CHAPTER VII

AGRICULTURAL REGIONALIZATION

After unfolding the agricultural landuse pattern in earlier chapter an attempt has been made to spot light the spatial distribution of various crops, their growth and response to physio-socio-economic conditions prevalent in the region. The cultivation of crops and their growth are closely related to the decision making process on one hand and adaptation of innovation in agriculture. The selection of crops for sowing in the field, present composite picture of cultivation of crops in the region. The hectarage under individual crop gives relative strength and realistic picture of cropland use in the analysis of crop ranking of the region. The ranks of crops and their combination provide spatial variation in the distribution patterns.

In this respect the study of crop combinations and diversification’s manifest the present agricultural scenario.

Region is one of the basic concepts of geography. It has been defined differently by different geographers. A widely accepted definition of region is “an area that is differentiated from other areas according to the specific criteria.” It has also been defined as “a differentiated segment of the earth surface” (Whittlesey, 1929).

Study of spatial variations in the distribution of various phenomenae which forms the core of geographic studies leads to the identification and explanation of occurrences of phenomenae over the earth’s surface. The occurrences which have some similarities can be grouped together and thus, a region which has some similarities and which is distinguished in some respect from the surrounding area is delimited. Geographers still have remained concerned with the ideas
of region and are using regional methods of investigation. Various types of regions are demarcated making use of selected variables. Delimitation of a region poses many a complex problem as it is difficult to incorporate all the relevant variables in the process of delimitation. The regions based upon only one variable are defined as single feature regions while multiple-feature regions take into account a number of variables (Datye, 1984).

Geographers identify region based on physical and cultural characteristics. The landform regions, climatic regions, pedological regions and biotic regions are some of the examples of physical regions, while population regions, linguistic regions, industrial regions, agricultural regions and trade and commerce regions are the examples of cultural regions. The main techniques used for the delineation of agricultural regions have also been examined (M. Husain, 1996).

Agricultural regionalization has attracted the attention of many scholars in the field of agricultural geography. Geographers have been interested in the overall agricultural region, although they by no means completely agree on its definition or the importance of its study in agricultural geography. Agricultural geographers have commonly used the physical and cultural attributes to define agricultural region.

Engelbrecht (1883) constructed individual distribution maps of major crops and animals for the U.S.A. and later in 1930 for other countries. Finally, he summarized his findings in his world map of “agricultural zones” (Landbauzonen). Multiple-feature regions then attracted many a geographers. Instead of emphasizing one factor, a number of variables were considered in combination to demarcate complex multi-factor regions. All these efforts can be grouped in
four categories viz., land capability regions, field system regions, farming system regions and functional regions (Gregor, 1970).

Buchanan (1959) thinks that the definition must be in agricultural terms – a crop, a crop association, a crop and livestock association, a system of organization of farm processes etc. Further, it was “usually determined principally by climatic conditions. Subdivisions of the region were the results of differences in land reliefs, or in slope and in soils”, which might cause variations in the proportion of land used for crops, pasture or forest, or in the relative importance of the crops. Economic principles were important also, but only in the capacity to “strengthen the influence of the physical factors to join with them in determining the boundaries of the region.” Whittlesey (1939) and Hartshorne and Dicken (1935) have emphasized the economic factors like operational structures of the farm rather than crop. Hartshorne and Dicken classified the agricultural regions of N. America and Europe using statistics for the measurement. Besides the physical and economic aspects, a cultural concept of the agricultural regions was espoused by Waibel (1933), Cholley (1946), and Carol (1952). Waibel viewed the agricultural and economic forces stressing the entire range of human forces as they are reflected in number and distribution over the earth surface and in social, economic, cultural and above all intellectual differentiation.

The worldwide classification of agricultural systems was worked out by Whittlesey (1936) and Hahn (1892). Based on a combination of various economic forces, Whittlesey identifies thirteen major regions. Hahn stressed more the cultural outlook in his six regions or economic forms. A third worldwide classification is based upon Bakers (1926-33) approach, but only in full detail for the U.S.A. and Canada.
In the late 1930’s British geographers used statistical data for delimitation of agricultural regions. Agricultural Atlas of England and Wales used parish statistics which has several limitations. The quantitative revolution induced geographers to apply different quantitative methods in the analysis of data. At the same time, introduction of the digital computers enabled geographers to handle a large volume of data. Making use of these facilities in the delimitation of crop association regions of the Middle-west of the U.S. Weaver (1954) used the standard deviation to measure the deviation of actual occurrences against the theoretical curve. The Weaver approach to determining multifactor crop combination regions can be regarded as a vital step forward in the integration of a number of variables for regional delimitation, Thomas (1963), modified the Weaver approach, making use of all the data available for the calculation of variance for each crop combination. Coppock (1964) extended the Weaver method to the whole spectrum of agricultural activity by converting livestock and crop production to common units and differentiating between various intensities of production by weighting in England and Wales. Johnson (1958) used simple scale of gradation based on averages, for identification of crop association regions of East Pakistan.

In the last four decades, Indian geographers have been applying quantitative techniques to study the crop association regions. Indian geographers have delimited agricultural regions based upon techniques like crop-association, cropping pattern, crop concentration, crop diversification and agricultural efficiency. Most of these works are the modifications and applications of the ideas of Weaver, Kendall (1939), Pownall (1953), Nelson (1965), Doi (1957) and others. Other techniques introduced by scholars like Rao (1954), Rafiullah (1956), Shafi (1960), Bhatia (1960, 1964, 1965),

I. Crop Association Regions:

Approach and methods of agricultural regionalization have been discussed earlier. This enables one to choose the most appropriate method for the present study of crop associations with respect to the available agriculture data for district. The data available are collected for three different levels of administrative units viz., village, tahsil and district. Data regarding the areal strength of crops for a village have to be collected from different tahsil headquarters. An ideal plan for agriculture regionalization should cover the entire agricultural activity in the study area, but the agriculture region has been reduced here to the level of crop association region. Therefore an attempt is made to delimit the crop association regions in the study area in four stages as follows:

i) To present areal strength of the crops grown in the region by ranking and interpret the factors responsible for this rank distribution.

ii) Identification of crop combination regions applying Doi’s method.

iii) To delineate the patterns of crops combination of the Thane District by applying Doi’s method and plot it in a regions of crop combination.
iv) To identify the crop diversification patterns of the study region by applying Bhatia’s method of crops diversification and find out the variables responsible for such patterns in the area under study.

The purpose of the study is to evaluate the influence of certain physical environmental and cultural factors on the spatial variation in agricultural landuse. In view of this, physical regions representing different rainfall, soil and relief features were defined in earlier chapter.

CROP RANKING

1. **Arbitrary Choice Method**

The relative strength of individual crop could be assessed from the actual share of total harvested land that a crop occupies. This is the most elementary method for studying crop associations but it helps one to understand the overall spatial pattern of crop distribution. The crop areas could be arranged into descending order of magnitude and termed first, second, third, fourth, fifth ranks. The rank grouping may be useful in identifying the major crop or crops in the study area.

The first six crops have been identified and mapped. The ranking crops and number of village are shown in Table - 7.1-
Crops Ranking Frequency

<table>
<thead>
<tr>
<th>Sr. No</th>
<th>Crops</th>
<th>I</th>
<th>II</th>
<th>III</th>
<th>IV</th>
<th>V</th>
<th>VI</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Rice</td>
<td>651</td>
<td>777</td>
<td>67</td>
<td>21</td>
<td>01</td>
<td>-</td>
</tr>
<tr>
<td>2.</td>
<td>Hill millets</td>
<td>116</td>
<td>73</td>
<td>349</td>
<td>57</td>
<td>20</td>
<td>07</td>
</tr>
<tr>
<td>3.</td>
<td>Pulses</td>
<td>05</td>
<td>38</td>
<td>243</td>
<td>338</td>
<td>33</td>
<td>05</td>
</tr>
<tr>
<td>4.</td>
<td>Fruits</td>
<td>-</td>
<td>26</td>
<td>153</td>
<td>76</td>
<td>91</td>
<td>60</td>
</tr>
<tr>
<td></td>
<td>Vegetable</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td>Oilseeds</td>
<td>-</td>
<td>03</td>
<td>44</td>
<td>87</td>
<td>123</td>
<td>59</td>
</tr>
<tr>
<td>6.</td>
<td>Grass</td>
<td>754</td>
<td>585</td>
<td>-</td>
<td>14</td>
<td>10</td>
<td>06</td>
</tr>
</tbody>
</table>

Source: Compiled by Author

Table -7.1

Crop Rank Frequency

![Crop Rank Frequency](image)

Fig. 7.1
First Rank Crops:

Among the crops grown in the study area, rice, hill millets, and grass dominate the agricultural landscape. Rice occupies the western most part of the district in a north-south belt. It is the first rank crop in six hundred fifty one villages. Hill millets as a first rank crop appear in one hundred sixteen villages dominating the entire northeastern part of the district. Rice is associated with coastal alluvial soil and some pockets are in the eastern margin of the region.

Grass occupies a significant first rank position in seven hundred fifty four villages in the south and southeastern part and some patches in the western coastal belt of the district. Pulses are not as important as first rank crops and appear only in five villages. Oilseeds and fruits and vegetables do not occupy the significant first rank position anywhere in the district (Map - 7.1).
SECOND RANKING CROPS:

The second ranking crops present relatively large number of crops than those of first ranking. Map No. 7.2 reveals six crops ranked second. These six crops are rice, grass, hill millets, pulses, fruits vegetables and oilseeds. Table No. 7.1 displays second ranking crops, number of villages in the region.

Rice dominates the region and holds the second rank in seven hundred seventy six villages occupying wide-spread in size in the region. This crop is found in southeastern, central and some patches in northern parts of the region.

Grass ranks second in 585 villages in the region (Map No. 7.2). Rice is spread out in western parts and some patches in eastern tract. There exists a significant association between rice and hill millets (in the eastern part) and hill millets and pulses (in the northeastern part). In most of the villages, wherever rice occupies the first rank, grass is the second rank crop and vice versa. The same is true about rice and hill millets. Cash crops are important as second crop in the coastal irrigation areas and in almost all cases they are associated with irrigated area.

On the eastern margins of pulses (thirty eight villages) dominant regions as well as oilseeds (three villages) are important as a second rank crop. The entire map is dominated by rice, grass, hill millets and pulses combinations in the district.
THIRD RANKING:

It is evident from Map No. 7.3 - that third ranking crops are wide spread and patchy form in their areal distribution pattern. These ranking crops are also five in number. These five crops are namely, hill millets, pulses, fruits and vegetables, rice and oilseeds. Among these crops hill millets, pulses, fruits and vegetables are the dominant crop in this rank group. Table No 7.1 displays the distribution of third ranking crops and villages in the region. It is seen from Map No-7.3 that hill millets occupies maximum area in 347 villages and holds third rank in the region, its areal extent
sprawls over the eastern and part in north-south direction, parallel to hill ranges and two pockets in central and northern part of the study region. Pulses are associated with rice and hill millets in the eastern heavy rainfall regions; with rice and with oilseeds in the southeastern part.

The fruits and vegetable rising villages concentrated in the part west and northwest, it is associated with coastal climate comprises in 153 villages. Fruits and Vegetables occupy dominant position in third ranking crops extended over western, northwest and central parts of the region. Oilseeds combine with pulses and hill millets grown in forty four villages in eastern and northeastern part of the district.

As third rank crops, hill millets, pulses, and cash crops replace rice and grass and dominate the entire district. Pulses and hill millets and pulses and oilseeds are closely associated either as second rank or as third rank crops.

Oilseeds are associated with rice and pulses in the eastern heavy rainfall regions; with rice and pulses in the transitional zone; and with hill millets and pulses in the eastern tracts. Cash crops appear in combination with rice and grass in the western zone and with grass and either pulses or oilseeds in the eastern parts. Cash crops are absent in the eastern regions. Pulses appear with rice and hill millets in the central part; with rice and either grass or cash crops in the western zone; and with rice and oilseeds in the central parts.
FOURTH RANKING CROPS:

Fourth ranking crops are distributed in many villages. There are five crops namely, pulses, oilseeds, fruits and vegetables and hill millets. Pulses hold largest coverage among fourth ranking crops in the region. It is cultivated in northeast, central and northern part in 329 villages in the area under study. Oilseeds ranking fourth and is confined to 87 villages in the western part and some pocket form in northeast. Most of the fruits and vegetables growing villages in fourth rank are dispersed throughout the region. Hill millet growing villages are spread in three pockets in the southeast, central and northwest part of the district.
FIFTH RANKING CROPS:

Three crops presents in fifth ranking the crops namely, oilseeds, fruits and vegetables and pulses (Map - 7.5 and Table 7.1). Oilseed holds largest coverage in one hundred twenty three villages among fifth ranking crops in the district. It is cultivated in northeastern and eastern part.

Fruits and vegetables are found in northeast part in fifth ranking covering in ninety one villages. Pulses grown in thirty three villages in the fifth rank. Pulses growing pockets are dispersed in the eastern part of the area under study. Shallow coarse soils and foot
The hills region has grown pulses and some other patches in the northwest and central part.

**CROP COMBINATION:**

Agricultural practices and typology are best represented by crops in any region. The principal crops tend to concentrate according to their requirement of physical environment. A single crop like rice can dominate a region and also occurs as a monoculture in three villages. Cropping pattern or crop combinations become essential. Crops combination can be identified by taking recourse to ranking. Ranking leads to determine few dominant crops, but at the same time ignoring others in any given region. These crops which have low ranks. Though there are
various methods to determine cropping patterns, in the present study K.Doi’s method has been used.

K.Doi’s Method

The method is a derivative of Weavers method of crop combination region. By taking recourse to all table which gives critical values for different combinations, it is possible to identify crop combinations percentage of different crops to net sown area are calculated and the combinations decided as per the table after due correction. The results according to Doi’s method are more realistic is in comparison to other methods. They are equally suitable in regions of high specialization, as well as in the region of no marked variations. In the present study Doi’s method is applied to villages which constitute the study region.

Five crop combinations have been identified for district. (Map - 7.6).

**Monoculture:**

These are the regions where only one crop is dominant to the extent to enable us to define then as monoculture areas. Rice appears to be the only important crops in twenty nine villages.

**Two crop combination:**

Rice, hill millets, pulses, grass, fruits and vegetables appear in various combinations with each other. Rice and hill millets are combined to form either pulses or grass combinations. Rice- hill millets combination occurs in the eastern and north east zone. While rice and Fruits and vegetables are associated in the irrigated tracts. Rice and pulses are in the combination eastern and south east part. Rice - grass combination occurs in the western coastal plain in five hundred fifty three villages.
Three Crop Combination:

There are three hundred thirty one villages in three crop combination in the region. Five crops enter in this combination are namely, Rice, hill millets and pluses in twenty four villages. Grass, rice, fruits and vegetables occurs in one hundred fourteen villages. Grass, rice, fruits and vegetables combination appears in western part in patchy form of the study area. Map -7.6 and Table -7.2 shows the crops in order. Rice, Grass and Vegetables combination is found in twelve villages. Three crop combination of rice grass and pulses observed in hundred villages in central and northwest and southeast part of the region.

Four crop combination:

Three hundred twenty four villages have been included into this category of combination in the eastern zone, two- three patches in the northern and central part. Combinations are of rice, hill millets, pulses and oilseeds in fifty four villages in the eastern part of study region. Another high magnitude of combination in this group namely, grass, rice, hill millets and pulses in one hundred forty nine villages lies southeast, central and northwest part of the district.

Five Crop combination:

Two hundred eighty six villages in the southeast and in the form of patches in the central zone have been classified as five crop combination regions. All the crops appear in the combination e.g. rice, grass, hill millets, pulses, fruits and vegetables in forty one villages. The combination of hill millets, pulses, oilseeds, rice and grass observed at southeast part and some patches along the eastern margin of the district.

The crop combination regions reveal the importance of various crops in combination. The spatial variation in the number of
crops in combination reflects their association with the physico-economic attributes. Monoculture is practiced in the western coastal plain with rice. The transitional zone of eastern margin exhibits a number of combinations. Here the agricultural landscape is not dominated by a single crop, instead, a variety of crops are grown. On the western side of the mountainous region, monoculture in the west and east is replaced by two crop combination. The generalized pattern of crop combination as one goes from west to east would be monocultures – two crop combination – three, four, five crop combinations Monoculture in the west and central part indicates the dependence on one crop. In the transitional zone a farmer has relatively more choice of crops.

### Crop Combination in Thane District

<table>
<thead>
<tr>
<th>Combination Types</th>
<th>Crops in Combination</th>
<th>Number of Village involved</th>
<th>Percentage Total Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monoculture</td>
<td>Rice</td>
<td>29</td>
<td>1.78</td>
</tr>
<tr>
<td>Two Crop-combination</td>
<td>Grass/Rice/ Hill millets/Pulses/fruit and vegetables</td>
<td>571</td>
<td>34.99</td>
</tr>
<tr>
<td>Three Crop-combination</td>
<td>Rice/Grass /Fruits/Pulses/hill millets/</td>
<td>331</td>
<td>20.28</td>
</tr>
<tr>
<td>Four Crop-combination</td>
<td>Rice/Grass/fruits and Vegetable/Pulses/hill millets/</td>
<td>324</td>
<td>19.85</td>
</tr>
<tr>
<td>Five Crop-combination</td>
<td>Rice/Grass/ Fruits and Vegetable /Pulses/hill millets/Oilseeds</td>
<td>286</td>
<td>17.52</td>
</tr>
</tbody>
</table>

Source: Compiled by Author

Table -7.2
### Combination Types and Crops in Combination

<table>
<thead>
<tr>
<th>Combination Types</th>
<th>Crops in Combination</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monoculture</td>
<td>Rice</td>
</tr>
<tr>
<td>Two Crop-combination</td>
<td>Grass/Rice/ Hill millets/Pulses/ fruits and vegetables</td>
</tr>
<tr>
<td>Three Crop-combination</td>
<td>Rice/Grass /Fruits and vegetables/ Pulses/hill millets</td>
</tr>
<tr>
<td>Four Crop-combination</td>
<td>Rice/Grass/fruits and Vegetable/Pulses/hill millets</td>
</tr>
<tr>
<td>Five Crop-combination</td>
<td>Rice/Grass/ Fruits and Vegetable / Pulses/ hill millets/ Oilseeds</td>
</tr>
</tbody>
</table>
CROP DIVERSIFICATION:

The Crop – diversification technique is applied to compute crop diversification pattern of the region. Its meaning is of raise variety of crops on arable land. It reflects the impact of physio –socio-variables. Moreover, it shows the contemporary competition among crops for an area, scope for rotation, the effect on double cropping, (Hussain, 1979). The greater number of crops led to greater competition, the higher is the magnitude of diversification.

Many geographers and economists so far have applied the concept of diversification in variety of sense. This concept, initially, was applied in the field of manufacturing to identity the degree of diversification and concentration by Clean (1930) later on by Tree (1938), Florence (1942) and Rainwald (1949). Gibb Martin (1974) has used diversification concept in computing measurement of diversification of employment in industry. Among geographers, Bhatia (1965) adopted and introduced crops diversification technique in order to understand crop competition in the region followed by Jasbir Singh (1976). Ayyer (1969) modified Bhatias method of crop diversification with accounting for that crop which occupy at least one per cent of the gross cropped area. (Dr. B. C. Vaidya, Agriculture land use in India).

Crop Diversification Technique:

In order to identify spatial pattern of crop diversification in present study. Bhatias method has been adopted in modified form. The crop having five or less than five percentage have been excluded from computation. This modification formula expresses as.
The obtained results have been displayed in Table -7.3 and Map-7.7 shows crops in number villages and area in crop diversification in the Thane district. Plate No-7.8 shows the area distribution pattern of crop diversification in the region. Maximum crop diversification appears in eastern part and lowest at southern and northern parts in the region.

It is seen from the above Exhibit that four crop – diversification region have been identified as:

1) Area of high crop diversification
2) Area of Moderate diversification
3) Area of low diversification and
4) Area of very low diversification

The four categories of crop diversification its class magnitude village and area as shown in Table No- 7.3. It is observed from this table that the largest area appears in the moderate crop diversification class covering 35 percent area in the region.
**Crop Diversification**

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Class of Crop Diversification</th>
<th>Magnitude of Crop Diversification</th>
<th>No of Village</th>
<th>Area Involved (Ha.)</th>
<th>Percent of Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0-10 High</td>
<td></td>
<td>416</td>
<td>239096</td>
<td>25.49</td>
</tr>
<tr>
<td>2</td>
<td>10-20 Moderate</td>
<td></td>
<td>586</td>
<td>336835</td>
<td>35.91</td>
</tr>
<tr>
<td>3</td>
<td>20-30 Low</td>
<td></td>
<td>311</td>
<td>178782</td>
<td>19.06</td>
</tr>
<tr>
<td>4</td>
<td>Above 30 Very Low</td>
<td></td>
<td>270</td>
<td>154582</td>
<td>16.48</td>
</tr>
</tbody>
</table>

Source: Compiled by Author

**Table -7.3**

**AREA OF HIGH DIVERSIFICATION:**

It is visible from Map - 7.7 that the area of high diversification appears in eastern part and some pockets in central part stretching south to north and northwest villages. The largest numbers of crops are found in high degree of diversification. There are six major crops, namely rice, grass, hill millets, fruits and vegetable, pulses and oilseeds enter in this diversification. High crop diversification observed in 416 villages covering 239096 hectares (25.49 per cent to total area) in the region. The eastern margin of the region is end to the hill range and foot hill villages have uncertain and lack of irrigation facilities, shallow soil of upland dose not give high yield per hectare. Hence high diversification of crops is obvious in this part of the region. In the central pockets also found high diversification rice grown is kharif season and some plantation crops through out the year. After kharif season the land may utilize for raising vegetables with the availability of irrigation by well.
AREA OF MODERATE DIVERSIFICATION:

The area of moderate diversification covers 336835 hectares (35.91 per cent to total area) in the area under study. The area of crop diversification appears along the eastern margin and in some pocket forms at northern, central and southern parts in the region. The major pockets are found along the coastal alluvial tracts (Map No. 7.7) where moderate diversification is observed, some patches are found in the southeast part. The crops in moderate diversification are rice, grass, hill millets, fruits and vegetables, pulses and oilseeds. These crops are raise on fertile coastal alluvial to shallow coarse soils in the region. The coastal tracts given high yield per hectare in coastal alluvial plain.

Five hundred eighty six villages appeared in the moderate diversification, southern part in the region identifies a small patches of moderate crop diversification on coastal alluvial tract, where rainfall ranging between 1500 mm to 2000mms. Major pockets of moderate crop diversification appears in the central and southern part in the alluvial to shallow course soil in the region.

AREA OF LOW CROP DIVERSIFICATION:

The area of low crop diversification covers 178782 hectares (19.06 per cent to total area) in the area under study (Map -7.7 and Table-7.3). Low crop diversification region appears disintegrated in patches in the south, central and north part of the region. The largest patch of this category is observed western coastal region.

Three hundred eleven villages appeared in this category of crop diversification. Rice Grass, Pulses, Fruits and Vegetables enter in this diversification. It appears western margins of the area under study.
AREA OF VERY LOW CROP DIVERSIFICATION:

This category covers 154582 hectare (16.48 percent to total area) under very low crop diversification in the region. The area of crop diversification appears in some patches in the north, south, central and some dispersed patches in the western coastal plain of Thane district.

Two hundred seventy villages appeared in this category of crop diversification in the area under study (Map - 7.7 and Table - 7.3) Rice and Grass are the major crops grown in alluvial soil to shallow coarse soils in the region.

Map- 7.7
RESUME:

To attempt an exposition of agriculture landuse pattern in the region the village has been taken unit for study to throw light on crop combination and diversification. The area strength of individual crop has been discussed by ranking. This falls into five descending order. Grass stands as first in ranking while rice in second ranking crops. Rice ranking in the first in six hundred fifty one villages, consequently occupying the predominant position within the region. Grass has been observed in first ranking in seven hundred fifty four villages. Other crops such as hill millets, pulses, fruits and vegetables have been ranking below rice and grass in the descending order.

The application of Doi’s method shows the realistic picture of crop combination in the region. It has been observed that two and three crop combination cover the largest areal extent in combination. Out of seven crops in total six crops namely, rice, hill millets, grass, fruits and vegetable and pulses enter in the three crop combination in 571 villages on (34.99 per cent to total area in the region). followed by this two crop combination three crop combination enter in three hundred thirty one villages on 20.28 per cent to total area in the region) Other crop combination are also significance in the region. The crops of four and five are covering the area of 19.85 and 17.52 percent to total area. Crops namely rice, grass, hill millets, pulses, fruits and vegetables are in combination.

In order to understand the competition among crops in the region the crop diversification has been computed by applying Bhatia’s formula. According to Bhatia’s method four crop diversification categories have been revealed in the region. The
result of crop diversification establishes relationship with physio–socio-economic conditions. The largest area covers with moderate crop diversification in 586 villages on 35.91 per cent followed by high crop diversification in four hundred sixteen villages on 239096 hectares (25.49 per cent) The high diversification is observed on eastern side and some patches spread west wards. The moderate crop diversification is found on extensive pockets in the study region, where crops namely rice, grass, vegetables, fruits, pulses and hill millets are grown in this diversification. Whereas the low diversification crops observed in three hundred eleven villages on 178782 hectares (19.06 percent) very low crop diversification covers 154582 hectares (16.48 per cent) observed in two hundred seventy villages.