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A Geographical Analysis of Agricultural Regionalization using of Geographical Information System: A Case Study of Chamarajanagara District, Karnataka State

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ABSTRACT

The present work has been made an attempt to delineate the agricultural regions in the Chamarajangara district with using of 2016-17 period data. It gives information about share of net sown area, different combinations of crop growing regions, crop concentration regions and crop diversification of the study region. The entire study is based on secondary data which all collected from Government departments of Chamarajanagara district. Chamarajanagara District is the southern-most district in the state of Karnataka. Chamarajanagara district is consisting of 4 taluks namely Chamarajanagara, Gundlupet, Kollegala and Yelandur. There are eleven crops were taken to delineate the agricultural regions in the study area. They are namely jowar, food grains, paddy, pulses, oilseed, ragi, maize, fruits, vegetables, cotton and sugarcane. Weaver's method, Bhatia's method, Gibbs and Martin index method has been used for this study. In the district five, six and eleven crops combinations can be seen among the four taluks. Five crops were cultivated in Yalandurtaluk, six crops cultivated in Gundlupet and Kollegaltaluk, eleven crops cultivated in Chamarajanagarataluk. Crop diversification has been varied from one region to another. The advantage of this present study helps to do better plan in the agriculture sector and helps to understand the situation of all the taluks.

Key words: Agricultural regionalization, Concentration, Crop combinations, Diversification.

INTRODUCTION

Agriculture occupies an important status in an economy. Agriculture region is a dynamic concept which changes in space and time. The main characteristics of agricultural (Chahal and Singh, 2020) regions are location, transitional boundaries, formal or functional characteristics. Agriculture region is a kind of device for selecting and investigating regional grouping of the complex agricultural phenomena found on the land. Agriculture regionalization (Dinye and Ayitio 2013) is the process of dividing an area into territorial units of uniformities and is the result of a set of processes. The main advantage of agricultural regionalization (Dayalan, 2018) lies in the fact that it helps in the formulation of agricultural plans, which may go a long way in reducing the regional disparities and inequalities. Agricultural regionalization (Hangaragi 2011) has been identified by many factors such as cropping pattern, crop combination, concentration and diversification patterns, Regional pattern of agricultural productivity, degree of commercialization and pattern of crop rotation.

Study area

Chamarajanagara District is the southern-most district in the state of Karnataka. Chamarajanagara town is the headquarters of this district; it is consisting of 4 taluks they are Chamarajanagara, Gundlupet, Kollegala and Yelandur. It is bordered by Mysore and Mandya district of Karnataka state in the North, Nilgiris and Coimbatore districts of Tamil Nadu state in the South-East, Waynad district of Kerala state in South-West. It has Geographical area of 5101 Sq. Kms. District latitude and longitude ranges from 76°24′ and 77°43′ east longitudes to 11°32′ and 12°16′ north latitudes.

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The Chamarajanagara district has good drainage system, the main water sources are: Suvarnavathi, Pallar, Moyar and UdutoreHalla. The south-western and southern parts of the district are begins in the edge of western Ghats, well endowed with sufficient rainfall and known for the production of variety of reunified crops. In addition to reunified cultivation, the canal network of Suvarnavathi and Chikkahole. The soils of the district can be broadly classified as the red-loam, sandy loam and black cotton soil. In the taluk of Chamarajanagar, Gundlupet and Kollegala there is deep red loam base occasionally interspersed with black soils. The red sandy loamy soils are derived from the granites and gneisses. Location of study area has shown in Map 1.

Aim and objectives of the study

- To analysethe crop wise net sown area in the study region.
- To delineate the crop combination and crop concentration regions in the study region.
- To analyze the crop diversification.

Data base

The present study is based on secondary data collected from various departments such as district statistical office, agricultural department and other published data of Chamarajanagar district.

MATERIALS AND METHODS

For the present work many statistical methods has been used such as weaver's minimum deviation method for Crop combinations, gibbs and martins method for crop diversification, batiya method for crop concentration, Arc GIS software and simple statistical method for calculate the percentage *etc.* all these has been calculated for the year 2016-17.

RESULTS AND DISCUSSION

In this present study focused on delineation of agricultural regions based on their different kind of components such as demark the crop wise net sown are, crop combination and crop concentration regions, crop diversification regions.

Taluk-wise analysis of net sown area in Chamarajanagar district 2016-17

In the present analysis in the period 2016-17 Food Grains has been occupied large share of net sown area in all the four taluks of the study region. Taluk wise share of net sown area are as follows:

Chamarajanagara taluk

Food grains are occupied large share of net sown area among the taluk that is 41.86 per cent followed by pulses-23.48 per cent, jowar-10.38 per cent, fruits-4.64 per cent, maize-4.51 per cent, vegetables-4.16 per cent, oilseed-3.88 per cent, sugarcane-3.09 per cent, ragi-1.78 per cent, paddy -1.70 per cent and cotton-0.50 per cent. This shown in Table 1.

Gundlupet taluk

In this taluk food grains has occupied 28.33 percentage of net sown area and it is stand in first position among the crops. Oilseed has occupied second position with per cent of 21.66 followed by pulses (15.12 per cent), jowar (11.34 per cent), cotton (10.12 per cent), vegetables (8.23 per cent), ragi (1.01 per cent), maize (0.85 per cent), cotton (0.09 per cent) and paddy (0 per cent).

Kollegala taluk

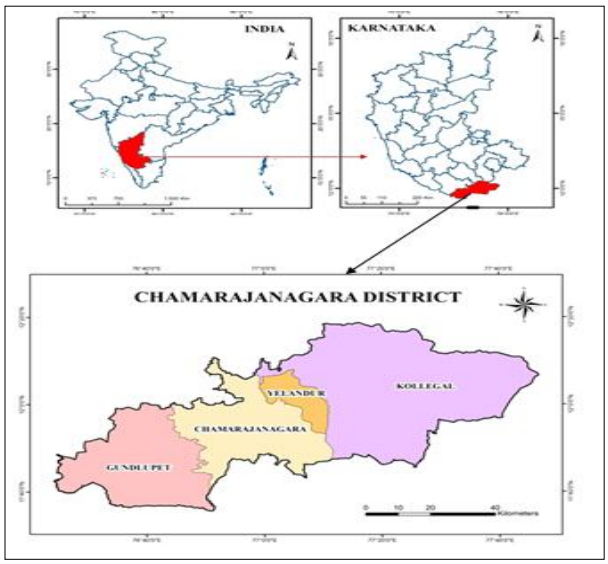
In Kollegalataluk among the eleven crops food grains are the main dominant crop because it has large share of net sown area *i.e.*, 45.38%. Other than this crop maize has second share of net sown area with 22.73 per cent. Pulses have 10.85%, ragi has 6.17%, paddy has 5.53 per cent, vegetable has 2.66%, Cotton has 1.91%, oilseed has 1.63% and jowar has 0.01 per cent of net sown area.

Yalandur taluk

In Yalandurtaluk also food grains (40.91%) are stands in first position among the crops, followed by paddy (16.43%), pulses (15.74%), sugarcane (12.07%), maize (6.21%), fruits (4.45%), ragi (2.53%), vegetables (1.60%) and oilseed (0.05%). This shown in Chart 1.

Taluk-wise analysis of crop combination regions 2016-17

Crop combination is a dynamic concept (Weaver, 1954) the study of crop combination regions is an important aspect because it provides the good basic information (Singh and Dhillon 1984) of the agricultural regionalization. It is a scientific device to study the existing spatial relationship of crops in association with each other in agricultural geography. Weaver's Minimum Deviation (Hussain 1996)



Map 1: Location map of Chamarajanagara district.

Table 1: Talukwise net sown area in Chamarajanagara district -2016-17.

Name of the taluk	Net sown area in percentage										
	Fg	Pu	Jo	Fr	Ma	Veg	Os	Sc	Pa	Ra	Co
Chamarajanagar	41.86	23.48	10.38	4.64	4.51	4.16	3.88	3.09	1.70	1.50	0.50
Gundlupet	28.33	15.12	11.34	3.23	0.85	8.23	21.66	0.09	0	1.01	10.12
Kollegala	45.38	10.85	0.01	2.27	22.73	2.66	1.63	0.85	5.53	6.17	1.91
Yalandur	40.19	15.74	0	4.45	6.21	1.60	0.05	12.07	16.43	2.53	0

Source: District at a Glance- Chamarajanagar District-2016-17.

Note: Fg: Food gains, Pu: Pulses, Fr: Fruit: Ma: Maize, Os: Oilseeds, Pa: Paddy, Ra: Ragi, Co: Cotton.

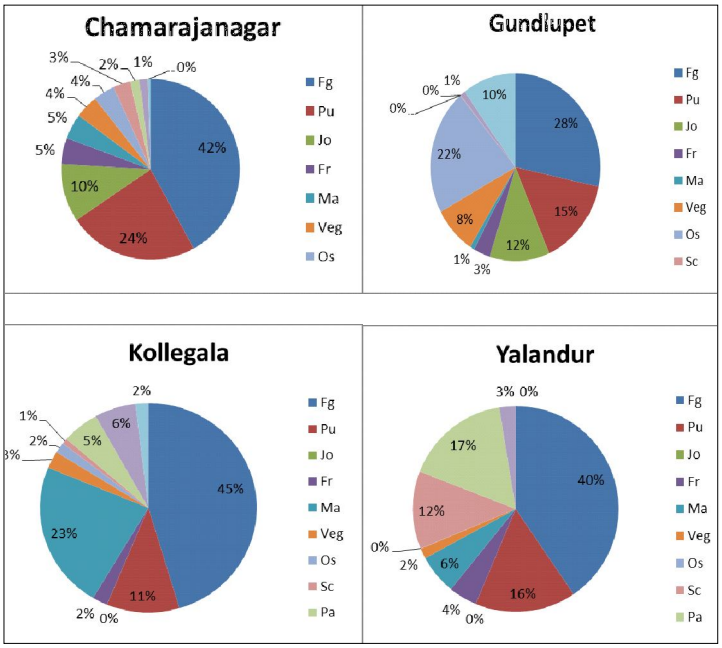


Chart 1: Talukwise net sown area in Chamarajanagara district -2016-17.

Note: Pu-Pulses, Ra-Ragi, Jo-Jowar, Sc-Sugarcane, Pa-Paddy, Ma-Maize, Fg-Fooodgrains, Fr-Fruits, Veg-Vegetables, Co-Cotton, OS-Oilseed.

method has applied for delineate the crop combination regions. He was the first geographer who was used statistical technique to show the crop combination in the field of agricultural geography. In this method Weavers has been used Standard Deviation and their percentage of net sown area. All these are explained below:

Standard deviation

$$S.D. = \frac{\Sigma d^2}{N}$$

Where,

d = is the differences between the actual crop percentage and the appropriate percentage in the theoretical curve.

n = no. of crop in a given combination.

According to weaver's method in Chamarajanagara food grains is the main dominant crop. Based on the minimum deviation method different combination of crops has been identified in all the taluks of the study region. Such as eleven crops combination has been found in Chamarajanagara taluk, six crop combinations has been identified in two taluks they are Gundlupet and Kollegala taluk, five crop combination crops were grown in Yalandur taluk. Among the taluks eleven crops is the highest crop combination in the study region. In the study region there is monoculture found among the taluks and also not found of two, three, four, seven, eight, nine and ten crop combinations. Only they are grown five, six and eleven combinations of crops. Talukwise crop combinations shown in the Map 2 and Table 2.

Talukwise crop concentration in Chamarajanagara district 2016-17

"The variation in the density of any crop in an area or region at a given point of time" is known as crop concentration. Crop concentration (Bhatia, 1965) is mainly depends on its terrain, temperature, moisture and other climatic conditions. The study of crop concentration is helps to analyze the distribution of crops of a region, there are many geographers were used techniques to delineate the crop concentration regions. S S Bhatia's Location Quotient method is adapted to our study of crop concentration. This expressed as follows:

Index of concentration =

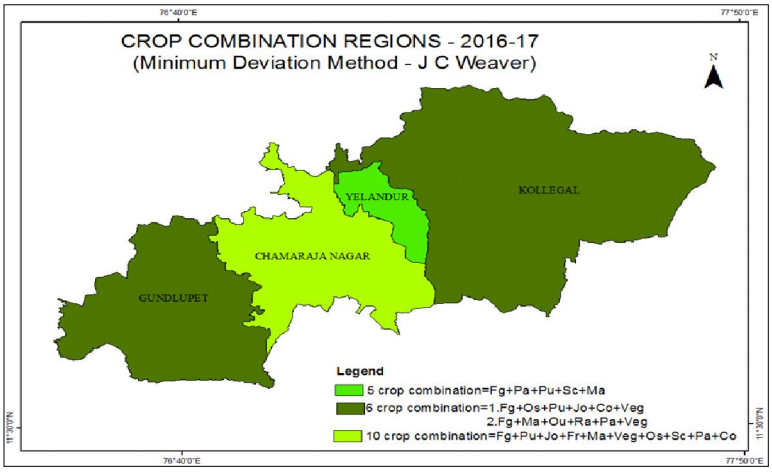
$$\frac{\text{Area of 'a' crop in the component area unit}}{\text{Area of all crops in the component areal unit}} \div \frac{\text{Area of 'a' crop in the entire region/country}}{\text{Area of all crops in the entire region/country}}$$

According to Batia's Location Quotient value crop concentration regions has been classified into three categories they are:

- High Concentration- 0-0.5.
- Medium Concentration -0.6-1.1.
- Low Concentration - >1.1.

Taluk wise pattern of crop concentration of Chamarajanagara district are as follow

The spatial variations in the degree of crop concentration (Samundeeswari and Srinivasan 2018) area are found to be the result of the different interaction (Pradeep Kumar, 2015) such as physiographic, climatic, hydrological, socio-economic and technological factors (Ramesh Chand and Raju, 2009) in organizational of an area. Pattern of crop concentration is shown in Table 3 and taluk wise crop concentration of the study region is follows below:



Map 2: Talukwise crop combination in Chamarajanagara district 2016-17.

Table 2: Talukwise crop combination in Chamarajanagara district 2016-17.

No of crops	Crop combination	No. of taluks	Name of the taluk
Mono crop	Nil	Nil	Nil
Two crop combination	Nil	Nil	Nil
Three crop combination	Nil	Nil	Nil
Four crop combination	Nil	Nil	Nil
Five crop combination	Food grain+Paddy+Pulses+ Sugarcane+Maize	1	Yalandur
Six crop combination	Food grain+Oilseed+Pulses+ Jowar+Cotton+Vegetable	2	Gundlupet
	Food grain+Maize+Pulses+ Ragi+Paddy+Vegetable		Kollegala
Seven crop combination	Nil	Nil	Nil
Eight crop combination	Nil	Nil	Nil
Nine crop combination	Nil	Nil	Nil
Ten crop combination	Food grain+Pulses+Jowar+ Fruits+Maize+Vegetable+ Oilseed+Sugarcane+Paddy+Cotton	1	Chamarajanagar
Eleven crop combination	Nil	Nil	Nil

Source: Computed by author using of weaver's minimum deviation method.

Table 3: Talukwise crop concentration in Chamarajanagara district -2016-17.

Name of the taluk	Crop concentration level		
	High	Medium	Less
Chamarajanagar	Jowar, Ragi, Pulses, Food grains, Sugarcane, Fruits	Paddy, Vegetable	Oil seed, Cotton, Maize
Gundlupet	Jowar, Ragi, Fruits, Vegetable, Cotton	Pulses, Food Grains, Oil seed.	Paddy, Sugarcane, Maize
Kollegala	Paddy, Ragi, Oil seed, Maize	Pulses, Food grains, Fruits, Vegetable	Jowar, Sugarcane, Cotton
Yalandur	Paddy, Ragi, Food grains, Sugarcane, Oil seed, Fruits	Pulses, Maize	Jowar, Vegetable, Cotton

Source: Computed by author-using of bhatia's location quotient method.

Chamarajanagara taluk

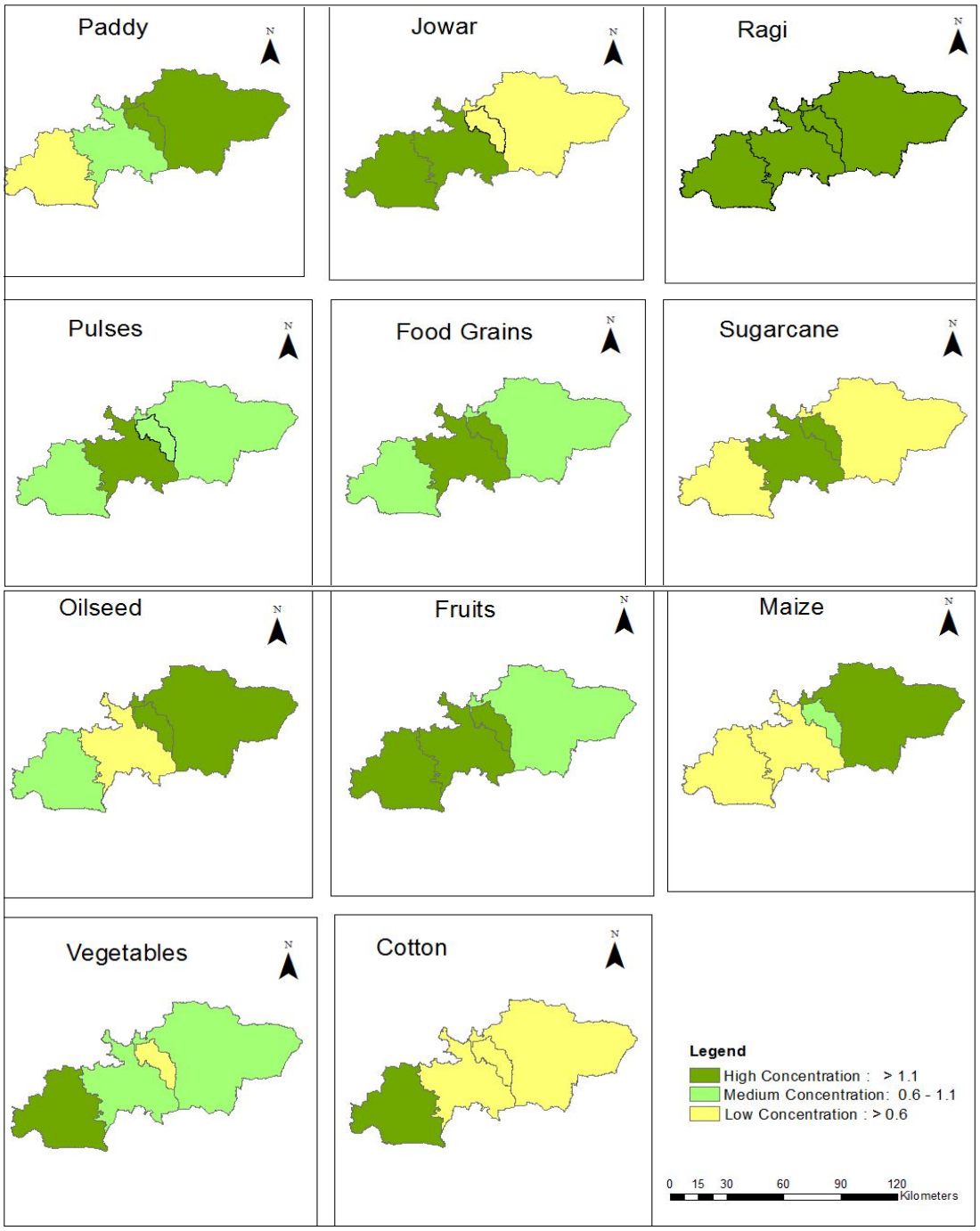
In this taluk jowar, ragi, pulses, food grains, sugarcane and fruits are highly concentrate, paddy, vegetables has medium concentration and maize, oil seed, cotton has low concentration 2016-17.

Gundlupet taluk

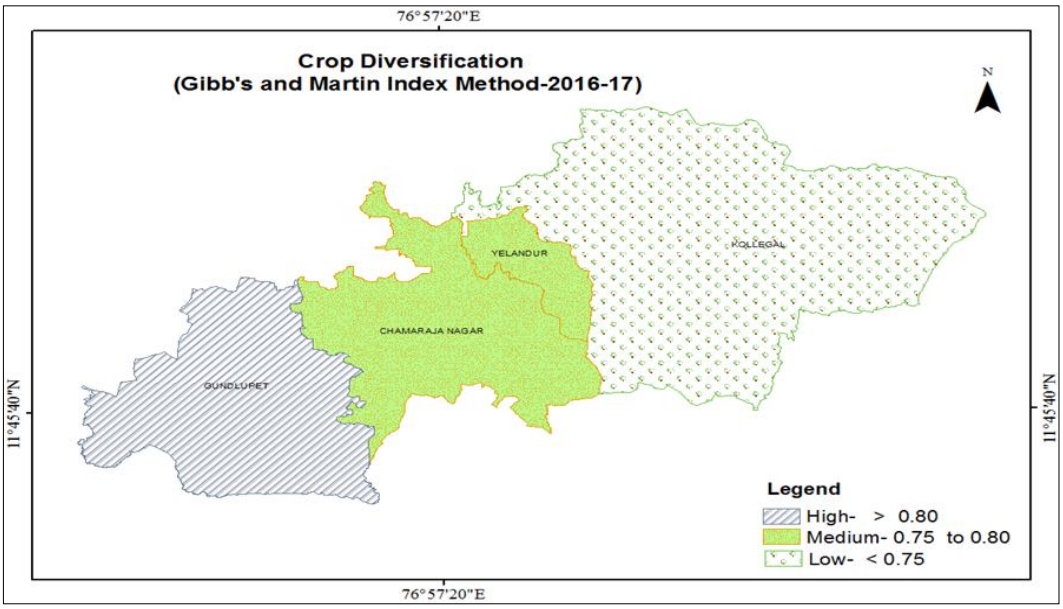
Jowar, ragi, fruits, vegetables and cotton crops are the highly concentrate in this taluk. Pulses, food grains, oil seed has medium concentration, paddy, sugarcane, maize has less concentration.

Kollegala taluk

In this taluk highly concentrate crops are paddy, ragi, oil seed and maize, medium concentrated crops are pulses, food grains, fruits, vegetables, less concentrated crops are jowar, sugarcane, cotton.



Map 3: Talukwise crop concentration (S.S. Bhatia's location quotient method) Chamarajanagara district 2016-17.



Map 4: Talukwise Crop Diversification Index in Chamarajanagara District -2016-17.

Table 4: Talukwise crop diversification index in Chamarajanagara district 2016-17.

Name of the taluk	Diversification index $1 - \frac{\Sigma x^2}{(\Sigma x)^2}$
Chamarajanagar	0.75
Gundlupet	0.83
Kollegala	0.72
Yalandur	0.76

Source: Computed by author.

Yalandur taluk

Paddy, ragi, food grains, sugarcane, oil seed, fruits are highly concentrated, pulses, maize are medium level concentrated, Jowar, vegetables, cotton crops has less concentrated in this taluk.

Taluk wise analysis of crop diversification 2016-17

Crop diversification is opposite to crop specialization (Chand and Chauhan 2002). Diversification is varies from region to region along with time period. Diversified crops were influenced (Ali, 2005, Singh, and Singh 2013) by the soil types, amount of rainfall, availability of irrigation facilities and accessibility of the arable land and using of technology (Dassand Mili, 2012) by the farmers and also depend on the geo-climatic and socio-economic conditions. Higher the level of technology (Thorat, 2007) there is lesser the degree of diversification.

Gibbs and Martin Index of crop diversification (Datta, 2012, Shyani, and Pandya 1998, Vyas, 1996 and Das and Mill 2012) have been adapted to our study to show the degree of crop diversification in each taluk of the district. Index of crop diversification (Chand and Chauan 2002) formula as show below:

$$\text{Index of diversification} = 1 - \frac{\Sigma x^2}{(\Sigma x)^2}$$

Where,

x = Percentage of the total cropped area occupied by each crop or Hectare under individual crop.

Based on diversification value diversified regions (Choudhury *et al.* 2013) has been classified into three categories to show the degree of crop diversification on map. They are as follows:

- High Level of Diversification
- Medium Level of Diversification
- Low Level of Diversification

In the year 2016-17 High level of crop diversity was found in Gundlupet taluk, Medium level of crop diversity of crops found in two taluks namely Chamarajanagara and Yelandur taluk. Low level of crop diversity was noticed in Kollegal taluk.it is depicted on Map 4 and Table 4.

CONCLUSION

In Chamrajanagar district there are eleven crops has been considered to delineate the agriculture regions like their pattern of crop combinations, crop concentration and crop diversification *etc.* they are namely paddy, jowar, ragi, pulses, food grains, maize, oilseed, cotton, fruits, vegetables and sugarcane. Among the eleven crops Food grains are the most dominant crop and it has occupied first position in all the taluks with share of largest net sown area *i.e.*, 38.06 per cent, followed by pulses (16.8%), oilseed (9.13%), maize (8.1%), jowar (7.3%), vegetables (5.00%), Cotton (4.13%), fruits (3.53%), paddy (3.14%), ragi (2.71%) and sugarcane (2.10%). Cultivation of crops has been seen in different types of combinations in the study regions, among the taluks, six, seven and eleven crop combinations has been cultivated in the district. The study of pattern of crop concentration has

been classified into three categories such as high level concentration, medium level concentration and less concentration among the eleven crops. Jowar, Ragi Paddy crops are highly concentrate in the study region. Gibb's and Martin Crop diversification method has been adapted to identify the level of diversification (Choudhury, 2013) in all the taluks. Highly diversified crops has found in Gundlupet taluk, medium level of diversification has found in Chamarajanagar, Yalandurtaluks and less diversification has found in Kollegaltaluk.

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Conflict of interest: None.

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