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CHAPTER - VI
LANDUSE AND AGRICULTURAL CROPS
COMBINATION REGIONS

6.1 INTRODUCTION:

The concept of Land use is related to the use of land for which land is put in a certain regions for a given period of time. Land use studies, are important, as they are aimed to explain the occurrence of different uses in different areas. They generally aim of explaining the constant interaction between available land resources on the one hand and human needs and efforts on the other. Land use, thus, is an expression of permanent struggle in which human efforts are applied to the land resources for the satisfaction of human needs. The competition between various types of uses is the result of scarcity of land. Some land is better than other land for a specific use depending on physical, economic and cultural characteristics of land to which its suitability for a particular use is related. Therefore, in agricultural geography, it is essential to understand the variations in the land use as a human reaction towards the satisfaction of human wants. The environmental factors no doubt, exert an influence upon the use to which land is put. This is true especially in the case of rural land use such as agriculture, forestry etc. The urban land use to a great extent reflects cultural and economic responses.

Land is the basis resource of human society. Its utilization shows a reciprocal relationship between the prevailing ecological condition of a particular region and man. Land is the surface utilization of all developed and vacant land on specific point, at a given time and space. This leads on back to the village farm and the farmer, to the fields, gardens, pastures, fallow land and forest and to the isolated farmstead. As a matter of fact, geography deals with the spatial relationship between these aspects and
planning. This is because land use changes to meet the variable demand for the land by the society in its new ways and conditions of life. The demand for new uses of land may be inspired by a technological change or by a change in the size, composition and requirements of a community some changes are short lived where as others represent a more constant.

In this way, land utilization is the use made of the land by man, as surveyed maps in a series, pasture, mining, transportation, gardening residential, recreational, industrial, commercial, uncultivable waste and barren and fallow land. It is not normally possible to use land for two or more purposes simultaneously, though, some times even this is possible only for the pasture woodland. Land use is an important aspect of geographical studies particularly to solve agricultural problems and agricultural development in the study region.

6.2 MEANING AND IMPORTANCE OF LAND USE:

The difference between land use and utilization is important. Land use is the use actually made of any parcel of land, house, apartments and industrial location are land use categories, where as the firm, residential, industrial and agricultural refer to the system of land utilization implying roads, neighborhood retail and service activities as well as location of industries and the carrying of agricultural pursuit. In a rural area, tree crops or row crop would identify land use; where as herding, truck farming and grazing indicate a system of land utilization. The term ’land utilization’ is also used for varied utilization of land and soil surveys e.g. land under cultivation, pasture, barren, orchard, fallow waste, cultivable waste, settlements, forests and water bodies. According to J. L. Buck “Land Utilization is the satisfaction’ which farm population derives from the type of agriculture developed the provision for future production and contribution to national needs”. While the definition given by Salter is as
follows; “land utilization research can be described as dealing with problem situations in which people in a given locality are in the process of transformation from activities with certain land requirements to activities with different land requirement.”

In this sense, land utilization involved an examination of the natural factors affecting both the harnessed and the potential productivity of the land is a changed situation of the locality and its requirements. These factors are the land, temperature, rainfall and soil which in a configuration together constitute the physical background of agriculture and determine the limits of both the cultivability and productivity of the land.

Land utilization mainly deals with the problems related to the society and the region as a whole, rather than a private farmer. Landuse is mainly related to optimum use of the land limited between the alternative major types of land use. In rural areas, the major type of land use is as follows.

1. Agricultural Land.
   a. Non-irrigated lands.
   b. Irrigated lands.
   c. Dry farming areas.
   d. Grazing areas.

2. Village Orchards or forest lands.

3. Forest land.
   a. Forest covered.
   b. Forest reclaimed land use.
   c. Culturable or recreational land use.

Land utilization also related to “conversion of land from one major use to another general use.” After reclamation of forest land, a question arises as to how the land should be utilized. The rotation of
crops and their combination are after all minor problems of land use study. This is because these aspects depend upon personal experience and institution of the farmer who decides which crops should be grown in rotation.

There is an intimate relationship between land economics and land utilization. The efficient use of land depends on the capacity of the man to utilize the land and to manage it. It also depends upon the systems of farming, systems of land tenures, and size of the holdings, where as the production efficiency and level of production depend upon the institutional frame work and the production function carried on by the farmer.

The man-land relationship can be experienced in three different aspects. First the land and the individual person who uses it, second the man and his influence on the use of the land as a means of production. In this case institutional infrastructure should be studied for improved land use. The third relationship between land and man can be expressed in terms of man as a social being and the land as an inexhaustible resource.

For human existence, within certain biotic, ecological and economic conditions the utilization of land is of prime importance. It involves a relationship that exist between the societies on the one hand and cultural advancement, resource planning and carrying capacity of the land on the other. The intensive use of land depends upon population concentration, economic prosperity through better agricultural production, human establishments, industrial locations, communication and transportation lines, while extensive use of land is related to sparse population, dispersed settlements, the absence of communication lines and the crude forms of transport. However, only the systematic utilization of land can be able to promote economic and cultural advancement. If there is no utilization of land, one cannot think of any progress. Thus, the
study of land utilization is of immense value in tracing out the past use of land and its future trend. Only through the study of the past land utilization, one can be able to predict for future use and evolve landuse planning of a particular region. The changing population and the economic, the biological and the ecological problems are so alarming that the conservation and the best utilization of land becomes a necessity.

6.3 LAND USE PATTERN IN SOLAPUR DISTRICT DURING 1970-71 TO 2001:

The main objective of such study is to highlight the changes in general land use in solapur district. The growing population of land and even increasing demand for the extent for food and raw material, the extent and nature of land use has been changed in the recent past.

Table 6.1


<table>
<thead>
<tr>
<th>Sr No.</th>
<th>Land Use categories</th>
<th>Years</th>
<th>Volume of change</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Forest</td>
<td>2.18</td>
<td>2.39</td>
</tr>
<tr>
<td>2</td>
<td>Area not available for cultivation</td>
<td>4.87</td>
<td>4.85</td>
</tr>
<tr>
<td>3</td>
<td>Other uncultivated land excluding fallow land</td>
<td>7.02</td>
<td>6.98</td>
</tr>
<tr>
<td>5</td>
<td>Net area shown</td>
<td>75.10</td>
<td>70.81</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>100</td>
<td>100</td>
</tr>
</tbody>
</table>


Note : figures in bracket indicates percentage.
The general land use pattern of Solapur district is based on the data abstracted from the socio-economic review for different periods since 1970 till 2001. It has been observed that remarkable changes have occurred in general land use pattern during the last three decades.

6.4 LAND CLASSIFICATION:

Land use classification is the systematic arrangement of various classes of land on the basis of certain similar characteristics mainly to identify and understand their fundamental utilities, intelligently and effectively in satisfying the needs of human society. Thus, land must be carefully utilized, so that it may fulfill our varied needs after its proper allocation. The best use of each parcel of land requires a scientific and methodically appreciable classification of the present land use. This may help us in investigation of the land use problems and the basis of planning for the best use of our land after considering the major land use categories.

Land use is an important aspect of studies in agricultural geography and for making the study of land use; it is classified into different categories. The concept of land use has been used in so many ways that no generally accepted scheme of classification exists, despite many years of land use studies by geographers. In most of such schemes, activity on the land has been the major criterion for classifying land use which is essential a qualitative rather than quantitative variable.

Land classification is based largely on the quality and intensity of the use of land. Census of India has classified land utilization in nine different categories but in the present study these have been grouped into five major land use categories. On the basis of the statistical data abstracted from the sources referred to above the Solapur district may be
divided into five major land use categories. The land use is the result of a combination of both natural genesis and human influences, which have been brought to bear on it in the past, and of those, which are still active in the present. Thus, the utilization of land for different purposes indicates an intimate relationship between prevailing ecological conditions and man. The Following table number 6.2 shows the changes in general land use in Solapur district

6.4.1 Area under Forest:

This category includes all areas actually under forests whether state owned or private and classified or administrated as forests under any legal enactment dealing with the forest.

The Solapur district has a very limited area under forest i.e. it occupies about 2.14 percent. Mostly out of the total geographical area in the district being lower than the average of Maharashtra, which is 17.28 percent in 2001. The changes pattern in the region under study during 1970 to 2001 is represented in table 6.1. The proportion of forest land has been increased from 2.18 percent in 1970-1971 to 2.39 percent in 1980-1981. During the period 1991-2001 forest land has tremendously decreased and became 2.1 percent in 2001. This has decreased due to the growing pressure of population some forest lands were converted in to agricultural land and some were denuded of vegetation and soil.

There are marked variations in tahsil level, ranging from below one percent in Akkalkot to over five percent in Mangalvedha. Highest percentage recorded in Mangalvedha, Pandharpur tahsils with 6.4 percent and 5.8 percent change respectively. Lowest percentage recorded in Akkalkot, Sangola and Malshiras tahsils with ‘0.0’ percent, 0.4 percent and 0.2 percent respectively. Forest gradually decreased from west to east. Most of the forests in the region are situated on hills and Ghats of Vadashing, Ghat in Barshi, Waghoba and Bodki in Karmala. (Fig. 6.1)
SOLAPUR DISTRICT

Area Under Forest (2000-01)

Change in Area Under Forest (1981-2001)

Area in Percentage
- More than 3
- 1.0 to 3
- Less than 1

Area in Percentage
- More than 2.5
- 1.0 to 2.5
- Less than 1

Figure 6.1
Both positive and negative changes were experienced in forest area during the period 1980 to 2001. Below one percent negative change in forest area was experienced in only Akkalkot (-0.4), tahsil, where as below one percent positive change in forest area was experienced in Barshi (+0.7) and Madha (+0.6) tahsils, during the period of investigation. (Table 6.2)

6.4.2 Area Not Available For Cultivation:

This category includes land put, to non agricultural uses, barren and uncultivable land like hill ranges and river beds. These land uses show that these areas will be available no more for crop cultivation in future. These areas which are not available for crop cultivation sort a close association with other and uncultivated land and net shown area will be transferred to this categories and this may happen particularly due to increasing urbanization, predominantly the spread of the cities of south solapur, Pandhapur and Barshi. The land under this category can not be brought under cultivation but for a very high price it can be brought under cultivation. About 5.3 percent of area belongs to this category which is much less as compared to Maharashtra which is 8 percent.

The area not available for cultivation in the region also experienced the changes during the 1970-2001 periods. In 1970-1971 to 1980-1981 area not available for cultivation, slightly decreased and became 4.85 percent in 1980-1981, while it increased during the next decade of 1980-81 to 1990-91 and became 0.42 percent. It must be noted that during 1990-91 to 2000-01 area not available for cultivation slightly increased by 0.08 percent. This increase in the area not available for cultivation may be attributed to shifting of land for other production of the crops, during the next season and area for housing purposes and industrial establishment.
<table>
<thead>
<tr>
<th>Talukas</th>
<th>Area Under Forest</th>
<th>Area not available for cultivation</th>
<th>Other uncultivated land excluding Fallow land</th>
<th>Fallow Land</th>
<th>Net Sown Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>North Solapur</td>
<td>1.5</td>
<td>3.07</td>
<td>-11.6</td>
<td>4.9</td>
<td>5.7</td>
</tr>
<tr>
<td>Barshi</td>
<td>1.7</td>
<td>2.4</td>
<td>+0.7</td>
<td>2.3</td>
<td>7.5</td>
</tr>
<tr>
<td>Akkalkot</td>
<td>0.4</td>
<td>0</td>
<td>-0.4</td>
<td>3.7</td>
<td>0.1</td>
</tr>
<tr>
<td>South Solapur</td>
<td>1.5</td>
<td>1.5</td>
<td>0</td>
<td>1.2</td>
<td>3.8</td>
</tr>
<tr>
<td>Mohol</td>
<td>3</td>
<td>1.2</td>
<td>-1.8</td>
<td>3.8</td>
<td>12.2</td>
</tr>
<tr>
<td>Mangalwedha</td>
<td>0.7</td>
<td>6.4</td>
<td>+5.7</td>
<td>3.1</td>
<td>3.4</td>
</tr>
<tr>
<td>Pandharpur</td>
<td>2.9</td>
<td>5.8</td>
<td>+2.9</td>
<td>4.9</td>
<td>5.5</td>
</tr>
<tr>
<td>Sangola</td>
<td>4.8</td>
<td>0.4</td>
<td>-4.4</td>
<td>6.1</td>
<td>9.2</td>
</tr>
<tr>
<td>Malshiras</td>
<td>3.8</td>
<td>0.2</td>
<td>3.4</td>
<td>10</td>
<td>3.5</td>
</tr>
<tr>
<td>Karmala</td>
<td>3.9</td>
<td>2.7</td>
<td>-1.2</td>
<td>7.6</td>
<td>5</td>
</tr>
<tr>
<td>Madha</td>
<td>1.1</td>
<td>1.7</td>
<td>+0.6</td>
<td>4.3</td>
<td>2.9</td>
</tr>
<tr>
<td>District Total</td>
<td>2.39</td>
<td>2.1</td>
<td>-0.29</td>
<td>4.85</td>
<td>5.3</td>
</tr>
</tbody>
</table>

**Source**: Socio-economic Abstract of Solapur district (1980-81 to 2000-01)
In Solapur district, Sangola, Mohol, Pandharpur, Karmala North Solapur and Barshi tahsils have substantial proportion (above the region average of 5 percent) of areas marked as land not available for cultivation. In solapur district, Akkalkot and Madha recorded a lesser proportion of land (Below 3 percent) under this category. (Fig. 6.2)

Both positive and negative changes were observed in area not available for cultivation during the period 1981 to 2001. Below one percent negative change in uncultivable land was not noticed while below one percent positive change in uncultivable land was noticed in only Madha (+0.2) tahsil during the period of investigation. Most of the farmers are very poor in the study region hence; they are unable to bring such land under cultivation.

6.4.3 Other Uncultivable Land Excluding Fallow Land:

This category of land consist of (a) Cultivable waste (b) Permanent pastures and grazing land and (c) land under miscellaneous trees crops etc., cultivable waste land includes the land which can be brought under cultivation but which have not been cultivated for some time and not been cultivated successively for more than five years. The category of miscellaneous trees, crops includes lands under casuarinas trees, grass bamboo bushes or other trees used for fuel. Actually, these are the lands which are put to some agricultural use but whose area extent is not included in the category of net area sown.

Total area under this land use category is 5.1 percent which is much less as compared to Maharashtra average of about 7.2 percent in 2001. The lands under the category of uncultivated excluding fallow land have also recorded a considerable decrease during 1970-71 to 1980-81 period, which slightly decreased by 0.04 percent. While during 1980-81 to 1990-91, the land under this category increased by 6.98 percent and became 11.11 percent during 1990-91 to 2000-01. Other cultivated land
was as low as 5.1 percent. The reason behind it may be attributed to several uses of the land in the sectors of housing, industries and development of Solapur corporation boundaries, as number of villages merged in the Municipal Corporation of Solapur during the period in 1991-2001, which resulted in the tremendous decline in the land of other cultivated land excluding fallow land.

There are marked variations in tahsil level ranging from under one percent in Mohol tahsil to over 10 percent in Sangola and Malshiras. Regional distribution under this category varies from below 5 percent to over 15 percent. Sangola and Malshiras tahsils recorded high (10 percent to 15 percent) percentage of area under this category. Only Barshi tahsil has 5 to 10 percent of land, classified as other undedicated land. Rest of tahsils such as North Solapur, Akkalkot, South Solapur, Mohol, Mangalvedha, Pandharpur, Karmala and Madha recorded very low proportion of land in this category. (Fig. 6.3)

Below one percent negative change is uncultivable land was not noticed, while above one percent positive change in uncultivable land was found in Madha tahsil.

**6.4.4 Fallow Land:**

The term fallow land is applied to land, not under cultivation at the time of reporting, but which have been under cultivation in the past. The Fallow land includes current fallow land and old fallow land are largely found due to inadequate water supply or excess of moisture supply, extensive holding and heavy clayey soils difficult for tilling at proper time. Some times, they are kept fallow for preserving fertility and to prevent soil exhaustion. Thus, efficiency of fallow land system in preserving fertility and maintaining crop yields to be acknowledged. Taking into consideration the period of fallow land, Census of India has
SOLAPUR DISTRICT

Other Uncultivated Land (Excluding Fallow Land) (2000-01)

Area in Percentage
- More than 10
- 5.0 to 10
- Less than 5

Other Uncultivated Land (Excluding Fallow Land) (1981-2001)

Area in Percentage
- More than 2
- 1.0 to 2
- Less than 1

Figure 6.3
dividend this categories into two types: for example, land kept as a fallow land during one year is called current fallow land and when it is kept fallow for one to five years, it is called as permanent fallow land. However, in the present study, both the sub categories are grouped together. Solapur district has a substantial proportion of fallow land with an average of 24 percent of the total geographical area.

This is much more of the state average of 7.2 percent in 2001. Nowadays, there is a tendency among the farmers to get high yield per hectar from the agricultural land, this has been reflected from the fact that during last decades (1990-2001) the land under fallow category is consistently increasing. This is clear from the fact, that is was 10.83 percent in 1970-71 and became as high as 24 percent in 2000-01.

There are marked variations within the region as regarded to fallow land. North Solapur, Barshi, Akkalkot, and Sangola tahsils recorded high percentage (above 25 percent) while South Solapur, Mohol, Mangalvedha, Pandharpur, Malshiras, Karmala and Madha recorded low percentage. The highest fallow land was observed in Barshi (54.9 percent) whereas the lowest fallow land was observed in Pandharpur (15.5 percent) during 2000-2001. (Fig. 6.4)

During 1991-2001 the proportion of fallow land declined by five percent in Mangalvedha, Pandharpur and Madha tahsils whereas below five percent positive change in fallow land was noticed in Malshiras tahsil during the concerned period.

6.4.5 Net Sown Area:

This category constitutes the extent of cropped land in any region and therefore, it is of vital significance in studies related to agricultural geography. The net area sown is the same cropped area in that year.
Fallow Land (2000-01)

Change in Fallow Land (1981-2001)

Area in Percentage
- More than 30
- 20.0 to 30
- 10.0 to 20
- Less than 10

Area in Percentage
- More than 15
- 10.0 to 15
- 5.0 to 10
- Less than 5

Figure 6.4
Total area under this land use category is 59.6 percent which is much less as compared to Maharashtra in 2001. Since, the region under study is relatively urbanized because it is dominated by city of Solapur and the merging of the number of villages in the municipal corporation of Solapur. The net area sown, therefore, declined gradually during the last decade, this may be due to the shifting of land in the other categories such as land for housing, industrial establishment and various other purposes. This is clear from the facts that the proportion under net area sown was 75.10 percent in 1970-71, 0.95 percent in 1980-81 and further it increased to 71.76 percent in 1990-91. (Fig.6.5)

Below 5 percent positive changes in net sown area were found in Pandharpur, Karmala and Malshiras tahsils during 1980-81 to 2000-01. While on the other hand, below 5 percent negative changes were observed in Mohol and Mangalvedha tahsils during the concerned period.

6.4 AREA UNDER DIFFERENT CROPS:

In Simple words cropping pattern means the proportion of the area under various crops at a point of time. It is a dynamic concept, because no cropping pattern can be said to be ideal for all times. It changes in space and time with a view to meet the requirements and is governed largely by the physical as well as cultural and technological factors. The change in cropping pattern in a particular span of time clearly indicates the changes that have taken place in the agricultural development. These changes are brought about by the socio-economic influence. “In most of the situations the physical environment reduces the choice of the enterprise, either by prohibiting the growth of certain crops altogether or by reducing their level.”

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The proportions of area under various crops and their changes have been shown in the Table 6.1. The major crops that are grown in the region under study may be grouped into two categories namely:

1) Food Crops:- The food crops include the production of rice, wheat, Jawar, Bajra, Pulses, Sugarcane and other crops.

2) Non Food Crops:- The non-food crops include, the production of different crops such as ground nuts, oil seeds (fruits, vegetables etc).

The overall cropping pattern according to tahsilwise trends in 1981-2001 are under different food grain, non food grain crops in Solapur district, which have been shown in the table 6.4. Cropping pattern means the proportion of area under different crops at a point of time. Substantial changes have occurred in the cropping pattern of the region during the period under study, spatial variations in the cropping pattern as depending upon the physical, socio-economic and technological environment. These are different from the regions overall characteristics.

Therefore, a detailed analysis of various crop's distribution based on the quinquennial averages of 1980-81 and 2000-2001. It also depicts the changes therein. These changes are found in the various tahsils, due to the combine effect of physical and non physical determinants. The changes in agricultural pattern also depend upon the traditional habits of the people in a particular region.

6.4.1 Food Crops:

The census department has grouped entire crops under the two broad categories namely food crops and non food crops. Among the food crops, cereals, pulses condiments and spices, sugarcane, fruit and vegetables are included. In the Solapur district, the crops occupy the largest area of 84.8 percent of the total cropped area.
In order to understand the trends of change of land use pattern in the region under study for the area under different crops, the proportion of changes considering crops, the proportion of changes considering 1970-71 as a base year, the proportion of land under different crops has been calculated for the years 1970-71, 1980-81, 1990-91 and 2000-01. The area under food crops and non food crops, together make the total land under crops which is fluctuating from 85.6 percent in 1970-71 and 84.8 percent in 2000-01. This is the area under different food crops, which is fluctuating due to the fact of variable in amount of rainfall from one year to another. This may also be partly due to the grazing land and fallow land as vary form year to year. More than 80 percent areas of the land cultivation have been under the use of various food crops during the last three decades. (Fig. 6.6) and

i) Rice -

Rice is the staple crop, which is grouped under food crops. Rice requires hot humid and alluvial lomi soils for its high production. The district of Solapur is a region, which belongs to the rain shadow area, and hence, area under rice has been slightly fluctuating from 0.6 percent in 1970-71 to 0.7 percent in 2000-01. The land under rice has been less than one percent of the total cropped area during the concerned period. Out of the total grass cropped area, below one percent area was under rice in North Solapur, South Solapur, Mohol, Mangalvedha, Pandharpur, Sangola and Madha Tahsils. While one percent and three percent gross cropped area was found under rice in Akkalkot and Malshiras tahsils. Above three percent gross cropped area, was observed under rice in only Barshi tahsil (22.9 Percent) during 2000-01 periods. (Table 6.3)
Table 6.3
Area Under different crops and its changes in Solapur district
(1970-2001)

<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Food crops</td>
<td>85.6</td>
<td>87.4</td>
<td>88.9</td>
<td>84.8</td>
<td>+1.8</td>
<td>+1.5</td>
<td>-4.1</td>
</tr>
<tr>
<td>Rice</td>
<td>0.6</td>
<td>0.5</td>
<td>0.3</td>
<td>0.7</td>
<td>+0.1</td>
<td>-0.2</td>
<td>+0.4</td>
</tr>
<tr>
<td>Wheat</td>
<td>2.3</td>
<td>4.7</td>
<td>1.7</td>
<td>10.4</td>
<td>+2.4</td>
<td>-3</td>
<td>+8.7</td>
</tr>
<tr>
<td>Jawar</td>
<td>5.4</td>
<td>62.2</td>
<td>66</td>
<td>22.6</td>
<td>+8.2</td>
<td>+3.7</td>
<td>-43.4</td>
</tr>
<tr>
<td>Bajra</td>
<td>11.4</td>
<td>3.3</td>
<td>4.9</td>
<td>2.3</td>
<td>-8.1</td>
<td>+1.6</td>
<td>-2.6</td>
</tr>
<tr>
<td>Pulses</td>
<td>6.4</td>
<td>4.2</td>
<td>4.4</td>
<td>0</td>
<td>-2.2</td>
<td>+0.2</td>
<td>-4.4</td>
</tr>
<tr>
<td>Sugarcane</td>
<td>1.2</td>
<td>1.7</td>
<td>3.3</td>
<td>28.1</td>
<td>+0.5</td>
<td>+1.6</td>
<td>+24.8</td>
</tr>
<tr>
<td>Other Food Crops</td>
<td>9.7</td>
<td>10.8</td>
<td>8.31</td>
<td>20.63</td>
<td>+1.1</td>
<td>-2.5</td>
<td>+12.3</td>
</tr>
<tr>
<td>Total Non food crops</td>
<td>14.4</td>
<td>12.6</td>
<td>11.1</td>
<td>15.2</td>
<td>-1.8</td>
<td>-1.5</td>
<td>+4.1</td>
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<td>Oil seeds</td>
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<td>0.6</td>
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<td>0.1</td>
<td>0</td>
<td>+4.6</td>
<td>-5.1</td>
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<td>1.6</td>
<td>+0.1</td>
<td>-0.8</td>
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<td>Ground nuts</td>
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<td>+4.7</td>
</tr>
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<td>other nonfood crops</td>
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<td>9</td>
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<td>6.7</td>
<td>+2.7</td>
<td>-5.4</td>
<td>+3.1</td>
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<tr>
<td><strong>Total crops</strong></td>
<td><strong>100</strong></td>
<td><strong>100</strong></td>
<td><strong>100</strong></td>
<td><strong>100</strong></td>
<td><strong>-</strong></td>
<td><strong>-</strong></td>
<td><strong>-</strong></td>
</tr>
</tbody>
</table>

Source: Socio-economic review of Solapur district (1970-2001)

Both positive and negative changes in area under rice were found in the study region. Below one percent negative change in rice area was observed in North Solapur, South Solapur, Mohol, Pandharpur, Karmala and Madha tahsils on the one hand while below one percent positive change in rice area was noticed in Mangalvedha, and Malshiras tahsils. Rainfall variability and decision of the farmers are the responsible factors for the positive and negative changes in rice area under study. (Fig. 6.7)
Fig. 6.6 Area under different crops and its changes in Solapur district (1971-2001)
<table>
<thead>
<tr>
<th>Crops</th>
<th>Year and Volume of Change in</th>
<th>North Solapur</th>
<th>Barshi Akkal</th>
<th>North Solapur</th>
<th>South Solapur</th>
<th>Mohol</th>
<th>Mangalvedha</th>
<th>Pandharapur</th>
<th>Sangola</th>
<th>Malshiras</th>
<th>Kar mala</th>
<th>Madha</th>
<th>District Total</th>
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<td>Total food crops</td>
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<td>86.9</td>
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<td>Vol. of change</td>
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<td>-10.2</td>
<td>-8</td>
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<td>+1.3</td>
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<td>Vol. of change</td>
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<td>+1.8</td>
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<td>-3.6</td>
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<td>22.8</td>
<td>22.8</td>
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<td>22.8</td>
<td>22.8</td>
<td>22.8</td>
<td>22.8</td>
</tr>
</tbody>
</table>
Figure 6.7

SOLAPUR DISTRICT

Rice Cultivation (2000-01)

Change in Rice Cultivation (1981-2001)

Area in Percentage

- More than 3
- 1.0 to 3
- Less than 1

Percentage Increase

- More than 2
- 1.0 to 2
- Less than 1

KM 40 20 0 40 KM
ii) Wheat -

Like rice, wheat is also a staple crop for mankind, commonly it is grown in the temperate region of Maharashtra. The production of wheat is not appreciable due to unfavorable climate condition, and poor soil in Solapur district. The Solapur is no exception for this trends, this is clear from the fact that the Table 6.1 represents the area under wheat, which is also below five percent of the cropped area, during the first two decades wheat crop is fluctuating from 2.3 percent in 1970-71 to 4.7 percent in 1980-81. Its percentage in 1990 was 1.7 which tremendously increased to 10.4 percent in 2000-01.

The area under wheat varies from tahsil to tahsil in the study region. Out of the total gross cropped area of the region, below five percent area was found under wheat cultivation in Madha and Mangalvedha tahsils, where as five percent to ten percent gross cropped area was observed under wheat in Sangola, Akkalkot, North Solapur, South Solapur. Mohol and Barshi tahsils, above ten percent wheat area was observed in Malshiras and Pandharpur tahsils, during 2000-01 (Fig. 6.8).

Both positive and negative changes in area under wheat were found in the study region. Below one percent positive change in wheat area was observed in Mangalvedha and Karmala tahsils and above one percent positive change in wheat area was found in North Solapur, Akkalkot, Pandharpur, Sangola and Malshiras tahsils, below one percent negative change in wheat area was observed in Barshi tahsil.
SOLAPUR DISTRICT

Wheat (2000-01)

Area in Percentage
- More than 10
- 5.0 to 10
- Less than 5

Change in Wheat (1981-2001)

Percentage Increase
- More than 6
- 3.0 to 6
- Less than 3

Figure 6.8
iii) Jawar -

Jawar is an important crop in the cropping pattern of the region. Jawar is well adapted to the environment and provides not only food for the people but also fodder, for livestocks. It is raised both in Kharif and Rabi seasons in the study region. It is grown in variety of soils, ranging from light sandy to heavy clays. Its performance is better in medium and deep black soils. Out of the total cropped area, about 22.6 percent was found under Jawar crop during 2000-01.

Jawar is the second most important crop in Solapur district, due to favorable climatic conditions and the increase in irrigation facilities, the land under, Jawar declined during the during 1990-2001. The proportion of Jawar is less than 15 percent in South Solapur and Malshiras tahsils. More than 30 percent Jawar was observed in Madha and Sangola tahsils. (Fig. 6.9)

Only negative changes took place in the study region, less than 25 percent negative change was noticed in Sangola and Madha tahsils, while more than 50 percent negative changes were observed in Mohol tahsil.

iv) Bajra -

This is another stable food grain grown in the drier part of the Solapur region. Bajra is a Kharif crop and generally grown during the rainy season. Due to the climatic variability and unsuitable soil conditions which are responsible for lower proportion of land under Bajra. About 2.3 percent of the total gross cropped area in the district is under Bajra.

The spatial distribution of Barja in the region is shown in (Fig.6.10). It is grown almost in all tahsils ranging from below two percent to over four percent. Sangola and Malshiras tahsils have recorded Medium proportion of area of about 2 to 4 percent, and low proportion of area under Bajra is recorded in Akkalkot, North Solapur, South Solapur,
Figure 6.9

**SOLAPUR DISTRICT**

**Jawar Cropping (2000-01)**

**Change in Jawar Cropping (1981-2001)**

Area in Percentage
- More than 30
- 15.0 to 30
- Less than 15

Percentage Increase
- More than 50
- 25.0 to 50
- Less than 25
Mohol, Madha and Barshi tahsils. Less than two percent area is recorded in Pandharpur tahsil is because of rainfall conditions. (Fig. 6.10)

Map showing, changes in Bajra area, recorded increase for below, one to over three percent. Below one percent positive change was recorded in eastern Solapur tahsils. While more than three percent increased was observed in Karmala and Malshiras tahsils during the 1980-2001.

v) Pulses:

Pulses occupy as important position in the agrarian economy of the Solapur district. The varieties of pulses are grown in the region under study which is Tur, Gram and Mug. These pulses are very useful in many ways. They serve as a excellent nutrition food and also increase the fertility of the soil. These are grown, both as Kharif and Rabi crops. The soil and moisture requirements vary from one type of pulses to another. But generally these need less moisture and most of these are rainfed.

The proportion of area under all the pulses (Tur and other pulses) in the regions is 8.2 percent during 2000-01. Fig.6.11 shows the variations in the share of pulses cropped area ranging from below 5 percent to 10 percent.

The Principal pulses growing areas are Karmala, Sangola and Mangalvedha tahsils. Else, where, the proportions are moderate because of low rainfall conditions. (Fig. 6.11)

Shows the changes in pulses area mostly high increased were observed in the tahsil level during 1980-2001. Malshiras, Pandharpur and Madha tahsils recorded less than two percent increase in the district
vi) Sugar Cane:

Sugarcane is one of the most important cash crops, grown in the region under study. The cultivation of sugar cane has been steadily increasing because of the opening of number sugar factories in the district and also due to the increase in the irrigation facilities. Sugarcane is only irrigated crop and is grown all over the district in deep black soils. Malshiras tahsil occupies the largest area under sugarcane.

It is a water-loving tropical crop; therefore, it requires high temperature, maximum moisture and irrigation facilities. Sugarcane cultivation has considerably increased in the canal areas since the opening of Nira Canal and Ujani Canal. About 28.1 percent of the total gross cropped area in the district is under sugar cane.

Sugar cane is the principal crop in the cropping pattern of the region. Sugar cane is tremendously increased in land use pattern during 1970-71 to 2000-01. The area under sugar cane has been below two percent during 1970 to 1980. It increased from 3.3 percent in 1981-91 and substantially increased during 2000-01 and hence, became major and principal crop in the Solapur district.

Sugar cane cropped area is shown in Fig. 6.12, while it ranges from below 15 percent to above 30 percent of the total gross cropped area. The tahsil of Malshiras recorded 42.7 percent, area under sugarcane which is followed by Pandharpur and South Solapur tahsils. The lowest area is recorded in Madha, Sangola and Mangalvedha tahsils. Rests of the tahsils have a moderate proportion.

The Fig. 6.12 exhibits the pattern of change in sugarcane cropping in the region. The area under sugarcane has increased during, the period under investigation. Two tahsils namely Sangola and Madha tahsils recorded less than fifteen percent, while more than thirty percent area under sugarcane are found in Malshiras, Pandharpur and South Solapur tahsils.
vii) Other food crops:

Apart from Rice, Wheat, Jawar, Bajra and Pulses, there are also many other cereals, which are grown in the region under study. During 1970-71 to 2000-01 there has been increase in the proportion of pulses. The area under pulses was 9.7 percent in 1971 which substantially increased to 12.5 percent in 2001.

6.4.2 Non Food Crops:

In the foregoing analysis the food grain crops and non-food grain crops are considered. Now, in this category of landuse only the oilseed is discussed. The area under non food crops have been of the magnitude of around 14.4 percent in the 1970-71, which declined to 12.6 percent in 1980-81 and slowly decreased to 11.1 percent in 1990-91. Crops like oil seeds (Sunflower, ground nut) and other non food crops also grown in the region under study, which are sizable due to the demand of oil by the people in day to day life.

Apart from this, there are many crops under the category of non-food crops, which are equally important for the farmers. Choice and interest have led farmers, to nonfood crops, hence, a sizable area was recorded in 1980-81, which was as high as 15.2 percent but there has been increase in the area under the different staple crops, in Solapur district.

i) Oil Seeds:

The oil seeds are very useful in many ways as they are used both for edible and industrial purposes and the edible oil seeds occupy most of the cultivated areas. Almost all the oilseeds are grown in Kharif season particularly on lighter type of soils. Oilseeds constitute an important group of cash crops. Oil seeds crop is fluctuating form 0.6 percent in 1970-71 to 0.9 percent in 1980-81 and it tremendously increased to 5.2 percent. The proportion of oil seed suddenly declined 0.01 to percent in
1991 further it was observed that area in oil seed is increasing during the last three decades.

The proportion of oilseed suddenly declined to 0.01 percent in 2001 and further it was observed that area in oil seed is increasing during the last few decades.

ii) **Groundnuts:**

Groundnut ‘BHUMIG’ is a Kharif crop. According to Indian census department, it is included in non-food crop category. It can be grown on light sandy soil, red loam and alluvial loam and also on black soil of good depth. The average area of groundnut in this region is 6.8 percent in 2000-01. The greater concentration of above ten percent area of groundnut is in the tahsils namely Akkalkot, Karmala and Madha. whereas less the five percent area under ground nuts are recorded in Mohol, Mangalvedha, Pandharpur, and Sangola tahsils.

The change in groundnut cropped is exhibited in Nine out of eleven tahsils of Solapur district. Some tahsils should have increased in the properties of seeds in ground nuts. Decline in the proportion of area under groundnut was recorded in Akkalkot, Pandharpur tahsils during the concerned period.

iii) **Other non food crops:**

Other non food crops are minor oil seeds, condiments and spices, chilly, turmeric onion and garlic. The proportion under other non food crops, the total gross cropped area is quite less. Thus, it is rather difficult to map these, especially because the area and such non-food minor crop is very insignificant in comparison to total cropped area of the district Solapur.
6.5 CROP COMBINATION REGIONS  
(BY RAFFIULLAH METHOD)

Some crops are seldom grown in absolute isolation but appear in combination. Various environmental factors tend to combine them in associations to rather in restricted areas where they receive their requisite ecological conditions. Crop combination as it provides areal significance and strength to individual crops, to advocate suitable device for planning and on improvement in the underdeveloped regions the crop combination is helpful in the introduction of innovation in agricultural field.

In the present study, an attempt is made by using maximum positive deviation introduced by Prof. Rafiullah (1915) of Aligarh University Aligarh.

Number of statistical procedures have so far been introduced to demarcate the crop-combination regions or to get elements that play significant role in any particular system more particularly, if an agricultural study is to be useful for planning the agricultural development, it is indeed, essential that the land of Solapur district should be divided into smaller units and which may have some coherence in terms of few important crops. The region of Solapur district hence is divided into crop-combination regions.

To divide an area into crop-combination regions, is a difficult task, since, it involves a question as to what crops should be included and which crops should be dropped. For crop combination regions, there are several methods adopted by several scholars, Weaver, Thomas, Johnson, Doi and Rafiullah. But a new technique has been evolved by Rafiullah for crop-combination analysis which is simple and less time consuming and sometimes gives lesser number of crops.

Rafiullah has used a deviation formula suitable for demarcating or delineating sharply the primary crop combination. He has considered the
standard deviation as the base though the technique involves a lot of calculation. It is useful statistical technique after finding the crop combinations. By using this method those crops which are insignificant and occupy less percentage will not be important and need not be sown on the land.

Rafiullah's maximum positive deviation method gives the critical crop combination with the help of formula given below:

$$D = \frac{[D^2P - D^2n]}{N^2}$$

Where,

- $D$ = deviation.
- $DP$ = Positive difference
- $Dn$ = Negative difference from the median value of the theoretical curve value of the combination.
- $N$ = Number of crops in the combination.

In the present work, Rafiullah’s method has been adopted. The changes in number of crops in the combination, has been given in Table 6.5.

Maximum positive deviation method by Rafiullah is applied for crop combination in the region of Solapur district and the resultant crop combination regions are show in Fig. 6.13.

There are four combinations out of eleven tahsils, six tahsils recorded two crop combinations and these are Barshi, Madha, Malshiras, Pandharapur, South Solapur and Akkalkot. In the remaining tehsils monoculture is observed; there are namely Karmala, Mohol, North Solapur, Sangola and Mangalvedha.
Table 6.5
Changes in crop combination in Solapur District (1980-2001)

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Tahsils</th>
<th>Rafiullah’s method (crop combination)</th>
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<td>1980-81</td>
</tr>
<tr>
<td>1.</td>
<td>Karmala</td>
<td>1</td>
</tr>
<tr>
<td>2.</td>
<td>Barshi</td>
<td>2</td>
</tr>
<tr>
<td>3.</td>
<td>Madha</td>
<td>2</td>
</tr>
<tr>
<td>4.</td>
<td>Malshiras</td>
<td>2</td>
</tr>
<tr>
<td>5.</td>
<td>Pandharpur</td>
<td>2</td>
</tr>
<tr>
<td>6.</td>
<td>Mohol</td>
<td>1</td>
</tr>
<tr>
<td>7.</td>
<td>North Solapur</td>
<td>1</td>
</tr>
<tr>
<td>8.</td>
<td>South Solapur</td>
<td>2</td>
</tr>
<tr>
<td>9.</td>
<td>Sangola</td>
<td>1</td>
</tr>
<tr>
<td>10.</td>
<td>Mangalvedha</td>
<td>1</td>
</tr>
<tr>
<td>11.</td>
<td>Akkalkot</td>
<td>2</td>
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</table>

Source: Socio-economic abstract of Solapur district

Changes in the crop combinations regions resultant from Rafiullah’s method during the period under study show some significant changes occurred in Karmala, and Sangola from monoculture to three crops, where as Madha tahsil changes from two crops to three crops combination. But Mohol, North Solapur and Mangalvedha tahsils do not show any change during the test two decades.
SOLAPUR DISTRICT

Crop Combination (Rafullah Method) (1980-81)

Abbreviations
C - Cereals
S - Sugarcane
P - Pulses
O - Other Crops

(2000-01)

Percentage Increase
- COS
- CO
- CP
- S
- O
- C

Figure 6.13
Table 6.6
Crop combination Regions by Rafiullah Method (1980-81)

<table>
<thead>
<tr>
<th>Tahsils</th>
<th>Cereals</th>
<th>Pulses</th>
<th>Sugarcane</th>
<th>Others Crops</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(Tahsil)</td>
<td>(Percent)</td>
<td>(Percent)</td>
<td>(Percent)</td>
<td></td>
</tr>
<tr>
<td>Kamala</td>
<td>89532</td>
<td>7085 (6.1)</td>
<td>406 (0.4)</td>
<td>18231 (15.8)</td>
<td>Mono crop</td>
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<tr>
<td></td>
<td>(77.7)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Madha</td>
<td>70376</td>
<td>10587 (9.8)</td>
<td>833 (0.8)</td>
<td>26552 (24.5)</td>
<td>2 crop</td>
</tr>
<tr>
<td></td>
<td>(64.9)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Barshi</td>
<td>92536</td>
<td>27009 (20.6)</td>
<td>661 (0.5)</td>
<td>10749 (8.2)</td>
<td>2 crop</td>
</tr>
<tr>
<td></td>
<td>(70.7)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>North Solapur</td>
<td>38207</td>
<td>6961 (13.8)</td>
<td>379 (0.7)</td>
<td>5053 (10)</td>
<td>1 crop</td>
</tr>
<tr>
<td></td>
<td>(75.5)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mohol</td>
<td>77020</td>
<td>9085 (9.4)</td>
<td>613 (0.6)</td>
<td>9575 (9.9)</td>
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</tr>
<tr>
<td></td>
<td>(80)</td>
<td></td>
<td></td>
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<tr>
<td>Pandharpur</td>
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<td>14670 (15.9)</td>
<td>2324 (2.5)</td>
<td>10057 (10.9)</td>
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<tr>
<td></td>
<td>(70.7)</td>
<td></td>
<td></td>
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<tr>
<td>Malshiras</td>
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<td>12359 (13.5)</td>
<td>10141 (11.1)</td>
<td>9075 (9.9)</td>
<td>2 crop</td>
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<tr>
<td></td>
<td>(65.4)</td>
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<tr>
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<td>924 (0.8)</td>
<td>14453 (12.8)</td>
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<tr>
<td></td>
<td>(78.8)</td>
<td></td>
<td></td>
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<tr>
<td>Mangalvedha</td>
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<td>10644 (13.2)</td>
<td>368 (0.5)</td>
<td>6737 (8.36)</td>
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<tr>
<td></td>
<td>(78)</td>
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<tr>
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<td>16144 (14.4)</td>
<td>653 (0.7)</td>
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<td>Akkalkot</td>
<td>78843</td>
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<td>1001 (0.8)</td>
<td>23493 (19.7)</td>
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<td>Total</td>
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<td><strong>18303</strong></td>
<td><strong>15686</strong></td>
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### Table 6.7

**Crop combination Regions by Rafiullah method (2000-01)**

<table>
<thead>
<tr>
<th>Tahsils</th>
<th>Cereals</th>
<th>Pulses</th>
<th>Sugarcane</th>
<th>Others Crops</th>
<th>Result</th>
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<tbody>
<tr>
<td>Kamala</td>
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<td>3130</td>
<td>3850</td>
<td>6999</td>
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<td>3850</td>
<td>980</td>
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<td>3240</td>
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<td>(32.9)</td>
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<td><strong>(5.2)</strong></td>
<td><strong>(28.1)</strong></td>
<td><strong>(27.6)</strong></td>
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