. Dumping of agricultural and urban wastages on the adjoining agricultural fields also has resulted the degeneration of agricultural land causing decline in crops yields as well as quality of crops.

During the field work of the study region, it has been noticed that the use of modern inputs has been very high, not only in the villages close to urban areas but also in the villages located at a distance from the urban and industrial areas. Increasing problems related to availability of the labourers in the area too has forced the farmers to start using tractors and other machinery to facilitate agricultural activities. The excessive and intensive ploughing of the land has enhanced the removal of the upper layer of productive soil due to the accelerated erosion and/or weathering. As a result decline in the thickness of the agricultural land and soil, loss of fertility and ultimately the productive capacity of agricultural land has become evident in many villages.

In most of the villages fertilizers and pesticides are being used without any discrimination and the production is being adversely
affected. Fertilizers have become the necessity of the day in the market-oriented commercial farming. During the cropping season farmers gradually enhance the quantity of chemical fertilizers to be used in the recent years. Unfortunately the output has start declining. This clearly indicates the decline in the fertility of soil ultimately affecting the agricultural output as well as the quality of products.

The urban and industrial wastes dumped on the agricultural land generate various insects and germs and are affecting the quality and quantity of the agricultural crops grown in the villages. Due to the deteriorating environmental conditions it becomes difficult to protect the crops from various enemy insect and germs, which are growing frequently. Thus it has become essential to use different types of strong pesticides for protecting the crops. Unfortunately with the frequent and excessive use of various types of pesticides pests have become resistant and the agro-environment has also been adversely affected. As a result with the excessive use of pesticides even the useful friendly pests of soils too have been adversely affected and/or destroyed and the quality of soil is effected. On the other side with the repeated use of the similar pesticides even by the small farmer pests and insects have gradually developed the resistance. During the fieldwork it has been observed that most of the farmers approximately 69.15 per cent interviewed by the researcher from the sample villages, are using the pesticides without assessing the need and the detailed knowledge about the quantity and its type to be used. This too has
caused and is causing harmful effects on the yields of various crops, soil fertility and also animals and men. Though D.D.T. and B.H.C. are banned, but the farmers of the region are frequently using D.D.T. as the main pesticide. By spraying these pesticides sizeable quantity of the particles remain undisolved, and continue to flate in the air and are deposited on the vegetables. By consuming such infected natural vegetation animals too also get infected. Along with this large number of weeds too has increased in the villages.

Most of the farmers prefer to spray D.D.T. every year, which clearly shows the harmful accumulated effects of these pesticides. It has been found that some of the farmers and children too have been affected due to the pollution being created due to the used pesticides. The plants and the crops absorb substantial quantity of harmful chemicals and pollutants and indirectly enters into the human body which becomes the cause of various diseases.

The dumping of urban waste in and around the agricultural fields the yield has been adversely effected. During the field work this has been observed from the Kungwa village. Fine-grained particles of wastes deposited on the agricultural land are gradually decayed and are mixed with the soil with the percolation of rainy or irrigation water into the lower layers of soil polluting the soil even at the protected areas. Polythene and other harmful materials and products too are mixed with soil. Gradually such diversified wastes generate harmful germs and agricultural crops are adversely affected with infection. The
burning of wastes, polythene, collected by the local people from the agricultural field also creates air pollution. The incident of land pollution has been reported from Kungwa village along with certain other sample villages specially from Maharajpur, Saliwara, Umariya Choubey, Pipariya and Nimkheda villages.

Irrigation with enhanced frequency, in Maharajpur, Saliwara, Umariya Choubey, Pipariya and Nimkheda villages without a developed drainage too has become the main cause of land degradation in the region. The inadequate and improper drainage also causes water logging which brings salts and mineral on the surface and gradually makes the land saline and barren. In some areas i.e. Saliwara, Umariya Choubey, Pipariya and Nimkheda due to the use of hard water for irrigation problem of saline and alkaline has become more evident in the recent years. With the excessive use of irrigation, the upper layer of fertile soil is removed, whereas in some areas of the region the problem of water logging too has increased. Degeneration of soil fertility due to water logging too has become a common feature in region specially in Matamar, Saliwara and Pipariya villages. With the growing use of dug wells and tube wells for irrigation supported power operated pumps without proper consideration of drainage the problem of soil salinity and alkalisation is becoming more evident in certain parts of the region. As the water evaporates, it leaves behind salt particles at the top of upper layers of the soil and start causing soil
pollution not only to the natural vegetation but also to the agricultural crops ultimately disturbing the prevailing eco-system in the region.

During the field survey it has been recorded that most of the farmers specially from Kungwa, Matamar and Saliwara village have not shown much interest in using the chemical fertilizers and pesticides to enhance the crop production. Ofcourse they use polluted water for irrigation due to the easy accessibility and do not use fertilizer and pesticide. Thus emergence of diseases in the crops and decline in their fertility as well as production has been noticed in different areas of the study region.

On the other hand with the increasing pressure of urban centres to provide the space for various expanding activities gradually the agricultural land has been transformed into non-agricultural land to meet the needs of residential and/or commercial areas as has been recorded from Saliwara, Maharajpur, Nimkhera, Pipariya, Aamanala, Kungwa and Matamar villages. In Nimkhera villages, agricultural land has been transformed to fulfil the needs of adequate land for educational institutions, poultry and dairies. The solid and liquid wastes generated by dairy and poultry farming are released on the adjoining agricultural land and have created the problem of land pollution and in some areas even causes the problem due to the logging of dirty water on large scale is becoming evident.
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Transformation of Agricultural Environment

As compared to the emerging problems the gap between the crop in the sample villages gradually has recorded a declining trend in agricultural production and their hecterage. Farmers have also expressed that in last few years the production of certain crops has not increased inspite of the repeated use of HYV, fertilizers and pesticides, while the representative from the representatives of the agricultural department expressed that farmers in the region are not using available modern inputs in right proportion.

In fact due to the frequent excessive use of all these inputs in a highly unsystematic way the available agricultural land has start degenerating due to the increasing pollution even in certain pockets it has degraded and fertility of the soil has declined. With the frequent use of these inputs not only the quality of soil is effected but the quality of available water too has been effected. Chemical fertilizes and pesticides, which are being used, and are dissolved with the irrigation and rainwater and reaches to the nearby water bodies and pollutes the water. As a result the taste and chemical & biological composition of the well water too has start changing in the Saliwara, Maharajpur, Matamar and Kungwa villages.

In some of the areas even the sewage water is being used for irrigation due to the non availability of freshwater and their has a harmful effect on the water bodies of the nearby areas. As the waste water is also harmful for the aquatic life which are useful for the survival of natural vegetation and human existence along these
sources. It has also been found that due to excessive use of wells and tube wells for irrigation, decline in the water level has been reported, and the shortage of water in villages is becoming a regular feature.

According to the district agricultural development agency, a survey has been conducted by the central government to assess the adverse effects of pesticides and chemical fertilizers. Some of the studies conducted by the scientists too have concluded that due to the increased use of pesticides and fertilizers, the water bodies use to be great help in agriculture, animals and human body, are being gradually polluted even at places degraded. Poisonous contents of pesticides and fertilizers have start reaching into the body of animals as well as of human beings through the food chains. The presence of such poisonous contents has been found in the animal’s milk and its impact has also been noticed among the children.

The study clearly shows that the region under study has emerged as a developed agricultural region. With the increasing pressure of population and their demands, agricultural environment has been transformed. The cropping pattern of the region gradually has shifted towards the commercialisation. To meet the expanding demands for various crops farmers of the region have start using highly, advanced technologies to ensure the enhanced and better agricultural output. However along with these achievements some of the hazardous problems causing agro environmental degeneration too have emerged due to the accumulated effects of the modern inputs.
and technologies. Thus, efforts have been made to control the side effects of the modern inputs on environment as well as on human health. Proper guidance should be provided by the government and the use of organic fertilizers and environment friendly pesticides have to be encouraged to control the negative effect of chemical fertilizers and pesticides so far intensively used by the local farmers to enhance the agricultural yields.

**Dairy and Poultry**

The area under study has emerged as the big and major urban market for the various dairy products which are perishable in nature. That is why they cannot be transported to the long distance. That is why most of diaries and poultries developed around the urban center and fully depend upon availability of fast dependable transport facilities and urban market.

Villages near to urban area like Saliwara, Maharajpur, Nimkhera, Aamanala, Kungwa, Pipariya, Umariya Choubey and Matamar are well known for their developed and organized dairy units and poultries. The growing demand of milk and ages, dairy and poultry units are established and developed on the adjoining agricultural fields, and the proportion of rich agricultural land is gradually shrinking. The private dairy and poultry farms are of small but in large number as compare to the largescale government dairies and poultries. Maharajpur, Saliwara, Nimkhera are well-known for its
developed dairy and poultry, whereas Aamanala is known for poultry and Matamar only for dairy.

It has been noticed that about 70.0 per cent farmer are owning a cow and a pair of buffalo. Milch animals are also kept by the farmers to ensure the supply of milk to the families and to sold the surplus. But with the growing demand in urban areas, the number of milch animals has increased, and related activities have started on the commercial level and become the major source of income.

About 40.0 per cent farmers are having the oxen, pair of bullocks, goat and hens. The expansion of the dairy and poultry activity has been favourably supported due to growing urban activities in the region. This has also been due to the availability of dependable transport facilities and accessibility with the market places and through metal roads. Thus, the above discussion clearly explains that the living environment of the rural area in the region has been transformed due to the increasing impact or urbanisation and modernisation.