Chapter – VII

CROPPING PATTERN

7.0 Introduction

The cropping pattern is based on both time and space sequence of crops. The variety in cropping pattern is the result of physical, economical and social factors. The physical environment provides a wide range of possibilities for growing crops but the economical and social conditions determine as to which the crops to be grown are and how much of it is to be devoted to different crops. Also, social and cultural values strongly influence on the cropping pattern especially in the countries where agriculture is a way of life.¹ Agricultural regions reflects the existing situation when compared with natural regionalization and in the light of demands and development trends can greatly help in delimitation of regions of anticipated production recommended for the futures.² The farming communities have developed their own techniques and traditions which affect the growing of crops. These crops are not always being grown where they are best adapted to nor where they can be grown most economically.³

With limited resources of land and water in our hand, their optimum use is a must for increased production of food grains to the demands of increasing population. The productivity in any area can be substantially raised by growing the crops suitable to the area with the help of new developed agricultural district, rainfed crops will continue to dominate in the agriculture of Koppal district. The selection of crops is very important in agro-climatic condition of district under the
study. Agricultural regions are used as a basis for planning and have been advocated as a suitable device for planning and improvements in underdeveloped countries. But the problem of defining agricultural regions is essentially one of recognizing what exists and eliminating the distinctive areas.

All correlates of cropping pattern are of a dynamic nature. Except the physical elements take a comparatively longer time to change their determinants belonging to the economic traits change very fast. The crop culture is very intensive in the area, though the types of agricultural produce happen to vary under the local conditions. The physiographic units of the area play a vital role for practicing almost all crops with certain concentration and diversification. The cropping pattern of the area is typical of an underdeveloped agricultural economy in which most of the cultivated area is devoted to subsistence food crops, mainly for local consumption and immediate market needs.

Technological advancement such as irrigation, soil and water conservation, adoption of high yielding variety of seeds, use of chemical fertilizers and pesticides, improvement in the means of transportation, marketing and storage facilities, price incentives and above all the change in mental attitude of farmers, the policy makers, the researcher and politicians have brought a tremendous change in cropping pattern. Considering above all factors the researcher has viewed the study area and concludes that a similar situation is prevailing in Koppal district. Therefore in this sub-section, parameters
dealing with ranking of crops, crop combination, crop concentration, cropping intensity and crop diversification are included.

7.1 Ranking of Crops

The percentage area under each crop was ascertained simply by ranking them for each taluka in order to have percentage of the total net sown area occupied by each crop. Ranking of crops gives an insight into the geographical reality of cropping pattern. Moreover ranking of crops helps in knowing the crops which compete with each other to gain more hectarage under cultivation. After assessing the relative strength of different crops in a geographical unit with the process of planning can be initiated more rationally for the optimum use of available for cultivation. A judicious use of land with adequate inputs in fact can help in raising the agricultural production even in the less fertile soil. Thus the study is useful in reducing the interregional disparities in the agricultural income and economy. Unless the major crops of the districts are studied in their ranking order and the areal strength of each crop is determined an appropriate association of soil and soil enriching crops for each situation cannot be ascertained.

Ranking Method

Ranking method can be studied by descriptive and quantitative ways to delineate the ranking of individual crops according to their areas of importance in each component unit. The crop with the larger percentage share of the net sown area forms the first ranking crop and the crop with the next largest share becomes the second ranking crop.
Table-7.1
Koppal District
Talukawise Ranking of Crops 1999-2000 and 2010-2011

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Name of the Talukas</th>
<th>Ranks 1999-2000</th>
<th>Ranks 2010-2011</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>1   2   3   4 5 6 7 8 9 10 11 12</td>
<td>1   2   3   4 5 6 7 8 9 10 11 12</td>
</tr>
<tr>
<td>1</td>
<td>Gangavati</td>
<td>P    J   B   GN OP C  BG T  SC MM W M</td>
<td>P    J   GN B  BG M  OP T  C MM SC W</td>
</tr>
<tr>
<td>3</td>
<td>Kushtagi</td>
<td>B    J   GN OP T  W  BG M  C  MM P Nil</td>
<td>B    J   GN OP BG M  T  C W MM P Nil</td>
</tr>
<tr>
<td>4</td>
<td>Yelburga</td>
<td>J    GN B  C  OP W  BG T  M  MM P Nil</td>
<td>J    BG GN B  M  C  OP W  T MM P SC</td>
</tr>
</tbody>
</table>

Similarly calculations have been made upto 1\textsuperscript{st} to 12\textsuperscript{th} ranking crops and the resultant patterns have been plotted in figure 7.1 for the year 1999-2000 and 2010-11. (Table 7.1 & Fig.7.1)

**First Ranking Crops**

Jowar is the most dominant crop in the district during 1999-2000, there were four crops i.e., Paddy, Groundnut, Bajra and Jowar which computed as first ranking crops in the study region. Paddy was cultivated as first ranking crop in Gangavati taluka, the Groundnut were grown in Koppal, the Bajra was grown in Kushtagi and Jowar was grown in Yelburga talukas respectively.

During 2010-11, Paddy, Maize, Bajra and Jowar were cultivated first ranking crops in the district. Gangavati, Yelburga and Kushtagi talukas are continued same crops cultivation except Koppal taluka. The Maize was grown only in Koppal taluka. The comparative ranking position of two periods shows that almost all the talukas have no change, there is only one single crop changed in Koppal taluka i.e., Maize from 1999-2000 to 2010-11 due to increased irrigation facilities.

**Second Ranking Crops**

Jowar and Groundnut were cultivated as second ranking crops in the study region during 1999-2000. Whereas only three crops viz. Jowar, Bajra and Bengal gram are cultivated as second ranking crops during 2010-11. During 1999-2000 Jowar was grown in three talukas namely Gangavati, Koppal and Kushtagi. Similarly Groundnut was grown in only one taluka i.e., Yelburga. In the year 2010-11, Jowar was
Fig. 7.1 Ranking of Crops

KOPPAL DISTRICT
FIRST RANKING CROPS – 1999-2000

INDEX
- Paddy
- Bajra
- Groundnut
- Other Pulses
- Cotton
- Minor Millets
- Other Crops
- Bengal Gram
- Jowar

KOPPAL DISTRICT
FIRST RANKING CROPS – 2010-11

INDEX
- Paddy
- Bajra
- Sugarcane
- Minor Millets
- Other Crops
- Bengal Gram
- Jowar

KOPPAL DISTRICT
SECOND RANKING CROPS – 1999-2000

INDEX
- Paddy
- Bajra
- Groundnut
- Other Pulses
- Cotton
- Minor Millets
- Other Crops
- Bengal Gram
- Jowar

KOPPAL DISTRICT
SECOND RANKING CROPS – 2010-11

INDEX
- Paddy
- Bajra
- Sugarcane
- Minor Millets
- Other Crops
- Bengal Gram
- Jowar

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cultivated in two talukas i.e., Gangavati and Kushtagi, Bajra and Bengal gram were grown in Koppal and Yelburga talukas respectively.

The comparative picture of second ranking crops shows that Jowar only is continued as second ranking crop in Gangavati and Kushtagi talukas, the dominance of Jowar as a staple food crop of the study region may be contributed more to the high population pressure necessitating self sufficiency in food grains as well as its favourable environmental conditions like less or moderate rainfall, red and black soil might have most suited for Jowar cultivation in the district.

**Third Ranking Crops**

Bajra was grown as third ranking crop in three talukas i.e., Gangavati, Koppal and Yelburga during 1999-2000 and the Groundnut was cultivated in both the study periods in Kushtagi taluka. The change from 1999-2000 to 2010-2011 shows that Groundnut is replaced by Bajra in three talukas i.e., Gangavati, Koppal and Yelburga. Groundnut was cultivated in Kushtagi taluka during both the study periods. Two crops have been grown in the study region as third ranking crops during both study periods, the favourable climatic conditions, rainfall and soil conditions might have boosted to grow these two crops as third ranking crops.

**Fourth Ranking Crops**

Other Pulses are cultivated as fourth ranking crops in two talukas viz., Koppal and Kushtagi and Groundnut in Gangavati taluka and Cotton were grown in Yelburga taluka during 1999-2000. Similarly, Bajra is replaced by Groundnut in Gangavati taluka, Bengal
Fig. 7.1 Contd…

**KOPPAL DISTRICT**

**THIRD RANKING CROPS – 1999-2000**

**INDEX**
- Paddy
- Bajra
- Groundnut
- Other Pulses
- Cotton
- Minor Millets
- Other Pulses
- Wheat
- Minor Millets
- Jowar

**KOPPAL DISTRICT**

**THIRD RANKING CROPS – 2010-11**

**INDEX**
- Paddy
- Bajra
- Groundnut
- Other Pulses
- Cotton
- Minor Millets
- Other Pulses
- Wheat
- Minor Millets
- Jowar

**KOPPAL DISTRICT**

**FOURTH RANKING CROPS – 1999-2000**

**INDEX**
- Paddy
- Bajra
- Groundnut
- Other Pulses
- Cotton
- Minor Millets
- Other Pulses
- Wheat
- Minor Millets
- Jowar

**KOPPAL DISTRICT**

**FOURTH RANKING CROPS – 2010-11**

**INDEX**
- Paddy
- Bajra
- Groundnut
- Other Pulses
- Cotton
- Minor Millets
- Other Pulses
- Wheat
- Minor Millets
- Jowar
gram is replaced by other pulses in Koppal taluka. Again Bajra is replaced by Cotton during 2010-11 in Yelburga taluka and the same crop is replaced in both the study periods in Kushtagi taluka.

**Fifth Ranking Crops**

The number of crops cultivated as fifth ranking crops are three during both the study period. Other pulses cultivated in two talukas i.e., Gangavati and Koppal. Paddy is grown in Koppal taluka and Tur was grown in Kushtagi taluka during 1999-2000. Bengal gram is cultivated in two talukas i.e., Gangavati and Kushtagi. Jowar is grown in Koppal taluka and Maize was grown in Yelburga taluka during 2010-11.

The change from 1999-2000 to 2010-11 shows that Bengal gram is replaced by other Pulses in Gangavati taluka and by Tur in Kushtagi taluka, Jowar is replaced by Paddy in Koppal taluka and Maize is replaced by other Pulses in Yelburga taluka.

**Sixth Ranking Crops**

Cotton is growing as sixth ranking crop in two talukas viz. Gangavati and Koppal during 1999-2000 and Wheat is cultivated in Kushtagi and Yelburga talukas during the same period. The number of crops cultivated as sixth ranking crops are two during 1999-2000 and three during 2010-11. Similarly, Maize is grown in Gangavati and Kushtagi talukas, other Pulses in Koppal taluka and Cotton in Yelburga taluka during 2010-11.
Fig. 7.1 Contd…

KOPPAL DISTRICT
FIFTH RANKING CROPS – 1999-2000

INDEX
- Paddy
- Bajra
- Groundnut
- Other Pulses
- Cotton
- Minor Millets
- Bengal Gram
- Jowar
- Sugarcane
- Wheat
- Groundnut
- Minor Millets
- Bengal Gram
- Jowar

KOPPAL DISTRICT
FIFTH RANKING CROPS – 2010-11

INDEX
- Paddy
- Bajra
- Groundnut
- Other Pulses
- Cotton
- Minor Millets
- Bengal Gram
- Jowar
- Sugarcane
- Wheat
- Groundnut
- Minor Millets
- Bengal Gram
- Jowar

KOPPAL DISTRICT
SIXTH RANKING CROPS – 1999-2000

INDEX
- Paddy
- Bajra
- Groundnut
- Other Pulses
- Cotton
- Minor Millets
- Bengal Gram
- Jowar
- Sugarcane
- Wheat
- Groundnut
- Minor Millets
- Bengal Gram
- Jowar

KOPPAL DISTRICT
SIXTH RANKING CROPS – 2010-11

INDEX
- Paddy
- Bajra
- Groundnut
- Other Pulses
- Cotton
- Minor Millets
- Bengal Gram
- Jowar
- Sugarcane
- Wheat
- Groundnut
- Minor Millets
- Bengal Gram
- Jowar
The change from 1999-2000 to 2010-11 shows that Cotton is replaced by Maize in Gangavati taluka and by other Pulses in Koppal taluka, Wheat is replaced by Maize in Kushtagi taluka and by Cotton in Yelburga taluka.

**Seventh Ranking Crops**

The number of crops cultivated as seventh ranking crops are two during 1999-2000, three during 2010-11. Maize is cultivated as seventh ranking crop in only one taluka i.e., Koppal taluka during 1999-2000, whereas, Bengal gram was grown as seventh ranking crops in Gangavati, Kushtagi and Yelburga talukas. Other Pulses crop has grown as seventh ranking crops in Gangavati and Yelburga talukas, Pulses crop is grown in Koppal taluka and Tur is cultivated in Kushtagi taluka during 2010-11.

The change from 1999-2000 to 2010-11 shows that, Bengal gram is replaced by other Pulses in Gangavati and Yelburga talukas, Tur in Kushtagi taluka and Maize is replaced by Pulses crop in Koppal taluka.

**Eighth Ranking Crops**

In this rank two crops were included during 1999-2000, whereas, in the year 2010-11 three crops are grown as eighth ranking crops in the study region. During 1999-2000, Tur was cultivated as eighth ranking crop in Gangavati, Koppal and Yelburga talukas. Maize is grown in only one taluka i.e., in Kushtagi. Similarly during 2010-11, Tur is continued in Gangavati taluka, Cotton is grown in Koppal and Kushtagi talukas and Wheat is grown in Yelburga taluka.
Fig. 7.1 Contd…

KOPPAL DISTRICT
SEVENTH RANKING CROPS – 1999-2000

KOPPAL DISTRICT
SEVENTH RANKING CROPS – 2010-11

KOPPAL DISTRICT
EIGHTH RANKING CROPS – 1999-2000

KOPPAL DISTRICT
EIGHTH RANKING CROPS – 2010-11
The change from 1999-2000 to 2010-11, indicate that, Tur is replaced by Cotton and Wheat in Koppal and Yelburga talukas respectively. Maize is replaced by Cotton in Kushtagi taluka but Tur is continued in Gangavati taluka during both periods.

**Ninth Ranking Crops**

In these rank four crops were included in the year 1999-2000, whereas, during 2010-11 three crops are grown as ninth ranking crops in the study region. During 1999-2000, Sugarcane is grown as ninth ranking crops in Gangavati taluka, Minor Millets in Koppal taluka, Cotton in Kushtagi taluka and Maize is cultivated in Yelburga taluka. Similarly during 2010-11, Cotton is grown in Ganagavati taluka, Tur is cultivated in two talukas namely Koppal and Yelburga and Wheat is grown in Kushtagi taluka.

The change from 1999-2000 to 2010-11 indicate that Sugarcane is replaced by Cotton in Gangavati taluka, Minor Millets was replaced by Tur in Koppal taluka, Cotton is replaced by Wheat in Kushtagi taluka and Maize is replaced by Tur in Yelburga taluka.

**Tenth Ranking Crops**

Minor Millets are grown as tenth ranking crops in three talukas namely Gangavati, Kushtagi and Yelburga during 1999-2000, and the same crops are continued in same three talukas during 2010-11. Two crops were grown as tenth ranking crops during 1999-2000 and 2010-11 in the district. Similarly, Wheat crop was grown in Koppal taluka during both the study periods. There are no any changes in tenth ranking crops during 1999-2000 and 2010-11.
KOPPAL DISTRICT
NINTH RANKING CROPS – 1999-2000

INDEX
Paddy
Sugarcane
Minor Millets
Other Pulses
Wheat
Vegetable
Bengal Gram

KOPPAL DISTRICT
NINTH RANKING CROPS – 2010-11

INDEX
Paddy
Sugarcane
Minor Millets
Other Pulses
Wheat
Vegetable
Bengal Gram

KOPPAL DISTRICT
TENTH RANKING CROPS – 1999-2000

INDEX
Paddy
Sugarcane
Minor Millets
Other Pulses
Wheat
Vegetable
Bengal Gram

KOPPAL DISTRICT
TENTH RANKING CROPS – 2010-11

INDEX
Paddy
Sugarcane
Minor Millets
Other Pulses
Wheat
Vegetable
Bengal Gram
**Eleventh Ranking Crops**

Wheat was grown as eleventh ranking crops in Gangavati taluka during 1999-2000, and it is replaced by Sugarcane during 2010-11. Three crops were grown as eleventh ranking crops during 1999-2000, whereas during 2010-11 two crops are grown as eleventh ranking crops in the study region. Bengal gram was grown in Koppal taluka, Pulses crops was grown in two talukas namely Kushtagi and Yelburga during 1999-2000. Sugarcane is grown in Koppal taluka and Pulses crops are grown in two talukas namely Kushtagi and Yelburga talukas during 2010-11.

The changes from 1999-2000 to 2010-11 shows that, Bengal gram is replaced by Sugarcane in Koppal taluka, Pulses crop is continued in Kushtagi and Yelburga talukas during both the study periods.

**Twelfth Ranking Crops**

The number of crops cultivated as twelfth ranking crops are two during 1999-2000 and three crops during 2010-11. Maize is grown in Gangavati taluka and Sugarcane is cultivated as twelfth ranking crops during 1999-2000. Similarly, Wheat is grown in Gangavati taluka, Minor Millets are cultivated in Koppal taluka and Sugarcane is cultivated in Yelburga taluka as twelfth ranking crops during 2010-11. The change from 1999-2000 to 2010-11 shows that, Maize is replaced by Wheat in Gangavati taluka, Sugarcane is replaced by Minor Millets in Koppal taluka, no ranking crops is mentioned in Yelburga taluka but replaced by Sugarcane crop. There are no ranking crops in two talukas
Fig. 7.1 Contd…

KOPPAL DISTRICT
ELEVENTH RANKING CROPS – 1999-2000

KOPPAL DISTRICT
ELEVENTH RANKING CROPS – 2010-11

KOPPAL DISTRICT
TWELFTH RANKING CROPS – 1999-2000

KOPPAL DISTRICT
TWELFTH RANKING CROPS – 2010-11
namely Kushtagi and Yelburga respectively during 1999-2000 and only one taluka is mentioned no ranking of crops in Kushtagi taluka during the year 2010-11.

In all the replacement of crops in different talukas of the study region is due to many factors namely, increase of area under irrigation, climatic changes from one region to another, soil types of different talukas, rainfall variations from one place to another place, etc. In dry farming talukas are usually Jowar, Groundnut, Bajra, Cotton, Minor Millets are the important crops grown in wet farming talukas are usually Rice, Sugarcane, Other Pulses and Maize, etc., are considered for cultivation. The villages which are close to urban centers can also practice the replacement of crops accordingly to the demand of crop and vegetables in urban centers. The increasing value of certain crops like Cotton, Rice, Groundnut and Sugarcane are very often yield better results to the replacement of crops. The spread of technological innovation have also a profound impact on the changing rank position of crops in different talukas. We have experienced during field work and data collection that, the above factors are really responsible in bringing the changing pattern of ranking of crops from 1999-2000 to 2010-11 (Table 7.1).

7.2 Crop Combination

In order to understand the cropping patterns in a particular region, a study of crop combination is imperative. The crop combinations on the one hand give an idea about the agricultural typology, agricultural economics and agricultural income of a region
and on the other, it gives an insight in the cropping practices and rotation of crops which are quite pertinent for the maintenance of soil fertility and their health. Indian farmers on the basis of their long experience as cultivators have adopted certain crops to be sown in Kharif and Rabi seasons. The growing demand for food to meet the requirement of increasing population and the expansion of arable land demand a careful and judicious utilization of land by selecting appropriate crop combinations to increase the production of food crops and to save soil depletion. It is therefore, essential to identify and adopt the crop combinations for each agricultural set-up which can give optimum agricultural returns.

Many a time the agricultural regions are known after their dominant crops e.g., Jowar region, Cotton region, Sugarcane region, Wheat region and so on. Such studies have confined themselves only to the dominant individual crops rather than complex agricultural system. This results in over generalizations because the individual crops occur only in rare circumstances of extreme mono-culture (Weaver, 1954). The delineation of crop combination regions constitute a significant aspect of agricultural geography as it provides a sound basis for developmental planning in agriculture. The studies which have confined themselves to the description of dominant individual crops usually suffer from over generalization because the individual crops except in relatively rare circumstances of extreme monoculture are not grown alone, but characteristically they appear in combinations. The concept of crop combination is a scientific device
to study the existing spatial relationships of crops in association with each other in agricultural geography. “A crop is seldom grown in isolation through its proportion may be exceptionally high cultivated plants are generally grown in combinational associations. Its delimitation is not an end in itself, but only a tool towards a better understanding of the agricultural situations. Owing to its importance the problem has engaged the attention of geographers and agricultural land use planners in recent years. Moreover, crop combination regions are used as a basis for planning and they have been accepted as suitable devices for improvements in under developed regions or countries of the world. For identifying the group of significant crops of a region, it is essential to adopt a statistical base.

A general understanding of the particular combination of the crops and their relative importance of each in an area can be very helpful in interpreting some aspects of social and economic geography of a region. Accordingly a large number of experts have suggested a number of statistical tools to delineate crop combination regions. The following are worthy mention here. L.L. Pownall (1953) mean positive deviation method, J.C. Weaver (1954) minimum deviation method, H.J. Nelson (1955) standard deviation method, Johnson (1958) the quartile method, Thomas (1963) least squared deviation method, S.M. Rafiullah (1965) maximum positive deviation method, N.P. Iyyar (1969) maximum distance method, A.G. Athawale (1969) lower limit method and Kostrowiki (1972) successive quotients method.
Techniques Used

A more reliable and rational approach for the delineation of crop combinations was adopted by Weaver. In his study crop combination regions in the Middle West, Weaver demarcated crop association developed in terms of variables based on certain differences which are relative and not absolute. This method, being based on statistical approach is more scientific and authentic. In this study, he has taken into account the percentage of the harvested cropped land occupied by each crop that held as much as one percent of the total cultivated land in each of the 181 countries covered in his work. Weaver calculated deviation of the real percentages of crops for all the possible combinations in the component areas units against a theoretical standard. The theoretical curve for the standard measurement was calculated as follows:

1. Monoculture = 100 per cent of the G.C.A. of one crop
2. Crop combination = 50 per cent in each of two crops
3. Crop combination = 33.33 per cent in each of three crops
4. Crop combination = 25 per cent in each of four crops
5. Crop combination = 20 per cent in each of five crops and so on.

For the determination of the minimum deviation for each of the component areas units the standard deviation method was as follows:

\[ \sigma = \sqrt{\frac{\Sigma d^2}{n}} \]

However, Weaver has pointed out the relative rank of the amount of deviation among the several possible combinations as was
desired by him and not the actual magnitude of the deviation, the square root were not extracted in accordance with the standard deviation formula. The specially used variant procedure can therefore be expressed as follows:

\[ \sigma = \frac{\sum d^2}{n} \]

Where ‘d’ is the difference between the actual crop percentages in a given areal unit and the appropriate percentage in the theoretical curve and ‘n’ is the number in a given combination.

Weaver’s Method has admirably been accepted and applied for the demarcation of crop combinations by geographers. The technique, however, gives most unwidely combinations for the areal units of high crop specialization.

To overcome Weaver’s over generalization; Doi K. (1959) modified the Weaver’s method and introduced a new deviation formula. Doi introduced a slight modification to Weaver’s formula by substituting \[ \frac{\sum d^2}{n} \]. The combination having the smallest \[ \sum d^2 \] will be the combination formed by the major crops.

The minimum deviation method advocated by Weaver tends to include all crops in the series including very minor crops occupying 1 percent of the net sown area. This results in an over-generalized combination. In order to overcome this weakness Rafiullah (1965) introduced another modification over Weaver’s method. The formula introduced by him is –
\[ \sigma = \sqrt{\frac{\Sigma Dp^2 - \Sigma Dn^2}{N^2}} \]

Where, D = is the deviation, DP = is the positive difference, Dn = is the negative difference from the medial value of the theoretical – curve value of the combination and N = is the number of crops in the combination.

Since it is the relative rank of the value of deviation which is needed, the root sign may be ignored to save laborious calculations and hence the formula can be expressed as follows:

\[ \sigma = \frac{\Sigma Dp^2 - \Sigma Dn^2}{N^2} \]

Here the maximum positive deviation i.e., maximum value of \( \sigma^2 \) gives the critical combinations.

The researcher has studied the basis of statistical examination of crop land occupying different crops. The crop combination at Koppal District has been determined by standard deviation. Formula, advanced by Weaver\textsuperscript{7} = \( \frac{\Sigma d^2}{n} \).

The method, however, is far from giving any visual picture of agricultural region. The combination of one, two and three....... has significance so far as it shows the dispersion of cultivated area under a number of crops. The larger the number of crops in the combination the greater dispersion, on the other hand decreasing the number of crops in a combination is indicative of growing concentration of land under few crops. The crop combination method has second place and it has been reproduced by the first letter.
By applying the technique of Weaver’s minimum deviation method to Koppal District for the years 1999-2000 and 2010-11, the district had fallen in 2 crops to 4 crops and 1 crop and 7 crops combination in both the study periods. The talukas falling into different crop combination are given in the table-7.2.

There is almost similarity in the crop combinations, more than 5 percentages of talukas. But there are many differences between some talukas during both the study periods. It is necessary to state that the higher the order of spatial association between any pair of crops, the greater is the order of achieved concordance or compatibility between them in the use of aggravate environmental opportunities. Here the researcher has calculated crops occupying more than 1% of an area in each taluka.

**Monoculture**

No one taluka emerges as monoculture in the study region during 1999-2000, but during 2010-11, Gangavati taluka had monoculture crop i.e., Paddy. (Table-7.2 & Fig. 7.2)

**Two Crops Combination**

During 1999-2000, Gangavati taluka had two crop combinations i.e., Paddy and Jowar, whereas, again no one taluka emerges as two crops combination during 2010-11 in the district.

**Three Crops Combination**

No one taluka emerges as three crop combination in the study region during both the study periods i.e., 1999-2000 and 2010-11.
Table-7.2

Koppal District

Crop Combination by Different Methods

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Name of the Talukas</th>
<th>S.M. Rafiullah’s Maximum Positive Deviation Method</th>
<th>J.C. Weaver’s Minimum Deviation Method</th>
<th>A.G. Athawale’s Lower Limit Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Gangavati</td>
<td>2 Crops</td>
<td>2 Crops</td>
<td>Nil</td>
</tr>
<tr>
<td>2</td>
<td>Koppal</td>
<td>2 Crops</td>
<td>3 Crops</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>Kushtagi</td>
<td>2 Crops</td>
<td>2 Crops</td>
<td>Nil</td>
</tr>
<tr>
<td>4</td>
<td>Yelburga</td>
<td>2 Crops</td>
<td>3 Crops</td>
<td>1</td>
</tr>
</tbody>
</table>

Fig. 7.2

KOPPAL DISTRICT
CROP COMBINATION REGIONS
J.C. WEAVER’S MINIMUM DEVIATION METHOD – 1999-2000

INDEX
- Monoculture
- 6 Crops
- 2 Crops
- 3 Crops
- 4 Crops
- 5 Crops
- 7 Crops
- 8 Crops
- 9 Crops

KOPPAL DISTRICT
CROP COMBINATION REGIONS
J.C. WEAVER’S MINIMUM DEVIATION METHOD – 2010-11

INDEX
- Monoculture
- 6 Crops
- 2 Crops
- 3 Crops
- 4 Crops
- 5 Crops
- 7 Crops
- 8 Crops
- 9 Crops

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Fig. 7.2

KOPPAL DISTRICT
CROP COMBINATION REGIONS
S.M. RAFIULLAHA'S MAXIMUM POSITIVE DEVIATION
METHOD – 1999-2000

INDEX

- Monoculture
- 6 Crops
- 7 Crops
- 8 Crops
- 9 Crops

KOPPAL DISTRICT
CROP COMBINATION REGIONS
S.M. RAFIULLAHA'S MAXIMUM POSITIVE DEVIATION
METHOD – 2010-11

INDEX

- Monoculture
- 6 Crops
- 7 Crops
- 8 Crops
- 9 Crops

196
Fig. 7.2

KOPPAL DISTRICT
CROP COMBINATION REGIONS
A.G. ATHAWALE’S LOWER LIMIT METHOD – 1999-2000

INDEX
- Monoculture
- 2 Crops
- 3 Crops
- 4 Crops
- 5 Crops
- 6 Crops
- 7 Crops
- 8 Crops
- 9 Crops

SCALE: 4 8 12 Kilms

KOPPAL DISTRICT
CROP COMBINATION REGIONS
A.G. ATHAWALE’S LOWER LIMIT METHOD – 2010-11

INDEX
- Monoculture
- 2 Crops
- 3 Crops
- 4 Crops
- 5 Crops
- 6 Crops
- 7 Crops
- 8 Crops
- 9 Crops

SCALE: 4 8 12 Kilms
Four Crops Combination

During 1999-2000, Koppal, Kushtagi and Yelburga talukas had four crops combination. The crops that grow in respective talukas are total, Groundnut, Jowar, Bajra and Other Pulses. Whereas, during 2010-11, no taluka emerges as four crops combination in the Koppal District.

Five Crops Combination

During 1999-2000, no taluka emerges as five crops combination. But in the year 2010-11, Kushtagi was the only taluka which fell under five crops combination i.e., Bajra, Jowar, Groundnut, Other Pulses and Bengal gram.

Six Crops Combination

No one taluka emerges as six crops combination in Koppal district during both the study periods (1999-2000 and 2010-11).

Seven Crops Combination

In the year 1999-2000, there was no one taluka emerges as seven crops combination in Koppal district. Whereas, during 2010-11, Koppal and Yelburga talukas had seven crops combination. The crops that are grown in respective talukas are Maize, Bajra, Groundnut, Bengal gram, Jowar, other Pulses, Cotton and Paddy.

7.3 Intensity of Cropping

Intensity of cropping, extent of maturity and increasing the yield from the existing cultivated area are problems of paramount importance in the agricultural economy of a region. These need a serious thought by the planners. Under utilization of a land is no
problem in a region, since most of the topographically accessible area for cultivation is already under plough, but the problems of the under use of the net area sown, under productivity and the risk of crop failures are taxing the rural population. It would be a useful gain to overcome these problems in the foreseeable future. Hence, it is desirable to investigate the degree of efficiency with which the net area sown is utilized.

Land use efficiency is defined as the extent to which the net area sown is re-sown. The total cropped area (gross area sown) as a percentage of the net area sown (net cropped area) gives a measure of landuse efficiency which really means the intensity of cropping. The intensity of cropping refers to the number of crops raised on a field during an agricultural year, for example, if one crop is grown on a field in one year the index of intensity of cropping is 100 per cent, if two crops in a year are produced, the intensity index will be 200 per cent. Therefore, the higher index of intensity of cropping, the higher is the landuse efficiency and the lower the index, the lower is the landuse efficiency.

Intensity of cropping in Koppal District is complex, it has been further accentuated by the impact of continued irrigational development and the state intervention in agriculture development. This extension of irrigation from the canals and tube wells improved the use of agricultural land and increased the hectare yields adding to agricultural progress.
Table-7.3

Koppal District

Intensity of Cropping

<table>
<thead>
<tr>
<th>Sl.No.</th>
<th>Name of the Talukas</th>
<th>1999-2000</th>
<th>2010-2011</th>
<th>Changes + or –</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Gangavati</td>
<td>164.32</td>
<td>157.82</td>
<td>-6.5</td>
</tr>
<tr>
<td>2</td>
<td>Koppal</td>
<td>119.63</td>
<td>128.22</td>
<td>8.59</td>
</tr>
<tr>
<td>3</td>
<td>Kushtagi</td>
<td>108.91</td>
<td>126.81</td>
<td>17.9</td>
</tr>
<tr>
<td>4</td>
<td>Yelburga</td>
<td>116.32</td>
<td>131.67</td>
<td>15.35</td>
</tr>
</tbody>
</table>

**Mean = 127.29**

<table>
<thead>
<tr>
<th></th>
<th>Mean = 127.29</th>
<th>136.13</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>S.D. = 21.72</strong></td>
<td><strong>12.65</strong></td>
</tr>
</tbody>
</table>

### Koppal District

**Intensity of Cropping Regions**

<table>
<thead>
<tr>
<th>Intensity Regions</th>
<th>1999-2000</th>
<th>2010-2011</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Range of Intensity</td>
<td>No. of Talukas</td>
</tr>
<tr>
<td>Very Low</td>
<td>Below 105.57</td>
<td>Nil</td>
</tr>
<tr>
<td>Low</td>
<td>105.58 to 127.29</td>
<td>3</td>
</tr>
<tr>
<td>Medium</td>
<td>127.30 to 149.00</td>
<td>Nil</td>
</tr>
<tr>
<td>High</td>
<td>149.01 to 170.72</td>
<td>1</td>
</tr>
<tr>
<td>Very High</td>
<td>Above 170.72</td>
<td>Nil</td>
</tr>
</tbody>
</table>
The following formula is used to delineate the intensity of cropping in the district.

\[
\text{I.C.} = \frac{\text{Gross Cropped Area}}{\text{Net Sown Area}} \times 100
\]

Where I.C. = Intensity of cropping

Gross cropped area = Net area sown plus area sown more than once in a year (double cropped area).

Net Sown Area = Area sown only once in a year.

During 1999-2000, the area sown more than once in the study region as a whole was 91608 hectares and it has increased to 130580 hectares in the year 2010-11. The taluka-wise intensity of cropping is grouped with the help of mean and standard deviation method (Table-7.3 & Fig. 7.3).

In the year 1999-2000, no one taluka was found under very low, medium and very high intensity of cropping in the study region. On the other hand, Koppal, Kushtagi and Yelburga talukas had low intensity of cropping and only one taluka i.e., Gangavati taluka under high intensity of cropping.

Among the four talukas of the study area, Gangavati and Koppal talukas had more area under irrigation through canals and bore wells than the other talukas. Even though, these two talukas had more area under irrigation, the intensity of cropping was not very high in these talukas. Koppal taluka grown more food grain crops and commercial crops like Rice, Maize, Jowar, Cotton, etc., and to some extent it grows few other crops like Bajra, Sugarcane, Bengal gram, etc. Therefore this
Fig. 7.3

KOPPAL DISTRICT
INTENSITY OF CROPPING – 1999-2000

INDEX
- Very Low: Below 105.57
- Low: 105.58 to 127.24
- Medium: 127.25 to 149.00
- High: 149.01 to 170.72
- Very High: Above 170.72

KOPPAL DISTRICT
INTENSITY OF CROPPING – 2010-11

INDEX
- Very Low: Below 123.48
- Low: 123.49 to 136.13
- Medium: 136.14 to 157.78
- High: 157.79 to 170.43
- Very High: Above 170.43

KOPPAL DISTRICT
CHANGE IN INTENSITY OF CROPPING
1999-2000 to 2010-11

INDEX
- Positive Change
  - Low: Below 10.00
  - Medium: 10.01 to 15.00
  - High: Above 15.00
- Negative Change
  - Low: Below 10.00

N 0 4 8 kms

N 0 4 8 kms

N 0 4 8 kms
taluka fell under low intensity of cropping region. Kushtagi and Yelburga talukas face erratic and scanty rainfall, poor fertility of soil, meager availability of irrigation and more land under waste; as a result, these talukas fall under low intensity cropping.

In the year 2010-11, very high intensity of cropping is not found in any talukas of the district, whereas, under high intensity is only found in one taluka i.e., Gangavati. Under low intensity cropping region can be found in Koppal, Kushtagi and Yelburga talukas were included during 1999-2000 and the same talukas are included in same intensity region during the year 2010-11, which is mainly because of non-availability of irrigation facilities, extending by L.B.C. of Tungabhadra river project and decreasing of underground water in the study area. (Fig. 7.4)

As a result, these talukas have grown more than one crop in a year and entered in low intensity region. Koppal, Kushtagi and Yelburga talukas continued their intensity from 1999-2000 to 2010-11. The remaining one taluka i.e., Gangavati was in high intensity group during both the study periods. It is because of availability of canal water by Tungabhadra river project. If the rainfall conditions and soil fertility status are remains good, then their status will remain good and their intensity of cropping will also improve.

7.4 Crop Concentration

An Application of Location Quotient Method

The special distribution of cropping pattern is a result of multi-dimensional interactions of its determinants. As this process is
dynamic and varied in space, we observe concentration and dispersion of cropping pattern in different talukas of Koppal District. The pattern of crop distribution reveals about the variations in the density of any crop grown in the district at a given point of time. Therefore an attempt is made here to identify the crop concentration pattern at two points of time (i.e., 1999-2000 and 2010-11). Such studies help us in getting a clear picture of the complex agricultural landscape and encourage in making a scientific analysis of the agricultural system in Koppal District. In this analysis the distribution pattern is shown into very low, low, medium, high and very high concentration of major crops. The designation of an area into jowar or cotton region, for instance, conceals the degree of its intensity of cultivation.

In order to determine the concentration of cropping pattern in Koppal District the “Location Quotient Method applied by S. S. Bhatia in his depth study of Crop Concentration of Uttar Pradesh” is used.9

**Methodology**

The general concentration of an enterprise can be quantified with the help of location quotient or coefficient of localization. This technique was primarily used to study of industrial locations (1948) and was also used by the urban geographers like Powanali (1953), Webb (1959) etc., for determining functional characters of an area. Later on the agricultural geographers like Jasbir Singh (1972) used it in a modified way.

The techniques expressed here to measure crop concentration are useful tools in the analysis of crop patterns of any part of the
world and appear to be of wider application in analysing various other agricultural elements as well.

For concentration of crops, S. S. Bhatia (1965) used the following location quotient method:

\[
\text{Index for determining concentration of crop } 'a' = \frac{\text{Area of crop 'a' in the component areal unit (taluka)}}{\text{Area of all crops in the component areal unit (taluka)}} \div \frac{\text{Area of crop 'a' in the entire region (taluka)}}{\text{Area of all crops in the entire region (taluka)}}
\]

Higher the index value of a crop concentration indicates that higher is the area under that crop. These would give us an idea of the level of concentration of crops.

The continuous high concentration of a particular crop in a taluka can also harm the soil structure and related ecology. Therefore, crop concentration studies must be used as a better tool of analysis in measuring the different associated parameters of crop cultivation like rainfall, porosity of soil, demand of a particular crop etc.

**Paddy**

In the year 2010-11 the concentration of Paddy was found in all talukas of the study area, but high concentration found in only one taluka i.e., Gangavati. The medium concentration was noticed in Koppal taluka and low concentration was in two talukas namely Kushtagi and Yelburga. During 1999-2000, Gangavati taluka continued as high concentration, Koppal taluka continued as medium concentration, Kushtagi taluka is also fall under low concentration and Yelburga falls under medium concentration, the change was found in Yelburga
taluka only. In the year 1999-2000 medium concentration of Paddy crop, but during 2010-11, it is fall under low concentration. This replacement is due to the adoption of commercial crops like Sugarcane and Cotton in irrigated tracts of these talukas.

**Jowar**

In the year 1999-2000 the concentration of Jowar was found in all talukas of the study region. Low and medium concentration was not found in any one of the talukas in the study area. Whereas, all talukas namely Kushtagi, Yelburga, Koppal and Gangavati were in high concentration category during 1999-2000 and in the year 2010-11 concentration of Jowar was found in all talukas. The low concentration of Jowar is not seen in any one taluka in the study region. Therefore, the medium concentration is noticed in Gangavati taluka and high concentration of Jowar in Kushtagi, Yelburga and Koppal talukas.

The changes shows that, Gangavati taluka had shifted from medium to high concentration, Koppal, Kushtagi and Yelburga talukas continued in high concentration during both the study periods. It is due to Jowar is the main food cropping of the district and surplus the food grain to the growth of population.

**Bajra**

During both the study periods i.e., 1999-2000 and 2010-11, the concentration of Bajra was found in all talukas of the district. Low concentration is not noticed in all talukas of the study region like Jowar crop, whereas, the medium concentration is noticed in Gangavati taluka, during 1999-2000 and 2010-11. Koppal, Kushtagi and
Table-7.4

Koppal District

Crop Concentration Indices 1999-2000

(An Application of Location Quotient Method by Bhatia’s)

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Name of the Talukas</th>
<th>Paddy</th>
<th>Jowar</th>
<th>Bajra</th>
<th>Wheat</th>
<th>Maize</th>
<th>Minor Millets</th>
<th>Bengal Gram</th>
<th>Tur</th>
<th>Other Pulses</th>
<th>Groundnut</th>
<th>Sugarcane</th>
<th>Cotton</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Gangavati</td>
<td>2.91</td>
<td>0.82</td>
<td>0.33</td>
<td>0.02</td>
<td>0.02</td>
<td>0.03</td>
<td>0.09</td>
<td>0.08</td>
<td>0.22</td>
<td>0.28</td>
<td>0.07</td>
<td>0.17</td>
</tr>
<tr>
<td>2</td>
<td>Koppal</td>
<td>0.42</td>
<td>1.13</td>
<td>0.58</td>
<td>0.07</td>
<td>0.35</td>
<td>0.08</td>
<td>0.06</td>
<td>0.17</td>
<td>0.55</td>
<td>1.25</td>
<td>0.04</td>
<td>0.35</td>
</tr>
<tr>
<td>3</td>
<td>Kushtagi</td>
<td>0.01</td>
<td>1.39</td>
<td>1.39</td>
<td>0.14</td>
<td>0.11</td>
<td>0.06</td>
<td>0.13</td>
<td>0.30</td>
<td>0.58</td>
<td>0.89</td>
<td>-</td>
<td>0.07</td>
</tr>
<tr>
<td>4</td>
<td>Yelburga</td>
<td>0.04</td>
<td>1.31</td>
<td>0.59</td>
<td>0.37</td>
<td>0.18</td>
<td>0.15</td>
<td>0.22</td>
<td>0.19</td>
<td>0.45</td>
<td>1.09</td>
<td>-</td>
<td>0.46</td>
</tr>
</tbody>
</table>

Note: Low = Below 0.25
Medium = 0.26 to 0.50
High = Above 0.50
### Table-7.5

**Koppal District**

**Crop Concentration Indices 2010-2011**

*(An Application of Location Quotient Method by Bhatia’s)*

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Name of the Talukas</th>
<th>Paddy</th>
<th>Jowar</th>
<th>Bajra</th>
<th>Wheat</th>
<th>Maize</th>
<th>Minor Millets</th>
<th>Bengal Gram</th>
<th>Tur</th>
<th>Other Pulses</th>
<th>Groundnut</th>
<th>Sugarcane</th>
<th>Cotton</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Gangavati</td>
<td>3.42</td>
<td>0.49</td>
<td>0.30</td>
<td>0.01</td>
<td>0.21</td>
<td>0.14</td>
<td>0.17</td>
<td>0.40</td>
<td>0.01</td>
<td>0.38</td>
<td>0.01</td>
<td>0.08</td>
</tr>
<tr>
<td>2</td>
<td>Koppal</td>
<td>0.41</td>
<td>0.53</td>
<td>0.89</td>
<td>0.10</td>
<td>1.43</td>
<td>0.03</td>
<td>0.54</td>
<td>0.10</td>
<td>0.42</td>
<td>0.60</td>
<td>0.10</td>
<td>0.24</td>
</tr>
<tr>
<td>3</td>
<td>Kushtagi</td>
<td>0.01</td>
<td>1.07</td>
<td>1.69</td>
<td>0.10</td>
<td>0.34</td>
<td>0.04</td>
<td>0.50</td>
<td>0.30</td>
<td>0.60</td>
<td>0.63</td>
<td>-</td>
<td>0.25</td>
</tr>
<tr>
<td>4</td>
<td>Yelburga</td>
<td>0.01</td>
<td>1.07</td>
<td>0.69</td>
<td>0.25</td>
<td>0.53</td>
<td>0.05</td>
<td>0.85</td>
<td>0.10</td>
<td>0.50</td>
<td>0.81</td>
<td>0.001</td>
<td>0.52</td>
</tr>
</tbody>
</table>

**Note:**
- Low = Below 0.25
- Medium = 0.26 to 0.50
- High = Above 0.50
KOPPAL DISTRICT
CROP CONCENTRATION – 1999-2000
(AN APPLICATION OF LOCATION QUOTIENT METHOD)

PADDY

INDEX
Low Below 0.25
Medium 0.26 to 0.50
High Above 0.50

N

JOWAR

INDEX
Low Below 0.25
Medium 0.26 to 0.50
High Above 0.50

N

BAJRA

INDEX
Low Below 0.25
Medium 0.26 to 0.50
High Above 0.50

N

WHEAT

INDEX
Low Below 0.25
Medium 0.26 to 0.50
High Above 0.50

N

Fig. 7.4
Fig. 7.4 Contd…

KOPPAL DISTRICT
CROP CONCENTRATION – 1999-2000
(AN APPLICATION OF LOCATION QUOTIENT METHOD)

MAIZE

INDEX
Low
Below 0.25
Medium
0.26 to 0.50
High
Above 0.50

MINOR MILLETS

INDEX
Low
Below 0.25
Medium
0.26 to 0.50
High
Above 0.50

BENGAL GRAM

INDEX
Low
Below 0.25
Medium
0.26 to 0.50
High
Above 0.50

TUR

INDEX
Low
Below 0.25
Medium
0.26 to 0.50
High
Above 0.50

KOPPAL DISTRICT
CROP CONCENTRATION – 1999-2000
(AN APPLICATION OF LOCATION QUOTIENT METHOD)
Fig. 7.4 Contd…

KOPPAL DISTRICT
CROP CONCENTRATION – 1999-2000
(AN APPLICATION OF LOCATION QUOTIENT METHOD)

OTHER PULSES

INDEX
Low Below 0.25
Medium 0.26 to 0.50
High Above 0.50

GROUNDNUT

INDEX
Low Below 0.25
Medium 0.26 to 0.50
High Above 0.50

SUGARCANE

INDEX
Low Below 0.25
Medium 0.26 to 0.50
High Above 0.50

COTTON

INDEX
Low Below 0.25
Medium 0.26 to 0.50
High Above 0.50

KOPPAL DISTRICT
CROP CONCENTRATION – 1999-2000
(AN APPLICATION OF LOCATION QUOTIENT METHOD)
Yelburga talukas are fall under high concentration category during both the study periods. There are no any changes in concentration of Bajra crop. It is due to second main food crop next to Jowar in the district (Table-7.4, 7.5 & Fig. 7.4, 7.5).

**Wheat**

Wheat is also concentrated in all talukas of the study region, during 1999-2000, low concentration of wheat is noticed in Gangavati, Koppal and Kustagi talukas, as well as medium concentration is found in Yelburga taluka. During 2010-11, Yelburga taluka is again stand in medium concentration and other three talukas are coming under low concentration of wheat crop. Variation of wheat crop from one region to another was mainly because of adoption of commercial crops in the study region.

**Maize**

In the year 2010-11 the high concentration of Maize was noticed in Koppal and Yelburga talukas, medium concentration in Kushtagi taluka and low concentration was found in Gangavati taluka. During 1999-2000, the high concentration of Maize was not noticed, the medium concentration of Maize was found in Koppal taluka and low concentration was found in Yelburga, Kushtagi and Gangavati talukas of the district.

The changes show that, Koppal taluka was in medium concentration region during 1999-2000, whereas, it was shifted to high concentration region during 2010-11. Likewise Yelburga taluka which was medium concentration has shifted to low concentration,
Fig. 7.5

KOPPAL DISTRICT
CROP CONCENTRATION – 2010-11
(AN APPLICATION OF LOCATION QUOTIENT METHOD)

PADDY

LOW
Below 0.25

MEDIUM
0.25 to 0.50

HIGH
Above 0.50

JOWAR

INDEX

LOW
Below 0.25

MEDIUM
0.26 to 0.50

HIGH
Above 0.50

BAJRA

INDEX

LOW
Below 0.25

MEDIUM
0.26 to 0.50

HIGH
Above 0.50

WHEAT

INDEX

LOW
Below 0.25

MEDIUM
0.26 to 0.50

HIGH
Above 0.50

N
4 0 4 Kilometers

N
4 0 4 Kilometers

N
4 0 4 Kilometers

N
4 0 4 Kilometers
KOPPAL DISTRICT
CROP CONCENTRATION – 2010-11
(AN APPLICATION OF LOCATION QUOTIENT METHOD)

MAIZE

INDEX
Low Below 0.25
Medium 0.26 to 1.50
High Above 1.50

MINOR MILLETS

INDEX
Low Below 0.25
Medium 0.26 to 1.50
High Above 1.50

BENGAL GRAM

INDEX
Low Below 0.25
Medium 0.26 to 1.50
High Above 1.50

TUR

INDEX
Low Below 0.25
Medium 0.26 to 1.50
High Above 1.50
KOPPAL DISTRICT
CROP CONCENTRATION – 2010-11
(AN APPLICATION OF LOCATION QUOTIENT METHOD)
OTHER PULSES

INDEX
Low
Below 0.25

Medium
0.26 to 0.50

High
Above 0.50

KOPPAL DISTRICT
CROP CONCENTRATION – 2010-11
(AN APPLICATION OF LOCATION QUOTIENT METHOD)
GROUNDNUT

INDEX
Low
Below 0.25

Medium
0.26 to 1.50

High
Above 1.50

Fig. 7.5 Contd…
Whereas, Kushtagi taluka has shifted from medium to low concentration. There are no any changes in Gangavati taluka, shifting of Maize crop from one region to another region was mainly because of adoption of high yielding variety of crops in the study region.

**Minor Millets**

During 1999-2000 and 2010-11 no one taluka were in medium and high concentration region of the study region. The low concentration of Minor Millets was in all talukas of the district. There is no any change from one category to another category. This is because of fertile soil and not timely arrival of south west monsoon during rainy season.

**Bengal Gram**

Bengal gram is concentrated in all talukas of district during the study periods. In the year 1999-2000, the medium and high concentration of Bengal gram crop were not noticed in the study region whereas, all talukas are found in low concentration of Bengal gram crop. During 2010-11, the high concentration in Yelburga and Koppal talukas, the medium concentration of Bengal gram was not noticed in the study area and the low concentration found in Gangavati and Kushtagi talukas of the district.

**Tur**

During 1999-2000, the high and medium concentration of Tur was not noticed in the district, whereas, the low concentration was seen in Gangavati, Koppal, Kushtagi and Yelburga talukas. In the year 2010-11, low concentration continued in Koppal and Yelburga
talukas, medium concentration of Tur was found in Gangavati and Kushtagi talukas. No one taluka is found in high concentration of Tur crop. The change shows that, Koppal and Kushtagi talukas were in low concentration region during 1999-2000 and it was shifted to medium concentration region during 2010-11. Koppal and Yelburga talukas continued its status as low concentration during both the study periods.

**Other Pulses**

During 1999-2000, the high concentration of other Pulses crops are found in Koppal and Kushtagi talukas, similarly, medium concentration of other Pulses found in Yelburga taluka and low concentration of this crop is found in Gangavati taluka.

In the year 2010-11, Gangavati and Yelburga talukas are continued as same in the previous periods and Koppal taluka is also fall under medium concentration of Other Pulses as well as Kushtagi taluka is continued as high concentration in study region. The changes show that, Koppal taluka was in high concentration region during 1999-2000 and it was shifted to medium concentration region during 2010-11. Such changes always take place due to some variation in prices, demand and adoption of new varieties of seeds during a particular period of showing.

**Groundnut**

In the year 1999-2000 and 2010-11 no one taluka is in low concentration region of the study region. During 1999-2000, the medium concentration was found in Gangavati taluka and high
concentration was found in Koppal, Yelburga and Kushtagi talukas of the district. Some categories are continued in same talukas of the study area during 2010-11.

**Sugarcane**

During 1999-2000 and 2010-11 Kushtagi taluka were not grown Sugarcane crop. Similarly, Yelburga taluka is also not grown Sugarcane crop during 1999-2000. Gangavati and Koppal talukas are found in low concentration of Sugarcane during 1999-2000 and in the year 2010-11, low concentration was found in three talukas namely Gangavati, Koppal and Yelburga talukas of Koppal district. The changes shows that, Yelburga taluka has not grown in the year 1999-2000 but it is shifted to low concentration category during 2010-11. Other talukas were continued their status as low concentration during both the study periods.

**Cotton**

In the year 1999-2000, the concentration of cotton was found in all talukas of the study region. Medium concentration was found in Yelburga and Koppal talukas, whereas low concentration was found in the talukas i.e., Gangavati and Kushtagi. No one taluka is found in high concentration of Cotton crop in the study region.

During 2010-11, low concentration was found in three talukas i.e., Gangavati, Koppal and Kushtagi. Medium concentration of Cotton was not found in any talukas of the district. The high concentration of Cotton crop was found in Yelburga taluka.
The change shows that, Yelburga taluka has shifted from medium to high concentration, whereas Koppal taluka has shifted from medium to low concentration. There are no any changes in Gangavati and Kushtagi talukas. Same status was continued during both the study periods. This sort of odd was due to failure of rain, lack of transportation and market facilities and the fall of prices, all these are the causes for low concentration of Cotton crop in Koppal district.

7.5 Crop Diversification

The diversification of cropping pattern means raising of different varieties of crops in an arable land. The keener the competition of crops, the higher will be the magnitude of diversification. In fact, it is obvious that greater the number of crops in a combination, the larger would be the degree of diversification. The differential and multiplicity of cropping in the areal unit is partly the result of the interactions of various agro-climatic phenomena and partly the differential effects of economic and cultural forces crop diversity is an important component of the crops geography of region. It refers to variety of crops, “Larger the number of crops grown in an area during a year with each crop occupying equal proportion of crop land, the higher is the crop diversification”.

In a diversified cropping system, soil nutrients extracted by some crops are likely to be replenished by other crops grown in rotation as against a specialized system, where a few of them may be taxed heavily.
Objectives of the Study of Crop Diversification

1. The main objectives of the study of crop diversification in Koppal district lie in the fact that it helps us to know the contemporary competition amongst crops, scope for rotation & effects on double cropping and also productivity.

2. It enables us to understand the impact of physical and socio-economic conditions of the agricultural mosaic of the district.

3. For complete comprehension of the geography of crops in the district, the interpretation of their diversification is essential.

   In view of these objectives an attempt is made to analyse the nature of crop diversification and its spatio-temporal variation in Koppal District.

Measurement of Crop Diversification: A Review of Literature

Crop diversification has engaged the attention of geographers since long. The study of crop diversification was attempted by a number of geographers in their study of cropping pattern. However, the works of Tress T.C. (1939), Edgar Conkling R. (1963), Shear James A. (1975) and Parr John B. (1965) are noteworthy and have used Lorenz curve for measuring diversification but the methods suffering from one or the other defects.

a. It leads to tedious calculations.

b. It is not so precise and accurate.

   It gives only the broad ideas of diversification of an area between the diagonals and the curve is quite laborious.
S.S. Bhatia (1965) has evolved a single formula by taking into account the total cropped area to make an objective measurement of crop diversification. He took the ratio between the area under all these crops which cover up to five percent of the crop land and the number of crops as an index of diversification. It is not only simple but also an easily workable technique.

However, it cannot be accepted here because of the following weaknesses.

i. Instead of using five percent and more than five as it is arbitrary limit the actual number of crops should have been considered separately.
ii. Some crops which are left out just because of less than of the net sown area may be of great importance.
iii. It is supersensitive because of fixing more than five percent value and
iv. The index is too insensitive towards the highest value of diversification, e.g. if, no value reaches more than ten percent then the index acquires in determinate form.

Mavi H.S. (1963) rectified this drawback by taking the ratio between the mean of the difference in percentage of crops under each of which is more than five percent of the total cropped area. This method is also not accepted because of the following weaknesses.

1. The method is not a better representative of the number of factors (number of crops) and
2. It gives only a broad idea of diversification of crops.
N.P. Ayyar (1969) has modified Bhatia’s method taking into account only those crops which occupy at least 1.0% of the gross cropped area. For each unit the standard of evenness is chosen differently according to the actual number of crops. This method also fails to identify clearly the critical values produced by the ideal distribution and hence it is proved to be supersensitive.

**Method Adopted in the Study Area**

The quantitative techniques proposed by Gibb’s and Martin for measuring crops diversification provides a useful alternative index for measuring the degree of diversification in the cropping pattern of an area. The formula developed for calculating the index was as under.

\[
\text{Index for Diversification} = 1 - \frac{\sum x^2}{(\sum x)^2}
\]

Where, X is the percentage of the total cropped area occupied by each crop or hectare under individual crop.

If the total cultivated area in a region is devoted wholly to one crop (i.e., specialization), the index value will be zero and if it is evenly distributed among all crops (i.e., maximum diversification). The index value approaches one. This method is accepted in the present study as it has the following advantages and had overcome the defects which occurred in other methods.

1. It has taken into consideration both the evenness factor (relative strength of crops) and number of factors (number of crops) perfectly to form the basis of proper measurement of diversity.
2. The method is neither incentive nor supersensitive like Bhatia’s method and is devoid of critical values.
Table-7.6
Koppal District

Crop Diversification 1999-2000
(Gibb’s and Martin’s Method)

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Name of the Talukas</th>
<th>Paddy</th>
<th>Jowar</th>
<th>Bajra</th>
<th>Wheat</th>
<th>Maize</th>
<th>Minor Millets</th>
<th>Bengal Gram</th>
<th>Tur</th>
<th>Other Pulses</th>
<th>Groundnut</th>
<th>Sugarcane</th>
<th>Cotton</th>
<th>(1 - \frac{\sum x^2}{(\sum x)^2})</th>
<th>Diversification Index</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Gangavati</td>
<td>4290905025</td>
<td>341140900</td>
<td>56655729</td>
<td>311364</td>
<td>259081</td>
<td>409600</td>
<td>3655744</td>
<td>3508129</td>
<td>24760576</td>
<td>39955041</td>
<td>2331729</td>
<td>14010049</td>
<td>4777902967 / 1.29×10^10</td>
<td>=1-0.37=0.63</td>
</tr>
<tr>
<td>2</td>
<td>Koppal</td>
<td>51308569</td>
<td>368486416</td>
<td>96275344</td>
<td>1555009</td>
<td>34880836</td>
<td>1677025</td>
<td>1132096</td>
<td>8208225</td>
<td>85951441</td>
<td>444197776</td>
<td>444889</td>
<td>35153041</td>
<td>1129270667 / 7308711081</td>
<td>=1-0.16=0.84</td>
</tr>
<tr>
<td>3</td>
<td>Kushtagi</td>
<td>36481</td>
<td>511076449</td>
<td>511619161</td>
<td>4897369</td>
<td>3073009</td>
<td>876096</td>
<td>4648336</td>
<td>90326016</td>
<td>209551576</td>
<td>377524900</td>
<td>6884029</td>
<td>1140624</td>
<td>1360201798 / 677594596</td>
<td>=1-0.20=0.80</td>
</tr>
<tr>
<td>4</td>
<td>Yelburga</td>
<td>514089</td>
<td>546016689</td>
<td>111091600</td>
<td>42850116</td>
<td>10876804</td>
<td>6943225</td>
<td>16128256</td>
<td>12110400</td>
<td>65399569</td>
<td>377524900</td>
<td>6884029</td>
<td>6884029</td>
<td>1258295857 / 8174510596</td>
<td>=1-0.02=0.98</td>
</tr>
<tr>
<td></td>
<td><strong>District Total</strong></td>
<td><strong>541342776</strong></td>
<td><strong>6995649600</strong></td>
<td><strong>2550048004</strong></td>
<td><strong>111598096</strong></td>
<td><strong>131469156</strong></td>
<td><strong>30316036</strong></td>
<td><strong>83685904</strong></td>
<td><strong>169234081</strong></td>
<td><strong>1013658244</strong></td>
<td><strong>3756954436</strong></td>
<td><strong>481636</strong></td>
<td><strong>362407369</strong></td>
<td><strong>2.06×10^{10} / 1.38×10^{11}</strong></td>
<td><strong>=1-0.15=0.85</strong></td>
</tr>
</tbody>
</table>

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Table-7.7
Koppal District

Crop Diversification 2010-2011
(Gibb’s and Martin’s Method)

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Name of the Talukas</th>
<th>Paddy</th>
<th>Jowar</th>
<th>Bajra</th>
<th>Wheat</th>
<th>Maize</th>
<th>Minor Millets</th>
<th>Bengal Gram</th>
<th>Tur</th>
<th>Other Pulses</th>
<th>Groundnut</th>
<th>Sugarcane</th>
<th>Cotton</th>
<th>$1 - \left(\frac{\Sigma x^2}{(\Sigma x)^2}\right)$</th>
<th>Diversification Index</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Gangavati</td>
<td>4893702025</td>
<td>100420441</td>
<td>38365636</td>
<td>23716</td>
<td>13010449</td>
<td>352836</td>
<td>18421264</td>
<td>7733961</td>
<td>12859396</td>
<td>60419529</td>
<td>84681</td>
<td>2505889</td>
<td>$514789923 / 1.23\times10^{10}$</td>
<td>1-0.42=0.58</td>
</tr>
<tr>
<td>2</td>
<td>Koppal</td>
<td>61921161</td>
<td>105740089</td>
<td>294225409</td>
<td>4040100</td>
<td>759278025</td>
<td>316969</td>
<td>109872324</td>
<td>5593225</td>
<td>6548100</td>
<td>132503121</td>
<td>3783025</td>
<td>20602521</td>
<td>$1563324069 / 1.09\times10^{10}$</td>
<td>1-0.18=0.82</td>
</tr>
<tr>
<td>3</td>
<td>Kushtagi</td>
<td>41209</td>
<td>335915584</td>
<td>847275664</td>
<td>3136441</td>
<td>34621456</td>
<td>577600</td>
<td>73633561</td>
<td>21362884</td>
<td>108243216</td>
<td>117332224</td>
<td>18045504</td>
<td>1560185343</td>
<td>$1560185343 / 8643420900$</td>
<td>1-0.18=0.82</td>
</tr>
<tr>
<td>4</td>
<td>Yelburga</td>
<td>11449</td>
<td>503822916</td>
<td>208571364</td>
<td>27258841</td>
<td>124121881</td>
<td>937024</td>
<td>313962961</td>
<td>8462281</td>
<td>108764041</td>
<td>285103225</td>
<td>196</td>
<td>120934009</td>
<td>$1701950188 / 1.28\times10^{10}$</td>
<td>1-0.13=0.87</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>District</strong></td>
<td><strong>6104921956</strong></td>
<td><strong>3730522084</strong></td>
<td><strong>4475208609</strong></td>
<td><strong>83832336</strong></td>
<td><strong>2321986969</strong></td>
<td><strong>8323225</strong></td>
<td><strong>515890119</strong></td>
<td><strong>160706329</strong></td>
<td><strong>1056835081</strong></td>
<td><strong>2209094001</strong></td>
<td><strong>5062500</strong></td>
<td><strong>456548689</strong></td>
<td><strong>2.4\times10^{10} / 1.8\times10^{11}</strong></td>
<td>1-0.13=0.87</td>
</tr>
</tbody>
</table>
### Table-7.8

**Koppal District : Talukawise Diversification Indices and their Change from 1999-2000 and 2010-2011**

<table>
<thead>
<tr>
<th>Sl.No.</th>
<th>Name of the Talukas</th>
<th>I.D. 1999-2000</th>
<th>I.D. 2010-2011</th>
<th>Change + or –</th>
<th>Increase or Decrease</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Gangavati</td>
<td>0.63</td>
<td>0.58</td>
<td>-0.05</td>
<td>Decrease</td>
</tr>
<tr>
<td>2</td>
<td>Koppal</td>
<td>0.84</td>
<td>0.86</td>
<td>0.02</td>
<td>Increase</td>
</tr>
<tr>
<td>3</td>
<td>Kushtagi</td>
<td>0.80</td>
<td>0.82</td>
<td>0.02</td>
<td>Increase</td>
</tr>
<tr>
<td>4</td>
<td>Yelburga</td>
<td>0.85</td>
<td>0.87</td>
<td>0.02</td>
<td>Increase</td>
</tr>
<tr>
<td></td>
<td><strong>District Total</strong></td>
<td><strong>3.12</strong></td>
<td><strong>3.13</strong></td>
<td><strong>0.01</strong></td>
<td>Increase</td>
</tr>
</tbody>
</table>

**Crop Diversification Categories for 1999-2000 and 2010-2011**

<table>
<thead>
<tr>
<th>Diversification Categories</th>
<th>1999-2000</th>
<th>2010-2011</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Range of Crops Diversification</td>
<td>No. of Talukas</td>
</tr>
<tr>
<td>Low</td>
<td>Below 0.75</td>
<td>1</td>
</tr>
<tr>
<td>Medium</td>
<td>0.76 to 0.80</td>
<td>1</td>
</tr>
<tr>
<td>High</td>
<td>Above 0.80</td>
<td>2</td>
</tr>
</tbody>
</table>

**Positive or Negative Change of Categories 1999-2000 and 2010-2011**

<table>
<thead>
<tr>
<th>Sl.No.</th>
<th>Range of Crops Diversification</th>
<th>Change + or –</th>
<th>No. of Talukas</th>
<th>Name of the Talukas</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Below 0.06</td>
<td>Positive</td>
<td>3</td>
<td>Koppal, Kushtagi, Yelburga</td>
</tr>
<tr>
<td>2</td>
<td>Below 0.06</td>
<td>Negative</td>
<td>1</td>
<td>Gangavati</td>
</tr>
</tbody>
</table>
3. The figures can be adjusted into hundreds, thousands, millions etc., which will not alter the results.

4. The indices are directly related to diversification whereas, they are inversely related to diversification in other method and

5. The indices are not only relative but also are precise in calculation.

Therefore, keeping the above advantages in view the Gibb’s and Martin’s index of diversification has provided the most suitable methods in measuring diversification of crops in Koppal district. It is adopted here at two points of time i.e., 1999-2000 and 2010-11 and results are plotted (Table-7.6, 7.7 & Fig. 7.6).

**Spatio Temporal Analysis**

The proceeding tables and figures indicate that the indices have been worked out for spatial distribution of crop diversification at talukas and district level. The district level diversification index has increased from 3.12 to 3.13 which means the diversity is increasing in the study period i.e., 1999-2000 to 2010-11. This increase is due to supply of water facilities, irrigation, timely rainfall and also proper utilization of fertilizers and manures (Table-7.6, 7.7 & 7.8).

**Taluka Level Analysis**

In the year 1999-2000 the low diversity was noticed in only one taluka i.e., Gangavati, the medium diversity was found in Kushtagi taluka, whereas, high diversity was noticed in Yelburga and Koppal talukas of the study region. During 2010-11, the low diversity is found in Gangavati taluka, there was no medium category of crop
diversification and high diversity was found in Yelburga, Koppal and Kushtagi talukas of Koppal district.

**Change in Crop Diversification**

The critical analysis of the result of the diversification of crops clearly reveals that, all the talukas of the study region have generally high diversity of agricultural crops. The comparison from taluka to taluka indicates that there is an abrupt variation which is grouped as follows.

a) Increased diversification : 0.02 to 0.02 index value

b) Decreased diversification : -0.05 index value

**a) Increased Diversification**

The increased diversification is found in Yelburga, Koppal and Kushtagi talukas have increased their diversity within a span of eleven years i.e., 1999-2000 and 2010-11. The highest diversification index value is noticed is 0.02 in all the above mentioned three talukas of the study region.

**b) Decreased Diversification**

Gangavati taluka have recorded a decreased diversification of crops. Fertile soil and an adequate amount of irrigation facilities are well suited to grow valuable food crops like Paddy, Jowar, Bajra and grow economically valuable crops like Cotton, Maize, Groundnut and Sugarcane. It is because the taluka is covered with black and red soil, therefore farmers prefer to extensively grow more food and commercial crops like Paddy, Jowar, Cotton and Sugarcane under irrigation facilities by using tube wells and canals. (Table-7.8)
7.6 Conclusion

In both the study periods more than fourteen crops were grown in the study region. The ranking pattern of crops changing from one taluka to another taluka indicates the changing importance of crop value and its utility. The crop concentration study helps us to know which are the talukas that can be affected by degradation of the soil ecology and how it can be reduced by changing the range of concentration. The high concentration of crop is associated with high intensity of irrigation and vice-versa. The crop combination analysis indicates no eight and above in the entire study region. As per the J.C. Weaver method the district exhibits monoculture to seven crop combination. It can be noted that lesser number of crops (one or two crops) combination, lower is the taluka irrigated or lower is the share of commercial crops. In case of more number of crops (7 crops) combination, the higher is the talukas is irrigated or higher is the share of commercial crops. The cropping intensity indicates the frequently use of arable land. Higher degree of intensity is created with higher percentage of irrigated land, whereas, the low intensity is well noticed in dry farming talukas. Similarly, the crop diversification is related to quality of soil, amount of rainfall received and percentage of irrigation. Thus, the whole chapter gives us certain clues to work the regionalization of agriculture in Koppal district of Karnataka state.
References


14) Manorama Year Book 2001: “Growing the food we need”.
16) Ibid., p. 561.
19) Hussain, Majid (1982); “Crop combination in India a Study”. Concept publishing company, New Delhi.