AGRICULTURAL RESOURCES

5.1. AGRICULTURAL LAND USE

The analysis of land use pattern finds solutions to the problems in conversion of land from one major use to another general use or converting barren or fallow lands into farm land. Thus this analysis helps to deal with the problems arising in the process of deciding between the different types of land, and putting the land into right use. The aim of the land use analysis is to see the trends in land use changes, effect of land quality environment and socio-economic structure of Karimnagar district. This helps in predicting the suitability of land for various uses.

Land use is a primary indicator of extent and degree to which man had made an impression on earth's surface. There has been a rapid increase in population and to meet there demand most of the land has been brought under cultivation. According to Vidyanath (p 78; 1985) "in vast country like India, where over 70% of the people depend upon agriculture; proper planning for land use and agriculture development is a vital necessity. In the absence of proper planning the pressure on land has resulted in not only low per capita income, but also reckless cultivation, over grazing, soil erosion etc. Pathak and Krishna Reddy (1986) rightly points out that the process of maximising production, man has changed the form and quality of land. The ultimate effect is under-utilisation, over-utilisation and mis-utilisation of land.

The land utilisation of Karimnagar districts depends upon two factors: Firstly, physical factors like surface configuration, drainage, climate and soil; secondly, economic factors like irrigation communication market accessibility, technical knowhow and availability of manners and fertilizers and other improved inputs etc.
In this chapter the changing trend of land use over a period of 10 years taking three years average figures 1997-98, 1998-99, 1999-2000 and 2007-08, 2008-09 and 2009-10 have been assessed and particular emphasis has been given on the changing trends in land use and its probable cause.

**LAND CLASSIFICATION:**

Land classification means dividing the land into different categories or classes according to a single factor or a particular interpretation (Chauhan, 1966). The importance of land classification into types based on the quality and intensity of its use hardly needs any elaboration in landuse studies (Mohammed, 1978). It relates climatic factors, soil characteristics, slope and degree of erosion, water supply and drainage and similar physical environmental conditions to the land use productivity (Arunachalam, 1959). In India land classification has not so far been attempted on a scientific basis. Different states have adopted arbitrary principals to classify land for the purpose of fixing revenues.

The present study deals with the land classification on the basis of the present land use classification of Government of Andhra Pradesh. The total land area accessible for major uses is classified into nine land use categories. An aggregation based on homogeneity, the land classification is broadly put under non-arable and arable land uses.

Arable lands includes: (1) Miscellaneous tree crops and groves, (2) Cultivable waste lands, (3) Current fallows, (4) Other fallow lands and (5) Net sown area.

Non-arable lands includes: (1) Forest, (2) Land put to non-agricultural uses, (3) Barren and uncultivable land, (4) Permanent pastures and grazing lands.
It will be useful to explain these various classifications to convey their exact meaning.

ARABLE LANDS:

1. Miscellaneous tree crops: These include all cultivable land which is not included in the area sown, but is put to some agricultural use, land under groves forest of timber and fell trees, shrubs, bushes etc. Which are not included under orchards are classed under this category.

2. Cultivable waste lands: These include land available for cultivation, whether or not taken up for cultivation or obtained after a few years for one reason or the other. Such lands may be assessed or un-assessed and may be in isolated blocks or within cultivated holdings. Land once cultivated but not cultivated for five years in succession is also been included under this category.

3. Current fallows: These include the cropped areas which are kept fallow during the current year.

4. Other fallow lands: These include all lands which are taken up for cultivation, but are temporarily out of cultivation for a period of not more than five years.

5. Net area sown: This consists of all the areas being cropped every year.

NON-ARABLE LANDS:

1. Forest: This category includes all actually forest areas or land classed or administered as forest whether state owned or private.
2. Land put to non-agricultural uses: This stands for all lands occupied by roads, buildings, industrial undertakings, grave yards, water bodies etc. and all other land put to any other non-agricultural uses.

3. Barren and uncultivable land: This covers barren and uncultivable lands like mountains and deserts etc. These lands are not suitable for cultivation.

4. Permanent pastures and grazing lands: This covers all grazing lands whether or not they are permanent pastures and meadows.

5.1.1. MISCELLANEOUS TREE CROPS:

During in the periods 1997-99 and 2007-09 the distribution of miscellaneous tree crops to the total geographical area in the district only 0.6 per cent. The highest percentage of this land use was found in Dharmapuri mandal with a highest percentage of 2.5 % in 1997-99 and 2.6% in 2007-09 and there is no miscellaneous tree crops identified in Sultanabad mandal. During 1997-99 this category of land is 7130 hectares and 7131 hectares in 2007-09.

During the period 1997-99, the area of miscellaneous tree crops under the category of very low percentage i.e. 0.2 % was found in 22 mandals which are Jagithial, Metpally, Korutla, Ibrahimpatnam, Vemulawada, Srirampur, Odela, Ramagundam, Sultanabad, Eligedu, Mallial, Kodimial, Mallapur, Muttaram (maha), Manakondur, Bejjanki, Sarangapur, Pegadapally, Gollapally, Kathlapur, Ellanthakunta and Dharmaram. The mandals noticed in the period 1997-99, were also noticed in 2007-09, except two mandals i.e. Velgatur and Dharmaram. These two mandals were transformed into low category.
The area of miscellaneous tree crops under the category of low percentage i.e. 0.3% - 0.6% was found in Karimnagar, Thimmapur, Gangadghara, Ramadugu, Choppadandi, Koheda, Peddapally, Saidapur, Raikal, Medipally, Julapally, Velgatur, Chigurumamidi, Elkathurthi and Kataram during both periods. Only Yellareddipet found in this category during 1997-99 was changed into moderate category during 2007-09.

During the period 1997-99, the area of miscellaneous tree crops under the category of moderate percentage i.e. 0.7% - 1.1% was noticed in 10 mandals which are Husnabad, Kamanpur, Thadicherla, Shankarapatnam, Chendurthy, Manthani, Mutharam (MNT), Bheemadevarapally and Jammikunta. During the period 2007-09, 9 mandals are identified i.e. Yellareddipet, Kamanpur, Husnabad, Thadicherla, Shankarapatnam, Chendurthy, Mutharam (MNT), Manthani and Bheemadevarapally. These mandals are located in south-western part, south-eastern part and eastern part of the district. These parts are identified with hilly topography. This area is suitable for agro-horticulture.

During the period 1997-99, the area of miscellaneous tree crops under the category of high percentage i.e. 1.2% - 1.7% was noticed in Gambiraopet, Konaraopet, Veenavanka, Kamalapur and Mustabad. Under this category during the period 2007-09, Jammikunta, Gambiraopet, Konaraopet, Veenavanka, Kamalapur and Mustabad were noticed. These mandals are spread in south-eastern and south-western parts of the district. These parts are identified with hilly topography and scanty water resources, causing to higher percentage of miscellaneous tree crops.

Boinpally, Huzurabad, Siricilla and Dharmapuri were identified with under the category of very high percentage of the area of miscellaneous tree crops i.e. above
1.7% during the both periods 1997-99 and 2007-09. The categories of moderate, high and very high were identified in the hilly topography areas. Generally this type of topography supports the growth of trees. These areas are very suitable for agro-horticulture.

5.1.2 CULTIVABLE WASTE LAND:

During the periods 1997-99 and 2007-09, the land under the cultivable waste land in the district, was accounted for 19,210 hectares (1.57%) and 18,375 hectares (1.50%) respectively to the total geographical area of the district. The highest concentration in this respect was observed in Srirampur mandal with 13.2% in the both periods. There is no cultivable waste land found in mandals like Vemulawada and Jagtial in 1997-99 and in the period 2007-09, Vemulawada, Jagtial, Ibrahimpatnam, Maidipally, Metpally and Boinpally. This category of land use noticed moderate in only one mandal Odela (5%) during both the periods. Due to lack of irrigation facilities in the Srirampur mandal it is noticed this kind of cultivable waste. Culturable wastelands completely absent in 7 mandals like Ibrahimpatnam, Maidipally, Metpally, Jagtial, Boinpally and Vemulawada during the both periods 1997-99 and 2007-09. These mandals have good irrigational sources.

The area of the cultivable waste land under the category of very low percentage i.e. below 2% was noticed in Chigurumamidi, Velgatur, Eligedu, Sarangapur, Korutla, Ibrahimpatnam, Kathlapur, Vemulawada, Mallial, Kodimial, Pegadapally, Metpally, Medipally, Dharmaram, Julapally, Muttaram (maha), Husnabad, Jagithial, Mustabad, Kataram, Mallapur, Boinpally, Sultanabad, Mahadevpur, Shankarapatnam, Koheda, Gollapally, Gambiraopet, Peddapally, Mutharam(MNT), Saidapur, Bheemadevarapally, Raikal, Dharmapuri, Thadicherla,
Thimmapur, Manthani, Ellanthakunta, Kamalapur, Jammikunta and Veenavanka during both periods. Only Choppadandi was found in this category during 1997-99, changed into low category during period 2007-09.

The area of the cultivable waste land under the category of low percentage i.e. 2.1% - 4% was in Karimnagar, Manakondur, Huzurabad, Ramadugu, Yellareddipet, Chendurthy, Konaraopet, Gangadhara, Choppadandi, Bejjanki, Siricilla, Elkathurthy and Ramagundam during the periods.

The area of the cultivable waste land under the category of moderate percentage i.e. 4.1% - 6% was noticed in only one mandal i.e. Odela during both periods. The area of the cultivable waste land under the category of high percentage i.e. 6.1% - 8% was noticed in only one mandal i.e. Kamanpur during both periods. The area of the cultivable waste land under the category of very high percentage i.e. above 8% was noticed in only one mandal i.e. Srirampur during both periods. The mandals Odela, Kamanpur and Srirampur are located in eastern part of the district.

5.1.3. CURRENT FALLOW LANDS:

Lands are left unsown during the current agricultural year only to restore fertility and for want of moisture and other economic reasons.

During the period 2007-09, in Karimnagar district, the total area covered under current fallow lands is 47951 hectares (4.0%) whereas it is 51969 hectares (4.9%) in the period of 1997-99. The highest concentration of current fallows was found in Chigurumamidi mandal which was about 23 % in 1997-99 and 22.9% in 2007-09. The land under current fallow lands was absent in Jagithial, Korutla, Ibrahimpatnam, Mallapur, Vemulawada, and Konaraopet mandals. The decrease
might be due to increasing irrigation facilities, increased use of fertilizers and multiple cropping etc.

During the period 1997-99, the area of the current fallow lands under the category of very low percentage i.e. < 10% was noticed in Peddapally, Mahadevpur, Thadicherla, Eligedu, Vemulawada, Mutharam (maha), Konaraopet, Ellanthakunta, Kathlapur and Kodimial. During the period 2007-09, under this category, Mutharam (maha), Boinpally, Thadicherla, Ibrahimpatnam, Peddapally, Husnabad, Pegadapally, Medipally, Chendurthy, Ramagundam, Metpally, Konaraopet, Elkathurthi, Mahadevpur, Manthani, Kamalapur and Kathlapur.

During the period 1997-99, the area of the current fallow lands under the category of low percentage i.e. 10.1% - 20% was noticed in Sultanabad, Elkathurthi, Mallapur, Choppadandi, Julapally, Korutla, Mutharam (MNT), Manthani, Chendurthy, Huzurabad, Mallial, Ibrahimpatnam, Kamalapur, Manakondur, Raikal, Husnabad and Odela. During the period 2007-09, under this category, the mandals noticed were Choppadandi, Manakondur, Jammikunta, Vemulawada, Mutharam (MNT), Chigurumamidi, Raikal, Yellareddipet, Kodimial, Thimmapur, Julapally, Dharmaram, Huzurabad, Srirampur, Saidapur, Korutla, Sarangapur, Ellanthakunta and Bejjanki.

During the period 1997-99, the area of the current fallow lands under the category of moderate percentage i.e. 20.1% - 30% was noticed in Metpally, Jammikunta, Srirampur, Chigurumamidi, Sarangapur, Shankarapatanam, Karimnagar, Pegadapally, Velgatur, Boinpally, Gambiraoet, Kataram, Jagithial, Thimmapur and Dharmaram. Under this category during 2007-09, Shankarapatanam, Gollapally,
Kataram, Dharmapuri, Veenavanka, Bheemadevarapally, Mallial, Ramadugu, Karimnagar, Kamanpur and Jagithial were noticed.

During the period 1997-99, the area of the current fallow lands under the category of high percentage was noticed in Gangadhara, Veenavanka, Dharmapuri, Bheemadevarapally, Koheda, Bejjanki, Siricilla, Medipally, Ramagundam and Kamanpur whereas under this category during 2007-09, Gambiraopet, Mustabad, Eligedu, Odela, Mallapur and Koheda were noticed.

During the period 1997-99, the area of the current fallow lands under the category of very high percentage was noticed in 5 mandals which are Gollapally, Yellareddipet, Ramadugu, and Saidapur. Under this category during the period 2007-09, Sultanabad, Siricilla, Velgatur and Gangadhara were noticed.

5.1.4. OTHER FALLOW LANDS

This land use includes all lands which were taken up for cultivation but are temporarily unsown for a period of not less than one year and not more than five years.

During the period 2007-09, in Karimnagar district, the total area covered under current fallow lands is 47,951 hectares (4.0%) whereas it is 51969 hectares (4.9%) in the period of 1997-99. The highest concentration of current fallows was found in Chigurumamidi mandal which was about 23 % in 1997-99 and 22.9% in 2007-09. The land under current fallow lands was absent in Jagithial, Korutla, Ibrahimpatnam, Mallapur, Vemulawada, and Konaraopet mandals In the district about 4.9 percentage and 4.0 percentage of land was under other fallows during the periods 1997-99 and 2007-09 respectively.
The highest concentration of this category of land use was observed in Chigurumamidi mandal with a percentage of 23 in 1995 and 22.9 % in 2007-09. The lowest concentration of other fallows was found in Dharmaram mandal with 0.1% in the both periods. In Jagithial, Korutla, Ibrahimpatnam, Mallapur, Konaraopet mandals, the other fallows were absent in both periods.

The decrease of the other fallow lands in the district during these periods of 1997-99 to 2007-09 was from 51,969 hectares to 47,951 hectares showing a net decrease of 4018 hectares. This land use registered a positive change. These lands were transformed into crop fields.

The area under very high percentage of other fallows i.e. above 20.1% was noticed in Chigurumamidi mandal in both periods. High percentage of other fallows area i.e. above 15.1% -20% was noticed in Manakondur and Thimmapur in both periods. Moderate percentage of other fallows i.e. above 10.1% - 15% was noticed in Vemulawada, Choppadandi, Karimnagar, Huzurabad and Kamalapur during 1997-99 period and Karimnagar, Veenavanka and Kamalapur are noticed in 2007-09 period.

Low percentage of other fallows area i.e. above 5.1% - 10% was noticed in Odela, Koheda, Thadicherla, Siricilla, Boinpally, Saidapur, Shankarapatnam, Ramagundam, Yellareddipet, Husnabad, Gangadhara, Elkathurthi, Ellanthakunta and Gambiraopet during the period 1997-99. During the period 2007-09 under this category, Odela, Mustabad, Koheda, Thadicherla, Siricilla, Saidapur, Shankarapatnam, Ramagundam, Yellareddipet, Husnabad, Gangadhara, Elkathurthi, Ellanthakunta, Gambiraopet and Veenavanka. This category is mainly noticed in southern part of the district. Only Ramagundam and Thadicherla are noticed in eastern part of the district.
Very low percentage of other fallows area i.e. below 5% is noticed in Jagithial, Korutla, Ibrahimpatnam, Mallapur, Konaraopet, Medipally, Metpally, Dharmaram, Muttaram(maha), Jammikunta, Eligedu, Sarangapur, Dharmapuri, Mahadevpur, Kataram, Julapally, Gollapally, Velgatur, Mallial, Mutharam(MNT), Sultanabad, Pegadapally, Kodimial, Manthani, Raikal, Huzurabad, Srirampur, Bheemadevarapally, Kamanpur, Choppadandi, Peddapally, Bejjiki, Ramadugu, Kathlapur and Chendurthy in both periods. Only Vemulawada and Boinpally are noticed with change under this category. This very low percentage category is spread in northern part of the district.

5.1.5. NET SOWN AREA:

The term arable land was derived from the Latin word arabils which means to plough as well as the Greek word ‘aroo’ (plough). So it means the land that is fit for ploughing. But, in practise, the term has a wide connotation and is used to cover the land which is actually ploughed and cropped. In the present study too, the term is used to include the land which actually cropped during the current agricultural year, that is the net area sown or net cropped area.

The area under arable land in the district accounted for 3,85,137 hectares (32.3%) during the period 1997-99 and 4,43,002 (37.3%) in 2007-09 period. Boinpally mandal has the highest percentage of arable land to the total geographical area of the mandal and it accounted for 61.5 percent in 1997-99 and 77.1 percent in 2007-09. The lowest percentage was found in Mutharam (maha) mandal with 0.1% in 1997-99 and 0.2% in 2007-09. Good irrigation facilities, fertile soils and farmers’ interest in agriculture, encourage these mandals to cultivate more land.
Arable land in the district increased from 3,85,137 hectares in 1997-99 period to 4,43,002 hectares in 2007-09. With a net increase of 57,865 hectares and it is nearly 4.8 percentage of the total geographical area of the district. It registered positive growth.

During the period 1997-99, very high percentage of net sown area i.e. 48.1% was noticed in Boinpally, Mallapur, Odela, Jammikunta, Choppadandi, Jagithial, Huzurabad, Sultanabad, Kamalapur, Metpally, Dharmaram, Elkathurthi, Gollapally and Pegadapally. During the period 2007-09, very high percentage of net sown area was noticed in Boinpally, Pegadapally, Choppadandi, Eligedu, Julapally, Peddapally, Jammikunta, Huzurabad, Metpally, Korutla, Kathlapur, Kamalapur, Saidapur, Medipally, Manakondur, Bejjanki, Elkathurthi, Gollapally, Dharmaram, Ibrahimpatnam, Husnabad, Ramadugu and Jagithial. These mandals are spread in the central part of the district where availability of good irrigational facilities and good fertile soils. There were 14 mandals in the period 1997-99 and 23 mandals in the period 2007-09. The area under net area sown increased is due to availability of good irrigational sources.

During the period 1997-99, high percentage of net sown area i.e. 36.1% - 48.1% was noticed in the mandals Manakondur, Mallial, Peddapally, Velgatur, Korutla, Srirampur, Karimnagar, Shankarapatnam, Ibrahimpatnam, Medipally, Bejjanki, Julapally, Kodimial, Thadicherla, Chendurthy and Gangadhara. During the period 2007-09, under this category Thimmapur, Vemulawada, Srirampur, Shankarapatnam, Odela, Veenavanka, Chigurumamidi, Karimnagar, Dharmapuri and Raikal. This category mandals are spread in central part of the district and this part is covered with good irrigational sources and good fertile soils.
During the period 1997-99, moderate percentage of net sown area i.e. 24.1% - 36% was noticed in the mandals Thimmapur, Vemulawada, Kathlapur, Husnabad, Saidapur, Ramadugu, Raikal, Veenavanka, Chigurumamidi, Koheda, Dharmapuri and Yellareddipet. Under this category during the period 2007-09, Gangadhara, Mallial, Mallapur, Kodimial, Chendurthy, Velgatur, Sultanabad, Koheda, Ellanthakunta, Mustabad, Bheemadevarapally, Mutharam (MNT), Konaraopet and Ramagundam were noticed.

During the period 1997-99, low percentage of net sown area i.e. 12.1%- 24% was noticed in the mandals Mahadevpur, Gambiraopet, Kataram, Mustabad, Sarangapur, Konaraopet, Mutharam(MNT), Manthani, Ramagundam, Siricilla, Kamanpur, Ellanthakunta and Bheemadevarapally. During the period 2007-09, this category mandals were Yellareddipet, Siricilla, Gambiraopet, Kataram, Thadicherla, Sarangapur, Manthani and Kamanpur. These mandals are distributed in south-western and eastern-parts of the district. These areas have hilly topography and ground water prospects are poor.

During the period 1997-99, very low percentage of net sown area i.e. below 12% was noticed in only one mandal i.e. Mutharam. In the period 2007-09, this category is noticed with Mahadevpur and Mutharam. These two mandals are located in the eastern-part of the district. Here forest cover is more dominance and soils are non-fertile. Ground water resources are very poor status in this area.

5.1.6. FOREST LAND USE:

In Karimnagar district, the thick forest cover is found in the eastern part of the district. Mahadevpur, Manthani, Mutharam, Kataram and Thadicherla have the highest concentration of the forest. During the period 2007-09, in Karimnagar
district, the total area covered under forests is 2,50,410 hectares whereas it is 2,50,229 hectares in the period of 1997-99. There is no significance change of forest land when comparing with one period to another. In every mandal, the government constituted forest committees namely Vana Samrakshana Samithis. Under these committees supervision, the forest cover is improving and reducing the rate of destruction of forest in district.

During the period 1997-99, the highest concentration of forest was found in Mutharam (maha) with 84.80 per cent followed by Mahadevpur with 77.8 per cent while the lowest percent was observed in Karimnagar, with 0.03 percent. In 16 mandals there were no forests at all.

Concerning the forest land use between 1997-99 and 2007-09, it was found that there was a marginal increase in these mandals. In 1997-99 and 2007-09, Mutharam (maha) had the highest concentration of forests accounting respectively for 84.08 % and 84.09 % to the total geographical area of the mandal. Very low distribution of forest i.e. below 20 percent was found in 41 mandals such as Karimnagar, Manakondur, Thimmapur, Bejjangi, Ramadugu, Choppadandi, Husnabad, etc. There is no variation of forest land when comparing the period of 1997-99 to 2007-09 under this category.

During the period of 1997-99, low index i.e. 21 % - 40% was found in 8 mandals which are Ibrahimpatnam, Mallapur, Raikal, Maidipally, Kodimial, Konaraopet, Kamanpur and Kataram. There is no variation of forest land when comparing the period of 1997-99 to 2007-09 under this category.

During the period of 1997-99, moderate index i.e. 41 % - 60% was found in 5 mandals which are Yellareddipet, Sarangapur, Manthani, Mutharam (Mnt) and
Thadicherla. There is no variation of forest land when comparing the period of 1997-99 to 2007-09 under this category.

During the period of 1997-99, showing high index i.e. 61% - 80% was found in only one mandal which is Mahadevpur. There is no variation of forest land when comparing the period of 1997-99 to 2007-09 under this category.

During the period of 1997-99, very high index i.e. above 81% was found in only one mandal which is Mutharam (maha). There is no variation of forest land when comparing the period of 1997-99 to 2007-09 under this category.

5.1.7. BARRENN AND UNCULTIVATED LANDS:

The land which is bare rocky outcrops of hills, plateaus, mountains deserts etc., is called barren land. This land cannot be cultivated under any circumstances except at a very high cost.

In 1997-99 period, in Karimnagar district, the percentage under barren and uncultivable land was 7.19 percent to the total geographical area. The highest percentage of barren and uncultivable land was found in Ellanthakunta mandal accounting for 27.1 per cent to the total geographical area of the mandal. The lowest percentage of this type of land use was noted in Thadicherla mandal with 1.6 percent to the total geographical area of the mandal.

During 2007-09 the district occupies 7% of Barren and uncultivable land to the district total geographical area. There is a slight decrease of barren and uncultivable land i.e., 0.19% from the period of 1997-99 to 2007-09. The decrease of barren and uncultivable land due to conversion of this land into cultivable land, since they have been facilitated water sources either in the form of tube wells or dug wells.
The highest and the lowest percentage of this type of land use were noticed in Ellanthakunta (27.1%) and Thadicherla (1.6%) mandals to the total geographical area respectively. During the period 1997-99, very high percentage i.e., 21% was found in only one mandal namely Ellanthakunta. There is no change under this category when comparing with the period of 2007-09.

During the period 1997-99, under the category of high percentage i.e., 16% - 20% was found only in one mandal that is Mallial. During the period 2007-09, there is no mandal under this category. The barren and uncultivable land reduced in Mallial mandal from 16% in the period of 1997-99 to 3.8% in the period of 2007-09.

During the period 1997-99, under the category of moderate percentage i.e. 11% - 15% was found in 8 mandals that they are Korutla, Kodimial, Gollapally, Velgatur, Konaraopet, Sultanabad, Husnabad, and Bheemadevarapally. During the period 2007-09 under this category 8 mandals are found that they are Korutla, Gollapally, Kodimial, Vemulawada, Konaraopet, Sultanabad, Husnabad and Bheemadevarapally.

During the period 1997-99, under the category of low percentage i.e. 6% - 10% was found in 29 mandals that they are Raikal, Ibrahimpatnam, Metpally, Kathlapur, Chendurthy, Bheemadevarapally, Boinpally, Yellareddipet, Gambiraopet, Mustabad, Siricilla, Karimnagar, Bejjanki, Koheda, Manakondur, Kesavapatnam, Saidapur, Veenavanka, Kesavapatnam, Saidapur, Jammikunta, Kamalapur, Elkathurthy, Srirampur, Julapally, Dharmaram, Pegadapally, Ramagundam, Srirampur and Kataram. During the period 2007-09, low per cent is found in 29 mandals that they are Raikal, Sarangapur, Ibrahimpatnam, Metpally, Kathlapur, Chendurthy, Boinpally, Yellareddipet, Gambiraopet, Mustabad, Siricilla, Karimnagar,
Manakondur, Veenavanka, Thimmapur, Kesavapatnam, Jammikunta, Saidapur, Bejjanki, Koheda, Elkathurthy Kamalapur, Kataram, Velgatur Dharmaram, Julapally, Eligedu, and Ramagundam. There is no drastic change under this category when comparing with the two periods.

During the period 1997-99, under the category of very low percentage i.e., below 5% was found in 19 mandals which were Mallapur, Sarangapur, Dharmapuri, Jagithial, Maidipally, Gangadhara, Ramadugu, Choppadandi, Thimmapur, Choppadandi, Huzurabad, Odela, Peddapally, Kamanpur, Manthani, Mutharam (mnt), Thadicherla, Mutharam (maha) and Mahadevpur. During the period 2007-09 under the category of very low percentage was found in 17 mandals such as Mallapur, Maidipally, Jagithial, Dharmapuri, Gangadhara, Ramadugu, Choppadandi, Chigurumamidi, Huzurabad, Odela, Peddapally, Kamanpur, Mutharam (Mnt), Manthani, Thadicherla, Mahadevpur, and Mutharam (maha).

Very high (i.e.> 21.00 %) concentration of barren and uncultivable land was recorded in only one mandal that is Ellanthakunta. It is located in southern part of the district. The barren and uncultivable land in Karimnagar district slightly decreased from 7.07 percent in the period of 1997-99 to 7.0 percent in 2007-09. This land was to the size of 84,184 hectares in 1997-99 and 83287 hectares in 2007-09 showing a net decrease of 48973 (table4.2).

In 1997-99 and 2007-09, the mandals Ellanthakunta, Husnabad, Konaraopet, Bheemadevarapally and Korutla witnessed high barren and uncultivable lands. In many mandals, these lands were converted into agricultural and other useful lands. The river-side mandals had more barren and uncultivable lands during 1997-99.
Thadicherla, Mutharam (Mnt), Gangadhara and Jagithial has lowest barren and uncultivable lands.

5.1.8. LAND PUT TO NON – AGRICULTURAL USE:

The lands under this category were lands occupied by settlement, roads and railways, beds of streams, ponds and canals. These are rendered sterile from the point of view of agriculture.

During the period 1997-99 and 2007-09, the land put to non-agricultural use account for respectively for 6.9 percent and 6.7 percent to the total geographical area of the district. The highest percentage of concentration was observed in Odela with 35.1% in 1997-99 and Ramagundam with 35.1% in 2007-09. The lowest percentage of this category of land use was found in Mutharam (maha) with 1.4% in both the periods of 1997-99 and 2007-09 the total geographical area of the district.

There is drastic change in land put to non-agricultural uses noticed in mandals like Karimnagar showed high increase from 6% to 26.4%, due to land use change to other commercial purposes and remaining mandals like Shankarapathnam, Mustabad, Kataram has showed decreased figures from 10.6% to 3.4%, 17.4% to 5.9%, 4.7% to 0.2% respectively.

Very high (>20) concentration of non-agricultural land was registered in only one mandal i.e. Odela in 1997-99 and Ramagundam in 2007-09. Most of these lands occupied under ponds, canals beds of streams were slowly converted into agricultural lands.

Theoretically this category of land should show an increase due to the increasing demand for land for settlement, road network and industrial establishments.
The land put to non-agricultural use in the district noticed a little with change from 80,157 hectares in 1997-99 and 81,214 hectares in 2007-09. In 1997-99, the volume of change in land put to non-agricultural use increased in only one mandal i.e. Ramagundam. This is due to increasing settlements and other related activities. Increased settlements are due to the presence of National Thermal Power Corporation. Differently, a moderate decrease was found in other parts of the district in 4 mandals. This is attributed to the reclamation of land development of irrigation.

During the period 1997-99, the area under land put to non-agricultural use under the category of very low i.e. < 5% is noticed in Eligedu, Mutharam(maha), Thadicherla, Mahadevpur, Ibrahimpatnam, Mutharam (MNT), Gangadhara, Dharmaram, Ramadugu, Peddapally, Manthani, Srirampur, Velgatur, Mallial, Yellaredhipet, Kodimial, Kataram, Husnabad, Thimmapur and Bejjanki. The same mandals noticed in 1997-99, were also noticed in 2007-09, except Pegadapally.

During the period 1997-99, the area under land put to non-agricultural use under the category of low i.e. 5.1% - 10 % is noticed in 32 mandals. These mandals are Julapally, Manakondur, Pegadapally, Dharmapuri, Jagithial, Siricilla, Sultanabad, Konaraopet, Medipally, Karimnagar, Ramagundam, Kamalapur, Kamanpur, Korutla, Huzurabad, Choppadandi, Koheda, Sarangapur, Odela, Elkathurthi, Mallapur, Gollapally, Chigurumamidi, Boinpally, Bheemadevarapally, Raikal, Chandurthy, Saidapur, Veenavanka, Jammikunta, Vemulawada and Kathlapur. Under this low category during 2007-09, 32 mandals are identified. These mandals are Manakondur, Pegadapally, Dharmapuri, Jagithial, Siricilla, Sultanabad, Konaraopet, Medipally, Karimnagar, Ramagundam, Kamalapur, Kamanpur, Korutla, Huzurabad, Choppadandi, Koheda, Sarangapur, Odela, Elkathurthi, Mallapur, Gollapally,

During the period 1997-99, the area under land put to non-agricultural use under the category of moderate i.e. 10.1% - 15% was noticed in 4 mandals which are Shankarapatnam, Metpally, Ellanthakunta and Gambiraopet. Under this category during the period 2007-09, Shankarapatnam, Metpally, Gambiraopet, Ellanthakunta and Vemulawada were noticed.

Gambiraopet and Mustabad were noticed under the category of high percentage of land put non-agricultural use i.e. 15.1% - 20% during the period 1997-99 and 2007-09 respectively. These mandals were located in the south-western part of the district. Odela and Ramagundam were noticed under the category of very high percentage of land put non-agricultural use i.e. > 20% during the period 1997-99 and 2007-09 respectively. Generally the areas of very low category and very high category are noticed in the eastern part of the district and south western part of the district respectively.

5.1.9. PERMANENT PASTURES AND OTHER GRAZING LANDS;

In the district, land under permanent pastures and other grazing lands for the periods 1997-99 and 2007-09 account for 5.08 per cent and 3.3 per cent to the total geographical area. The highest percentage of this category of land use was found in Chendurthy mandal with 21.6% in 1997-99 and 21.7 % in 2007-09. The lowest percentage (below 4.7%) was noted in 30 mandals. Some of them are Ibrahimpatnam, Mustabad, Jagtial, Mutharam (maha), Odela, Mahadevpur etc.
Development of dairy industry was the main cause of land use change under permanent pastures and grazing lands. In every mandal in the study area most of the farmers maintain separate fields for fodder.

This category of land use registered no change except in mandals like Velgatur (decreased), Metpally (decreased), Veenavanka (increased) and Vemulawada (increased) during these two periods in comparison (i.e. 1997-99 and 2007-09). In terms of hectares, the increase was from 54,830 hectares to 54,852 hectares, showing a net increase of 22 hectares. The increase is due to most of the farmers kept their remote lands for their cattle grazing. In Velgatoor and Metpally mandals showed decrease under this category land use due to land utilized for cultivation purpose.

The area under permanent pastures and other grazing lands under the category of very low percentage i.e. below 4.3% was found in Ibrahimpatnam, Eligedu, Mustabad, Jagithial, Mutharam(maha), Odela, Mahadevpur, Yellareddipet, Korutla, Mallapur, Thadicherla, Saidapur, Peddapally, Manthani, Ellanthakunta, Kataram, Siricilla, Mutharam(MNT), Sarangapur, Raikal, Kathlapur, Gambiraopet, Ramagundam, Huzurabad, Kamanpur, Dharmapuri, Medipally, Velgatur, Bejjanki, Sultanabad and Elkathurthi during the both periods. Change was found in Metpally and Velgatur under this category.

The area under permanent pastures and other grazing lands under the category of low percentage i.e. 4.4% - 8.6% was found in Ibrahimpatnam, Eligedu, Mustabad, Jagithial, Muttaram(maha), Odela, Mahadevpur, Yellareddipet, Korutla, Mallapur, Thadicherla, Saidapur, Peddapally, Manthani, Ellanthakunta, Kataram, Siricilla, Mutharam(MNT), Sarangapur, Raikal, Kathlapur, Gambiraopet, Ramagundam,
Huzurabad Kamanpur, Dharmapuri, Medipally, Velgatur, Bejjanki, Sultanabad and Elkathurthi during the periods. Change is found only in one mandal i.e. Veenavanka.

During the both periods, the area under permanent pastures and other grazing lands under the category of moderate percentage i.e. 8.7% - 13% was notice in central part of the district which covers mandals such as mandals Ramadugu, Choppadandi, Vemulawada, Mallial, Konaraopet, Dharmaram, Husnabad, Koheda, Metpally and Chigurumamidi etc.

During the both periods, the area under permanent pastures and other grazing lands under the category of high percentage i.e. 13.1% - 17.3% was notice in only one mandal Chendurthy. Very high percent category is noticed in Bheemadevarapally during both periods. The mandals Chendurthy and Bheemadevarapally are situated in hilly topography where forest cover is dominant and soils fertility is very low. That is why the land under permanent pastures and other grazing lands are high in these mandals.

5.2. CROPPING PATTERN

Cropping pattern simply means the proportion of area under different crop at a point of time. The cropping pattern of an area is generally controlled by physical, social economic and technological factors. The important factors which contribute to cropping pattern are the point of time, the proportion of area and the change in crops to be raised. Therefore, cropping pattern implies a change in the proportion of area under different crops at a given point of time. The physical characteristics of land, changes in weather, rainfall and irrigation facilities play an important part as such many areas have witnessed significant structural changes. Extensive irrigation facilities play a key role in cropping pattern. Adequate irrigational facilities, in any
area provide for the growth of different crops and also make possible double even triple cropping. It may even change the whole method of cultivation and superior crops can be grown and new method of rotation of crops can be introduced. When there is no rotation of crops, the rotation can be introduced and where rotation is in existence it can be improved.

Andhra Pradesh is predominantly an agricultural state. It produces not only a large variety of crops including cereals, cash crops but also spices. The cereal crops cultivated are rice, wheat, bajra and pulses.

The cash crops include the industrial raw material such as tobacco, sugar-cane, groundnut and various oil seeds. Andhra Pradesh enjoys a position of pre-eminence in respect of crop production, particularly grains and is popularly known as rice bowl of India.

Out of the total cropped area of 6.88 lakh hectares in the district, the food grains like, paddy, maize, and jowar account for 4.37 lakh hectares, which workout to more than 63.5 %. Among millets, maize is an important crop grown in this district. The district accounts for nearly 40 % of the total maize area of the state. Among other crops, pulses and cotton are the important crops. The most important crops grown among several other crops during kharif are Paddy, Cotton, Maize, Green gram, Sugarcane and Turmeric. Horse gram is usually sown under late kharif conditions on marginal soils. Normally under major, medium and minor irrigation sources, kharif rice is followed rabi rice. Well irrigation is a predominant feature in the district and under this source.

The cotton and maize are the chief crops with an area covering 1 lakh hectares and 95 thousand hectares respectively during period 1997-99. But rice is
chief crop during 2007-09 with an area of 147 thousand hectares of land. With provided good irrigational source, the area under rice cultivation has been increased.

Sowing of paddy nurseries usually commence from last week of May under wells, and continue up to July depending up on the onset of South-West monsoon. The transplanting of paddy commences from second fortnight of June and continues up to last week of September depending up on the receipt of water in irrigation sources.

In dry-lands during kharif season, green gram, groundnut, maize, cotton and chillies are cultivated. Likewise, kharif maize is followed by rabi groundnut in Karimnagar and Peddapally divisions while in Jagtial and Metpally tracts, cultivation of turmeric and chillies is taken-up as relay crop during rabi period. An area of about 2400 hectares in under sugarcane which is chiefly confirmed to Metpally, Korutla, Mallapur, Ibrahimpatnam and Gambiraopet Mandals. Cotton is sown in an area of about 89,000 hectares during period 2007-09.

**Rice:** About 50 per cent of area of paddy was cultivated in Sri Ram Sagar project command area and the remaining under 3.5 lakh agricultural pumpsets connections in the district. The rice production in Karimnagar district during the period 1997-99, area under rice cultivation was 66,000 hectares whereas it is 1,47,000 hectares in 2007-09. 81,000 hectares are increased from 1997-99 to 2007-09. In the period 1997-99, 1,48,000 tonnes of rice produced and in 2007-09, it was 5,02,000 tonnes of rice was produced which is showing net increase of 3,54,000 tonnes of rice. Yield kilograms per hectare of land was 2261 kg during 1997-99 and it was 3413 kg during 2007-09. Use of better seeds and fertilisers are the main reasons for this increased productivity.
**Jowar:** Jowar is also negligible in terms of area and production in both periods. Yield kilograms per hectare of land were 528 kg during 1997-99 and it was 1200 kg during 2007-09. Use of better seeds and fertilisers are main reasons for this increased productivity. Whenever we compare the jowar productivity with rice productivity, it is much low.

**Maize:** During the period 1997-99, area under maize cultivation was 95,000 hectares whereas it is 1,34,000 hectares in 2007-09. The area under maize increased from 39000 hectares 1997-99 to 2007-09. In 1997-99 period, 2,16,000 tonnes of maize produced and in 2007-09 it was 527000 tonnes of maize was produced which is showing net increase of 3,54,000 tonnes of rice. Yield kilograms per hectare of land was 2275 kg during 1997-99 and it was 3413 kg during 3916 kg. Use of better seeds, assured supply of water and fertilisers are the main reasons for this increased productivity. The productivity is high whenever comparing with rice productivity.

**Bengal gram:** During the period 1997-99, area under Bengal gram cultivation was 5000 hectares whereas it is 3000 hectares in 2007-09. 2000 hectares of land decreased from 1997-99 to 2007-09. The area under this crop decreased. In 1997-99 period, 4000 tonnes of Bengal gram produced and in 2007-09 it was 4000 tonnes of Bengal gram was produced which is showing no change. Yield kilograms per hectare of land was 879 kg during 1997-99 and it was 1420 kg during 2007-09 period. Use of better seeds and fertilisers are the main reasons for this increased productivity.

**Red gram:** During the period 1997-99, area under red gram cultivation was 11,000 hectares whereas it is 17,000 hectares in 2007-09. 6000 hectares of land increased from 1997-99 to 2007-09. The farmers’ interest to cultivate this crop is the main reason for increased area under this crop. Yield kilograms per hectare of land was 225
kg during 1997-99 and it was 680 kg during 2007-09. Use of better seeds and fertilisers are the main reasons for this increased productivity. The productivity is high whenever comparing with rice productivity.

**Green gram:** During the period 1997-99, area under green gram cultivation was 14,000 hectares whereas it is 17,000 hectares in 2007-09. 6000 hectares area has been increased from 1997-99 to 2007-09. In 1997-99 period, 3000 tonnes of red gram produced and in 2007-09 it was 17000 tonnes of green gram was produced which is showing net increase of 354000 tonnes of rice. Yield kilograms per hectare of land was 195 kg during 1997-99 and it was 311 kg during 2007-09. Use of better seeds and fertilisers are the main reasons for this increased productivity. The productivity is high whenever comparing with rice productivity.

**Black gram:** This crop is in negligible position in terms of area, production and yield

**Cow gram:** During the period 1997-99 area under cow gram cultivation was 1000 hectares whereas it is 2000 hectares in 2007-09. 1000 hectares increased from 1997-99 to 2007-09. The farmers’ interest to cultivate this crop is the main reason for increased are under this crop. In 1997-99 period, 2000 tonnes of cow gram produced and in 2007-09 it was very low. The production decreased from 1997-99 to 2007-09. Yield kilograms per hectare was 453 kg during 1997-99 and it was 317 kg during 2007-09. The farmers did not show interest to cultivate this crop.

**Groundnut:** During the period 1997-99, area under groundnut cultivation was 1000 hectares. It decreased during 2007-09 period. In period 1997-99, 1000 tonnes of groundnut produced and in 2007-09 it was also 1000 tonnes of groundnut. Yield kilograms per hectare was 857 kg during 1997-99 and it was 884 kg during 2007-09. There is no change in this criterion.
**Cotton:** During the period 1997-99, area under cotton cultivation was 1,00,000 hectares while it is 1,17,000 hectares of land during 2007-09 period. It is showing net increase of 17,000 hectares. It is a cash crop that is why farmers have shown interest. In 1997-99 period, 1,25,000 tonnes of groundnut produced and in 2007-09 it was also 2,69,000 tonnes of cotton. High variation is found between these periods. Net increase of 1,44,000 tonnes of cotton noticed. Yield per hectare was 212 kg during 1997-99 and it was 390 kg during 2007-09. There is great variation between these both periods, that crop productivity has attained double rate. The better seeds are main reason for this growth.

**Caster:** During the period 1997-99, area under caster cultivation was 3000 hectares while it is 10,000 hectares of land during 2007-09 period. It is showing net increase of 7000 hectares. It is a cash crop that is why farmers have shown interest. In 1997-99 period, 1000 tonnes of groundnut produced and in 2007-09 it was 4000 tonnes of cotton. High variation is found between these periods. Net increase of 3000 tonnes is noticed. Yield per hectares was 376 kg during 1997-99 and it was 382 kg during 2007-09. There is no change in productivity.

**Chillies:** During the period 1997-99, area under chillies cultivation was 9000 hectares while it is 5000 hectares of land during 2007-09 period. It is showing net increase of 17000 hectares. It is a cash crop that is why farmers have shown interest. In 1997-99 period, 13000 tonnes of chillies produced and in 2007-09 it was 7000 tonnes of chillies. High variation is found between these both periods. Net decrease of 6000 tonnes of chillies production is noticed. Yield kilograms per hectare of land was 1388 kg during 1997-99 and it was 1490 kg during 2007-09. There is no variation between these both periods.
Table No. 5.2

KARIMNAGAR DISTRICT

AREA, PRODUCTION AND YIELD PER HECTARE OF MAIN CROPS

(Area in '000 in hectares, Production in '000 tonnes, and yield kg per hectares.)

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<tr>
<td></td>
<td></td>
<td>Area</td>
<td>Production</td>
</tr>
<tr>
<td>1</td>
<td>Rice</td>
<td>66</td>
<td>148</td>
</tr>
<tr>
<td>2</td>
<td>Jowar</td>
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<td>N</td>
</tr>
<tr>
<td>3</td>
<td>Maize</td>
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<td>216</td>
</tr>
<tr>
<td>4</td>
<td>Bengal gram</td>
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<td>4</td>
</tr>
<tr>
<td>5</td>
<td>Red gram</td>
<td>11</td>
<td>2</td>
</tr>
<tr>
<td>6</td>
<td>Green gram</td>
<td>14</td>
<td>3</td>
</tr>
<tr>
<td>7</td>
<td>Black gram</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>8</td>
<td>Horse gram</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>9</td>
<td>Cow gram</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>10</td>
<td>Other Pulses</td>
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<td>N</td>
</tr>
<tr>
<td>11</td>
<td>Groundnut</td>
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<td>1</td>
</tr>
<tr>
<td>12</td>
<td>Sesame</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>13</td>
<td>Chillies</td>
<td>9</td>
<td>13</td>
</tr>
<tr>
<td>14</td>
<td>Cotton</td>
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<td>125</td>
</tr>
<tr>
<td>15</td>
<td>Castor</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>16</td>
<td>Sugarcane</td>
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<td>92</td>
</tr>
<tr>
<td>17</td>
<td>Onion</td>
<td>N</td>
<td>2</td>
</tr>
</tbody>
</table>

N=Negligible

Source: Director, Directorate of Economics and Statistics, Hyderabad

**Sugarcane:** During the period 1997-99, area under sugarcane cultivation was 1000 hectares while it is also 1000 hectares of land during 2007-09 period. There is no change under this criterion. In 1997-99 period, 92,000 tonnes of sugarcane produced
and in 2007-09 it was 1,29,000 tonnes of sugarcane produced. High variation is found between these both periods. Net increase of 30,000 tonnes of sugarcane production is noticed. Yield kilograms per hectare of land was 71,069 kg during 1997-99 and it was 93,321 kg during 2007-09. There is highly variation between these both periods.

5.3. **CROP INTENSITY:**

Cropping Intensity is defined as a ratio between Net Sown Area (NSA) and Gross Cropped Area (GCA). It thus indicates the additional percentage share of the area sown more than once to NSA. It may be measured by the formula-gross cropped area/net sown area x 100. The intensity of cropping, therefore, refers to raising a number of crops from the same field during one agricultural year. The index of cropping intensity is 100 if one crop has been grown in a year and it is 200 if two crops are raised. Higher the index, greater is the efficiency of land use.

The level of cropping intensity is determined by several factors. The most important factor is the availability of water from natural (rainfall) or man -made resources (irrigation). The cropping intensity has direct correlation with assured irrigation which enables farmers to go for multiple cropping and use higher dose of fertilizers and HYV seeds. Hence, besides irrigation fertilisers, early maturing high yielding variety of seeds, selective mechanization such as the use of tractors, pumping sets and seed drills, etc., plant, protection measures through the use of insecticides, pesticides etc., do have role in affecting the intensity of cropping.

The index of cropping for the country as a whole was 126% (2009-10). The highest cropping intensity was recorded in Punjab (160%) followed by Haryana
(158%) and Uttar Pradesh (145%). Because of fertile soils, irrigation and famous able agro-climatic conditions the great plains India (from Punjab to west Bihar), Mahanadi and Godavari delta, Chhattisgarh and Malabar coast (Kerala) are the areas of extremely high (above 135%) cropping intensity.

Cropping Intensity refers to rising of a number of crops from the same field during one agricultural year, or it can be expressed through a formula-

\[
\text{Crop Intensity} = \frac{\text{Gross Cultivated Area}}{\text{Net Cultivated Area}} \times 100
\]

The total cropped area or gross area sown as percentage to net area sown gives a measure to landuse efficiency, which really means the intensity of cropping (Singh 1972). Intensity of cropping refers to the number of crops grown on the same area in a year. Therefore higher the intensity of cropping higher is the landuse efficiency and vice versa (T.S. Chauhan – 1987).

**Cropping Intensity in Karimnagar district:**

During the period 1997-99, very low intensity i.e. below 120% was noticed in 18 mandals that they are Mutharam (maha), Mahadevpur, Thadicherla, Kataram, Husnabad, Mutharam(mnt), Peddapally, Kamanpur, Kodimial, Srirampur, Odela, Ramagundam, Bejjanki, Mallial, Dharmaram, Elkathurthy, Koheda whereas under this category during the period 2007-09, it was noticed in 4 mandals that they are Mustabad, Boinpally, Vemulawada, and Kataram. During the period 1997-99 the area under very low category was 4,46,819 hectares (37.5%) whereas it was 82,310 hectares (6.9%) during the period 2007-09. This remarkable change under this category is because of increased irrigational facilities.
During the period 1997-99, low intensity i.e. 121% - 140% was noticed in 15 mandals which were Koheda, Kamalapur, Gangadhara, Metpally, Mustabad, Jammikunta, Kathlapur, Boinpally, Velgatur, Maidipally, Bhimdevarpally, Karimnagar, Choppadandi, Ibrahimpatnam, and Chendurthy. These mandals were spread in where irrigational facilities are low.

During the period 2007-09, low intensity i.e. 121%- 140% was noticed in 16 mandals which were Ellanthakunta, Kodimial, Mallial, Dharmapuri, Sarangapur, Mutharam (mnt), Bejjanki, Ramadugu, Mahadevpur, Mallapur, Siricilla, Yellaredhipet, Mutharam(maha), Konaraopet, Srirampur and Kamalapur.

During the period 1997-99 the area under this category was 2,76,269 hectares (23.24%) whereas it was 2,49,906 hectares (35.61%) during the period 2007-09. Under this category the net increase of area is 1,47,022 hectares.

During the period 1997-99 moderate intensity i.e. 141%- 160% was noticed in as many as 14 mandals Yellareddipet, Vemulawada, Saidapur, Ellanthakunta, Dharmapuri, Mallapur, Ramadugu, Manthani, Jagtial, Konaraopet, Gollapally, Thimmapur, Sultanabad, and Pegadapally. During the period 2007-09, under the moderate intensity was noticed in 16 mandals that they are Jammikunta, Saidapur, Gangadhara, Kathlapur, Odela, Choppadandi, Ibrahimpatnam, Husnabad, Bhimdevarpally, Eligedu, Elkathurthy, Metpally, Velgatur, Kamanpur, Ramagundam, and Thadicherla. This area is covered under the canal irrigation system thus it has good irrigational potential.

During the period 1997- 99 the area under this category was 284993 hectares (23%) whereas it was hectares 2,91,645 (24%) during the period 2007-09. Under this category the net increase of area is 6652 hectares (0.5%).
During the period 1997-99 high intensity i.e. 160% – 180% was found in 10 mandals that they are Korutla, Gambiraopet, Veenavanka, Kesavapatnam, Sarangapur, Raikal, Huzurabad, Manakondur, Siricilla, and Julapally.

During the period 1997-99 the area under this category was 1,82,847 hectares (15.38%) whereas it was 3,83,570 hectares (18.98 %) during the period 2007-09. Under this category the net increase of area is 42,732 hectares. This increase is due to increased irrigational facilities from the period 1997-99 to 2007-09.

During the period 1997-99 very high intensity i.e. above 181% was found in only mandal i.e., Chigurumamidi. During the period 2007-09 very high intensity i.e. above 181% was found in 9 mandals that they are Manakondur, Pegadapally, Korutla, Koheda, Sultanabad, Dharmaram, Kesavapatnam, Gambiraopet and Chendurthy. This very high concentration is due to assured supply of water to crops.

During the period 1997-99, the area under this category was 14,555 hectares (1%) whereas it was 1,65,674 hectares (13.0%) during the period 2007-09. Under this category the net increase of area is 1,68,292 hectares. This increase is due to increased irrigational facilities from the period 1997-99 to 2007-09.

5.4. CROP DIVERSIFICATION

Crop Diversification implies raising a variety of crops from the soil. Crop Specialisation indicates cultivation of less number of crops. The keener the competition, the higher the magnitude of diversification, and lesser the competition, the greater will be the trend towards specialisation or mono cultural farming where emphasis is on one or two crops (Jasbir Singh, 1976: 317). “In fact, it is obvious that
the greater the number of crops in combination is the greater will be the degree of
diversification” (Ayyar 1969: 18).

Agricultural diversification is a process of a gradual movement out of
subsistence food crops (particularly staple foods) toward diversified market-oriented
crops that have a larger potential for returns to land. This process is triggered by the
availability of improved rural infrastructure, rapid technological advancements in
agricultural production, and changing food demand patterns. Hence, this process of
diversification towards high-value crops is likely to accelerate agricultural growth and
usher in a new era of rural entrepreneurship and generate employment opportunities.
Experiences from most Southeast Asian countries, and some scattered examples from
the South Asian countries, reveal that diversification toward HVCs leads to the
development of innovative supply chains and opens new vistas for augmenting
income, generating employment and promoting exports (Shanmuga Sundaram 2004,
2003, Vickramasingh et al. 2003, Goletti 1999). It is also observed that food and
income security improved in regions where agricultural diversification took place in
favour of horticulture activities, animal husbandry, and aquaculture (Dorjee et al.
2002, Barghouti et al. 2003, Shanmuga Sundaram 2004). There appears immense
scope for diversification of agriculture towards high-value commodities in South
Asian countries (FAO 2003).

According to FAO (Food and Agriculture Organization) Crop Diversification
in the Indian Perspective with the advent of modern agricultural technology,
especially during the period of the Green Revolution in the late sixties and early
seventies, there is a continuous surge for diversified agriculture in terms of crops,
primarily on economic considerations. The crop pattern changes, however, are the outcome of the interactive effect of many factors which can be broadly categorized into the following five groups: a) Resource related factors covering irrigation, rainfall and soil fertility. b) Technology related factors covering not only seed, fertilizer, and water technologies but also those related to marketing, storage and processing. c) Household related factors covering food and fodder self-sufficiency requirement as well as investment capacity. d) Price related factors covering output and input prices as well as trade policies and other economic policies that affect these prices either directly or indirectly. e) Institutional and infrastructure related factors covering farm size and tenancy arrangements, research, extension and marketing systems and government regulatory policies.

Obviously, these factors are not watertight but inter-related. For instance, the adoption of crop technologies is influenced not only by resource related factors but also by institutional and infrastructure factors. Similarly, government policies - both supportive and regulatory in nature - affect both the input and output prices. Likewise, special government programmes also affect area allocation and crop composition. More importantly, both the economic liberalization policies as well as the globalization process are also exerting strong pressures on the area allocation decision of farmers, essentially through their impact on the relative prices of inputs and outputs. Although the factors that influence the area allocation decision of farmers are all important, they obviously differ in terms of the relative importance both across farm groups and resource regions. While factors such as food and fodder self-sufficiency, farm size, and investment constraints are important in influencing the area allocation pattern among smaller farms, larger farmers with an ability to circumvent resources constraints usually go more by economic considerations based
on relative crop prices than by other non-economic considerations. Similarly, economic factors play a relatively stronger role in influencing the crop pattern in areas with a better irrigation and infrastructure potential. In such areas, commercialization and market networks co-evolve to make the farmers more dynamic and highly responsive to economic impulses.

What is most notable is the change in the relative importance of these factors over time. From a much generalized perspective, Indian agriculture is increasingly getting influenced more and more by economic factors. This need not be surprising because irrigation expansion, infrastructure development, penetration of rural markets, development and spread of short duration and drought resistant crop technologies have all contributed to minimizing the role of non-economic factors in crop choice of even small farmers. What is more, the reform initiatives undertaken in the context of the on-going agricultural liberalization and globalization policies are also going to further strengthen the role of price related economic incentives in determining crop composition both at the micro and macro levels. Obviously, such a changing economic environment will also ensure that government price and trade policies will become still more powerful instruments for directing area allocation decisions of farmers, aligning thereby the crop pattern changes in line with the changing demand-supply conditions. In a condition where agricultural growth results more from productivity improvement than from area expansion, the increasing role that price related economic incentives play in crop choice can also pave the way for the next stage of agricultural evolution where growth originates more and more from value-added production.
Crop Diversification is the raising of different types of crops in a given area at a given period of time. It indicates an increase in agricultural activities and also an intensification of land use. Crop Diversification is intended to give a wider choice in the production of a variety of crops in a given area so as to expand production related activities on various crops and also to lessen risk. Crop Diversification in India is generally viewed as a shift from traditionally grown less remunerative crops to more remunerative crops. The crop shift (diversification) also takes place due to governmental policies and thrust on some crops over a given time. Market infrastructure development and certain other price related supports also induce crop shift. Often low volume high-value crops like spices also aid in crop diversification. Higher profitability and also the resilience/stability in production also induce crop diversification, for example sugar cane replacing rice and wheat. Crop Diversification and also the growing of large number of crops are practiced in rain fed lands to reduce the risk factor of crop failures due to drought or fewer rains. Crop substitution and shift are also taking place in the areas with distinct soil problems. For example, the growing of rice in high water table areas replacing oilseeds, pulses and cotton; promotion of soybean in place of sorghum in vertisols (medium and deep black soils) etc.

Bhatia (1965) developed a simple formula to measure the degree of crop diversification. The index of diversification is obtained by dividing the sum total of percentages of cultivated area under a crop occupying more than 5 percentages of the sown area with number of such crops. Here the lower is the value of the index, the higher will be the diversification and vice versa. Ayyar (1969) modified Bhatia’s (1965) method and took into account only those crops which occupied at least 1 per cent of the gross cropped area.
The Gibbs and Martin index of diversification (1962) provides a useful alternative index for measuring the degree of diversification in the cropping pattern in an area and the formula developed for calculating the index is as under

\[
\text{Index of Crop Diversification} = 1 - \frac{\sum X^2}{(\sum X)^2}
\]

Where ‘x’ is the percentage of total cropped area of total cropped area occupied by each crop, or hecterage under an individual crop.

Hence, the Gibbs and Martin index of diversification is used for present analysis.

**Crop Diversification in Karimnagar district:**

The mandal wise picture regarding the Crop Diversification for the period 1997-99 indicates that very low diversification i.e. below 0.50 is noticed in the 5 mandals of the district which are spread in South-Western part of the district mandals such as Gambiraopet and Mustabad, and in the eastern part, mandals such as Kamanpur, Muttaram(Mnt) and Muttaram(Maha) respectively. During the period 2007-09, very low Crop Diversification i.e. below 0.50 is found in 8 mandals spreading in the North-Eastern part, covering the mandals such as Ramagundam, Dharmaram, Peddapally, Sultanabad and Eligedu and southern part of the district, mandals such as Kesavapatnam and Huzurabad respectively.

During the period 1997-99, index of Low Crop Diversification i.e. 0.50 to 0.60 is found in 6 mandals such as Yellareddipet and Siricilla (spreading in South-Western part of the district), Dharmaram and Sultanabad (spreading in Central part of the district), Manthani and Kataram (spreading in Eastern part of the district). Whereas in the period 2007-09, Low Crop Diversification showed in 9 mandals, they are Manakondur and Veenavanka (spreading in central part of the district),
Bheemadevarapally and Elkathurthy (spreading in south-western part of the district), Gambiraopet and Mustabad (spreading in Southern part of the district), Kamanpur, Muttaram(MNT), Muttaram(Maha) (spreading in eastern part of the district).

During the period 1997-99, Moderate Crop Diversification i.e.0.6 to 0.7 is found in 11 mandals such as Konaraopet, Vemulawada, Boinpally, Karimnagar, Manakondur, Kesavapatnam, Huzurabad, Chigurumamidi, Peddapally, Thadicherla and Mahadevpur. Whereas in the period 2007-09, Moderate Crop Diversification showed in 20 mandals, they are Metpally, Korutla, Sarangapur, Jagtial, Gollapally, Velgatur, Mallial, Kodimial, Vemulawada, Boinpally, Karimnagar, Thimmapur, Choppadandi, Julapally, Srirampur, Odela, Jammikunta, Thadicherla, Kataram and Mahadevpur.

During the period 1997-99, High Crop Diversification i.e. 0.7 to 0.8 is noticed in 31 mandals such as Ibrahimpatnam, Mallapur, Metpally, Korutla, Kathlapur, Medially, Chendurthy, Kodimial, Mallial, Jagtial, Sarangapur, Dharmaram, Gollapally, Velgatur, Ramagundam, Pegadapally, Gangadhara, Ramadugu, Choppadandi, Julapally, Ellanthakunta, Thimmapur, Koheda, Husnabad, Saidapur, Bheemadevarapally, Kamalapur, Jammikunta, Veenavanka, Odela, and Srirampur. During the period 2007-09, High Crop Diversification i.e. 0.70 to 0.80 is found in 16 mandals such as Ibrahimpatnam, Mallapur, Raikal, Dharmapuri, Kathlapur, Maidipally, Chendurthy, Konaraopet, Yellareddipet, Siricilla, Ellanthakunta, Bejjanki, Koheda, Husnabad, and Saidapur.

Very High Crop Diversification i.e. above 0.81 showed during 1997-99 in 3 mandals, they are Raikal (northern part of the district), Bejjanki (southern-part of the district), and Elkathurthy (south-eastern part of the district). During 2007-09, Very
High Crop Diversification i.e. above 0.81 showed in only one mandal, that is Chigurumamidi whereas in the period 2007-09 Moderate Crop Diversification showed in 20 mandals, they are Metpally, Korutla, Sarangapur, Jagtial, Gollapally, Velgatur, Mallial, Kodimial, Vemulawada, Boinpally, Karimnagar, Thimmapur, Choppadandi, Julapally, Srirampur, Odela, Jammikunta, Thadicherla, Kataram and Mahadevpur.

In south eastern part of district, Peddapally, Kamanpur, Manthani, Thadicherla, Kataram, Mahadevpur, Mutharam mandals are located. In south eastern part of the district Kamalapur, Jammikunta, Veenavanka and Odela are located. These mandals are irrigated predominantly under tanks. Poor status of irrigation intensity is due to underdevelopment of other type irrigation sources such as canals and wells.

5.5. CROP COMBINATION

The geographical investigation of agriculture which purports to select various crops or agricultural elements to be studied collectively in an area may be termed as combination analysis or combinatorial analysis. The combination analysis was originally introduced into geographical research by Weaver (1954) in his outstanding study of crop combinations in the Midwestern United states. The study of crop combination regions constitutes an important aspect of agricultural geography as it provides a good basis for agricultural regionalization. The crops are generally grown in combinations and it is rarely that a particular crop occupies a position of total isolation other crops in a given area at a given time. The physical factors determine their extent. With the development of better irrigation facilities, new varieties of crops can be introduced in the place of traditional and unprofitable agricultural system.
In recent years the concept of crop combination has engaged the attention of geographers and agricultural land use planners.

A large number of experts have suggested a number of statistical methods to delineate crop-combination regions.

The Thomas technique suggests that the theoretical 2-crop combination. Thomas included all the crops in the region. It’s quite a sensible modification. The final modification incorporated by Coppock (1964) was the use of the Thomas technique to calculate only the sum of squared deviations and not to divide it by the total number of crops under discussions. The Coppock technique, therefore, quite sensibly suggests that the divisions of the sum of squared deviations by the total number of crops included in discussion is an additional calculation without bringing about any further improvement in the result.

The combination having the smallest or lowest sum of the squared deviations, known as the least squares, will be taken as the established crop combination.

The scene of crop productivity is diversified by a combination of amenity resources, input resources, and social and economic conditions thereby giving scope to the concept of diversified cropping pattern rather than a mono crop culture. Thus the physical, socio-economic conditions govern by the cropping systems resulting in the emergence of crop regions. The dynamic nature of land use has exemplified the complexity in the delineation of crop regions. Here an attempt has been made to determine the crop association and delimit various crop combination regions based on average strength of selected crops. For these purpose, Weaver’s minimum deviation technique was used.
Crop combination in Karimnagar district- period 1997-99:

An examination of the crop combination (figure no. 5.5.a) for the period 1997-99 reveals that mono-culture with rice crop is found in the three mandals namely Gambiraopet, Mustabad, and Kamanpur.

Two- crop combination with ground nut and rice, rice and cotton, rice and maize, rice and jowar are found in the Metpally, Sultanabad, Yellareddipet, Vemulawada, Boinpally, Ellanthakunta, Mahamuttaram mandals of the district respectively. Jowar is noticed in only Mahamuttaram as this mandal’s soils are not fertile this crop is grown. This crop sustains in low fertility soils also.

Three-crop combination is seen in several mandals of the district. The combinations of crops are being rice, maize, total pulses, ground nut and cotton. . The combination with rice-groundnut-maize is noticed in Manakondur, Kesavapatnam, Thimmapur, Chigurumamidi, Konaraopet, Mutharam and Huzurabad mandals. The combination with cotton-rice-chillies is only noticed in Kamalapur mandal. The combination with rice-maize-total pulses is Raikal, Dharmapuri, Mallial, Pegadapally, Ibrahimpatnam, Kathlapur, Peddapally, Ramagundam, and Dharmaram. Rice-cotton-groundnut combination is noticed in Siricilla. Chendurthy is noticed with combination of rice-cotton-total pulses. Siricilla and Chendurthy are well known cotton growing mandals in district. Thadicherla with rice-jowar- groundnut, Mahadevpur with jowar-rice- chillies and Kataram with rice-jowar-ground nut combinations are noticed.

Four -crop combination is noticed in Karimnagar, Gangadhara, Ramadugu, Choppadandi, Husnabad, Koheda, Jammikunta, Veenavanka, Saidapur, Bhimdevarpally, Jagtial, Kodimial, Gollapally, Korutla, Maidipally, Mallapur, Odela, Velgatur, Julapally and Manthani mandals. The combinations are being rice-maize-
ground nut, total pulses, rice –cotton-total pulses-maize, cotton-rice-chillies-maize, rice-maize-total pulses and rice-jowar-total pulses-groundnut. Five- crop combination is found in Bejjanki, Elkathurthy and Srirampur. Cotton, maize, rice, groundnut and total pulses are the crops in this combination.

**Crop combination in Karimnagar district- period 2007-09:**

An examination of crop combination (figure no. 5.5.b) for the period 2007-09 shows a significant change in the pattern of crop combinations. 6 mandals such as Ramagundam, Peddapally, Kamanpur, Thadicherla, Shankarapatnam, and Huzurabad have shown mono-culture with rice as the chief crop.

Two-crop combination with rice and cotton has been replaced by rice and maize in 17 mandals such as Sarangapur, Dharmapuri, Maidipally, Gambiraopet, Mustabad, Dharmaram, Julapally, Eligedu, Sultanabad, Veenavanka, Kamalapur, Yellareddipet, Srirampur, Mutharam, Kataram and Mahamuttaram. 11 mandals have shown rice and maize as the combination and 6 mandals rice and cotton as the combination during the period 2007-09.

Another significant change is noticed in several mandals where four crop combinations were seen during 1997-99 have been replaced by three crop combinations with chief crops being rice-maize-cotton, rice-maize-total pulses.

Four-crop combination was found in seven mandals such as Mallapur, Kathlapur, Konaraopet, Gangadhara, Koheda and Mahadevpur during the period 2007-09. The crop- combination is being Rice-Cotton-Total pulses and Maize, Rice-Maize-Total pulses and Turmeric, Rice-Maize-Turmeric and Sugarcane. Five crop
combination was found in only one mandal i.e., Chigurumamidi. The crop combination is being maize, rice, cotton, ground nut and total pulses.

5.6. CROP CONCENTRATION

By concentration we generally mean the clustering of a recognizable degree of a particular element in an area. Crop concentration exhibits than different crops when viewed together by superimpose-section depict areas wherein their regional concentrations do not overlap.

For example, on the national scale, the areas of rice concentration in eastern India and the areas of bajra concentration in western Rajasthan do not even partly coincide. Here only a single crop, either rice or bajra, shows a regional concentration. Crop concentration helps us in understanding the complex agricultural landscape of a region so as to enable us to decide the strategy for agricultural planning.

Both qualitative and quantitative approaches have been used to explain the degree of crop concentration. Of these the latter are more precise and accurate. The general concentration of a crop can be measured by the technique using or coefficient of localization for which different methods have been suggested by Florence (1948), Chisholm (1962), Bhatia (1965) and J. Singh (1976). Singh J. (1976) has used location quotient formulae to measure the crop concentration in India.

Using above formula rice concentration regions of India (1969-70) have been identified by Singh and Dhillon (1984, p. 219). Rice is mainly concentrated in the north-eastern and coastal areas of the country. Very high concentration of rice is noticed (LQ 3-4) in the north-eastern states, Gangetic West Bengal, south Bihar, coastal and northern Orissa; while high concentration (LQ 2-3) areas include northern
West Bengal, central Bihar, Chhattisgarh, southern Orissa, and coastal areas of Andhra Pradesh, Tamil Nadu, Karnataka, Maharashtra, and the Volley of Kashmir. Areas of moderate concentration are confined in northern Bihar, eastern Uttar Pradesh, eastern Maharashtra, southern Tamil Nadu and Kerala. Similarly low and very low concentration (LQ below 1) areas are found in remaining parts of the country.

The study of crop concentration is helpful in many ways in deriving relevant conclusions about crop distribution. Higher the crop concentration index, higher is the level of interest in the production of that crop. It helps in taking important decisions regarding marketing, storage, and trading of the crop produce.

In terms of types of concentration, crops may be identified by a single nucleus to multiple nuclei and by high density to low density distribution. Changes in the pattern of concentration may throw light on the expansion and contraction of its high density areas and on the changing core of the crop. The spatial variations in the degree of concentration are largely determined by the interaction between various factors such as physiographic, climatic, seraphic, hydrological, socio-economic and techno-organizational, etc. It can be calculated with below formula:

\[
\text{Crop Concentration} = \frac{\text{Total Cropped Area In Mandal}}{\text{Total Geographical Area in mandal}} + \frac{\text{Total Cropped Area In District}}{\text{Total Geographical Area in District}}
\]

**Crop concentration in Karimnagar district:**

During the period 1997-99, very low concentration i.e. below 0.40 noticed in only three mandals that they are Thadicherla, Mahadevpur and Mutharam whereas under this category during the period 2007-09 it has been noticed in 4 mandals Thadicherla, Mahadevpur Mutharam and Yellareddipet. These mandals except
Yellareddipet are spread in the eastern part of the district where forest cover is dominant and irrigational facilities are low. During the period 1997-99, the area under very low category was 1,46,800 hectares (12.4%) whereas it was 1,60,898 hectares (13.6%) during the period 2007-09.

During the period 1997-99, Low concentration i.e. 0.41-0.80 was noticed in 16 mandals which are Kataram, Manthani, Mutharam(maha), Ramagundam in eastern part of the district, Sarangapur, Dharmapuri northern part, Koheda, Husnabad, Bheemadevarapally in southern part and Konaraopet, Yellareddipet, Konaraopet, Mustabad, Siricilla, Ellanthakunta in south western part of the district. These mandals were spread in where irrigational facilities are low. During the period 1997-99, low concentration i.e. 0.41-0.80 was noticed in 10 mandals which are Kataram, Manthani, Mutharam(maha), Ramagundam in eastern part of the district, Sarangapur, Mallapur north-western part, and Chendurthy, Konaraopet, Mustabad, Siricilla in south-western part of the district. These mandals were spread in where irrigational facilities are low. The number of mandals decreased from 16 to 10 during these two periods showing a positive growth. During the period 1997-99 the area under this category was 403334 hectares (33%) whereas it was 249906 hectares (21%) during the period 2007-09. Under this category, the net decrease of area is 1,53,428 hectares. This means that the area of net decreased changed into high concentration index. It is due to improved irrigational sources.

During the period 1997-99, Moderate concentration i.e. 0.81-1.20 was noticed in as many as 20 mandals. Karimnagar, Thimmapur, Gangadhara, Ramadugu, Chigurumamidi, Ibrahimpatnam, Kathlapur, Veenavanka, Elkathurthy, Saidapur, Raikal, Dharmaram, Mallial, Kodimial, Maidipally, Ibrahimpatnam, Vemulawada, Chendurthy, Peddapally, Srirampur fall under this category. Under this category,
During the period 2007-09, 13 mandals were noticed such as Raikal, Dharmapuri, Velgatur, Mallial, Kodimial, Vemulawada, Ellanthakunta, Bejjanki, Karimnagar, Husnabad, Bheemadevarapally, Kamanpur, and Srirampur. This area is covered under the canal irrigation system thus it has good irrigational potential.

During the period 1997-99, the area under this category was 3,72,268 hectares (31%) whereas it was 3,10,064 hectares (26%) during the period 2007-09. Under this category the net decrease of area is 62,204 hectares and mostly this area is converted into high concentration areas.

During the period 1997-99 high concentration i.e. 1.21-1.60 was found in 12 mandals that they are Manakondur, Choppadandi, Jammikunta, Veenavanka, Shankarapatnam, Jagithial, Pegadapally, Gollapally, Korutla, Odela, Velgatur, and Julapally. Under this category, 2007-09 period, 23 mandals were found that they are Ibrahimpatnam, Korutla, Kathlapur, Maidipally, Gollapally, Pegadapally, Dharmaram, Boinpally, Gangadhara, Ramadugu, Choppadandi, Peddapally, Odela, Veenavanka, Jammikunta, Kamalapur, Elkathurthy, Manakondur, Thimmapur, Kesavapatnam, Chigurumamidi, Saidapur, Koheda were identified. The number of mandals increased from 12 to 23 mandals. This increase is due to increased irrigational facilities.

During the period 1997-99 the area under this category was 2,12,776 hectares (17%) whereas it was 3,83,570 hectares (32%) during the period 2007-09. Under this category the net increase of area is 1 70,794 hectares. This increase is due to increased irrigational facilities from the period 1997-99 to 2007-09.

During the period 1997-99 very high concentration i.e. above 1.61 was found in 3 mandals that they are Boinpally, Huzurabad, and Mallapur. During the period
2007-09, very high concentration i.e. above 1.61 was found in 6 mandals that they are Metpally, Jagithial, Julapally, Eligedu, Sultanabad, and Huzurabad. This very high concentration is due to assured supply of water to crops.

During the period 1997-99, the area under this category was 43,667 hectares (3.6%) whereas it was 84,061 hectares (7.0%) during the period 2007-09. Under this category the net increase of area is 40,394 hectares. This increase is due to increased irrigational facilities from the period 1997-99 to 2007-09.