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### **A Study of Crop Combination Regions in Thiruvananthapuram District, Kerala**

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#### **ABSTRACT**

The agricultural scenario including the cultivation of various crops and their growth are very much related to the existence of a region. It is inevitable for decision making process on one hand and helps in the adaptation of innovation in agriculture. Crop combination regions are one of the important bases for agricultural regionalization. It is helpful in analysing the trends seen in agricultural sector. The ranking of the crops in the study area helps in understanding the significance of each crop in the cropping pattern. On this note, the study of crop combination regions of the Thiruvananthapuram district is carried out. The district is a fast developing administrative centre, still along the midland and highland portions of the district, agriculture have a dominant role. The study carried out using Weaver's method of Crop Combination at panchayat level revealed that, majority of the district is under two crop combination and include twenty six panchayats. The major crops cultivated in the district are coconut, tapioca, rubber, plantain, paddy, vegetables and pepper. The crop combination and ranking helps in highlighting the current scenario of agriculture and can help agriculturalists to suggest plans either to maintain or to modify the trend visible in the district.

**KEYWORDS:** agricultural regionalization, cropping pattern, crop combination, crop ranking

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## **INTRODUCTION**

Cropping pattern is the proportion of area under various crops at a point of time and is a dynamic concept which changes with space and time<sup>1</sup>. It is closely influenced by geo-climatic, socio-cultural, economic, historical and political factors. Crops are generally grown in combination and it is rarely that a particular crop occupies a position of total isolation from other crops in a given area<sup>2</sup>. Crop combination regions provide spatial predominance to certain crops and would ultimately minimize the chance of oversimplified<sup>3</sup>. This analysis has many advantages: firstly, it provides adequate understanding of an individual crop, secondly, combination in itself is an integrative reality that demands definition and distribution analysis and finally these are useful in the construction of more complex structure of vivid agricultural regions<sup>4</sup>. Thus crop combination is a scientific device to study the existing spatial relationship of crops in association with each other. To understand the dominance of agricultural activities in a region and for better planning and development of agriculture, a study on crop combinations is essential<sup>5</sup>.

In order to demarcate regions with different crop combinations, scholars have introduced various methods and the pioneers were Weaver, Thomas, Coppack, Johnson, Rafiullah, Bhatia, Doi, Athawale and Ayyar. Weaver can be regarded as the first geographer who used statistical technique (1954) to show the crop combination of a region. He attempted to delineate agricultural regions of the Middle West in the United States based on acreage statistics.

## **STUDY AREA**

Thiruvananthapuram, the southern most district of Kerala State lies between north latitudes 8° 17' 27" and 8° 51' 41" and east longitudes 76° 40' 25" and 77° 17' 06". The district ranks eleventh in area among the districts of Kerala with an area of 2192 km<sup>2</sup>. The district is bounded by Kottarakkara, Kollam and Pathanapuram Taluks of Kollam district on the north, Ambasamudram Taluk of Thirunelveli district on the east and Vilavancode Taluk of Kanyakumari district of Tamil Nadu on the south and south east and Lakshadweep Sea on the west (Figure 1). The population of the district, according to 2011 census, was 33,01,427 persons.

## **DATA AND METHODOLOGY**

The study used secondary data on crops at panchayat level which were compiled from reports available in various Krishi Bhavans in Thiruvananthapuram district and also from the District Economics and Statistics Department for the year 2015-16. In this study, for the delineation of crop combination regions in study area, Weaver's technique of crop combination has been adopted. Weaver's method has been accepted and applied widely for the demarcation of crop combination

region and agricultural regionalization as its application results in suitable and accurate grouping of crops.

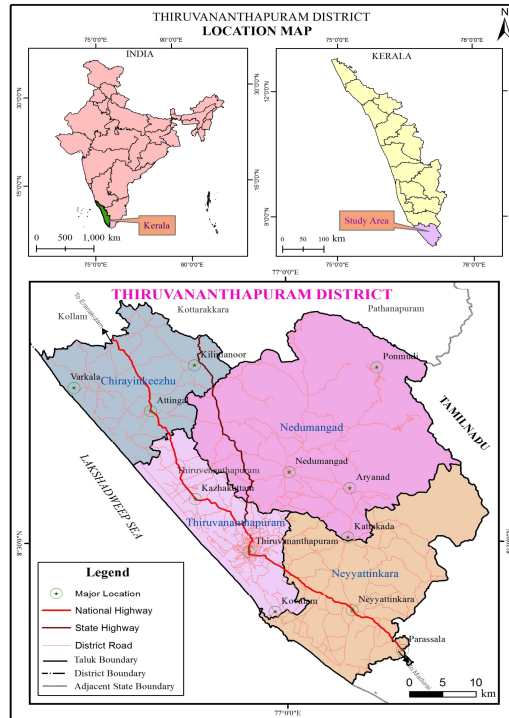


Figure 1. Study Area

In Weaver's method, the crop combination is measured by calculating the deviation of real percentages of crops (occupying over one percent of the cropped area) for all possible combinations in the component area units against a theoretical standard. The theoretical distribution for the standard measurement was employed as follows:

- Monoculture = 100 percent of the total harvested crop land in one crop
- 2- crop combination = 50 percent in each of two crops
- 3- crop combination = 33.33 percent in each of three crops
- 4- crop combination = 25 percent in each of four crops
- 5- crop combination = 20 percent in each of five crops etc.

For the determination of the combination regions, the standard deviation method was used:

$$S.D = \frac{\sum d^2}{n}$$

where, 'd' is the difference between the actual crop percentage in a given regional unit and the percentage in the theoretical distribution and 'n' is the number of crops in a given combination. Firstly the percentage of individual crop area to the total cropped areas of each panchayats has been calculated and thereafter the values of each crop was arranged in rank wise from higher to lower then

the deviation was calculated by applying the above mentioned formula. The lowest value of the deviation of actual percentages from the theoretical curve is denoted as crop combination resulting into the identity and the number of crops in the basic combination. In monoculture 100% of the region is under a single crop, in two crop combination 50% of the region is under one crop and the rest 50% by the second crop and so on will divide the region according to the number of combinations. The increase in the number of crops in a crop combination of the region points to the increasing diversification of crops cultivated in the area.

## **RESULT AND DISCUSSION**

Based on the data, main crops cultivated in the district include coconut, tapioca, rubber, plantain, paddy, vegetables, pulses, pepper etc. The crop combination analysis considered sixteen seasonal crops and nine tree crops for the year 2015-16. About seven crop combinations have been identified for the panchayats. Monoculture prevails in thirteen panchayats of the district which cover 16.66 percent of the total area of panchayats and about 10.90 percent of the total cropped area (Table 1). Anchuthengu, Athiyannur, Elakamon, Kadinamkulam, Kanjiramkulam, Karumkulam, Kottukal, Poovar, Thirupuram, Uzhamalackkal, Vakkom, Vellarada and Venganoor are single crop dominant panchayats (Figure 2).

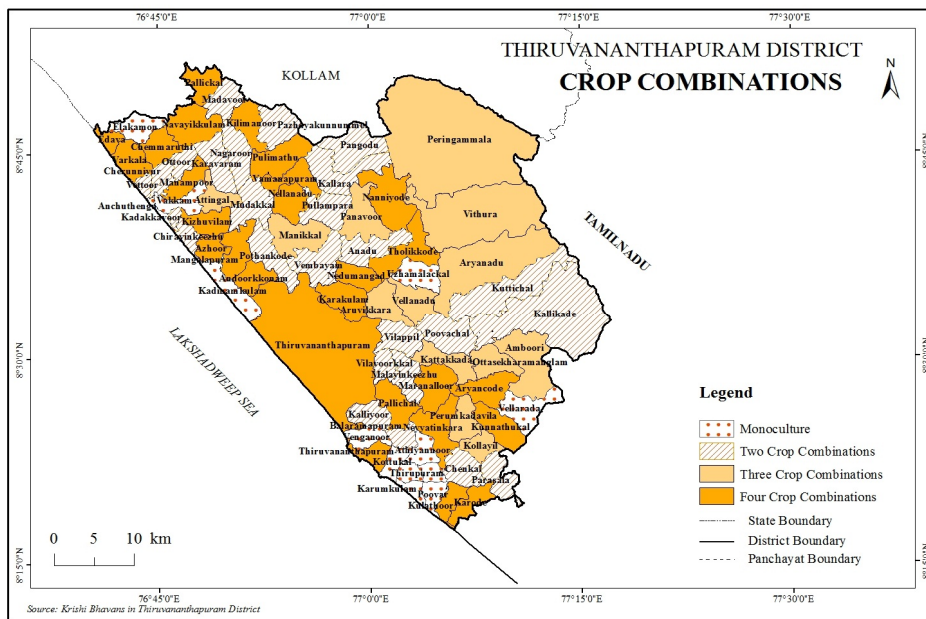
Among the single dominant crop category, coconut is the dominant crop in eleven panchayats and rubber is the dominant crop in two panchayats. Coconut is seen more common along the panchayats near to the coast where as rubber is found in Vellarada and Uzhamalackkal panchayats, which are lying along the highland portion of the district (Figure 2). Two crop combinations are identified for the twenty six panchayats (Table 1). This is the common combination found in the district and covers 35.56 percent of the total cropped area. In this, rubber and coconut combinations are the common combinations followed by coconut and plantain, and coconut and tapioca. Three crop combinations are found in twelve panchayats and one municipality, Attingal and covers 17.44 percent of the total cropped area of the district. The important combinations observed include rubber, coconut and plantain, coconut, plantain and tapioca, coconut, rubber and plantain.

Table 1: Types of Crop Combinations Identified in Thiruvananthapuram District

Sl.No.	Types of Crop Combination	No. of Panchayats/ Corporations	Percent to total Panchayats/Corporation	Percentage of area
1	Monoculture	13	16.66	10.90
2	Two crop Combination	26	33.33	35.56
3	Three crop combination	13	16.66	17.44
4	Four crop combination	13	15.4	19.26
5	Five crop combination	7	8.97	7.87
6	Six crop combination	3	5.1	3.88
7	Seven crop combination	3	3.84	5.08
8	Total	78	99.96	100

Source: Krishi Bhavans in Thiruvananthapuram District

Four crop combination regions occupy second highest in the total cropped area with 19.25 percent devoted for it. Ten panchayats and two municipalities i.e. Neyyattinkara and Nedumangad and the corporation area come under this combination.



Source: Krishi Bhavans in Thiruvananthapuram District

Six panchayats and Varkala municipality comes under five crop combination regions which has 7.87 percent area under it. Three panchayats each with six and seven crop combinations occupying 3.88 and 5.08 percent of the area respectively are the other crop combinations found in the district.

### Crop ranking

The ranking of the crops in the district was helpful in understanding the significance of each crop in the cropping pattern. There are four first ranking crops in the district (Table 2). Coconut is the common crop and is included in the combinations of 37 panchayats and three municipalities of Attingal, Neyyattinkara and Varkala and the corporation area. Rubber is the important crop in thirty two panchayats and in Nedumangad municipality, mixed trees in three and plantains in one panchayat. Seven crops occupy the second position ie, coconut, plantain, rubber, mixed trees, tapioca, paddy and pepper. Among these, coconut is cultivated in 28 panchayats as second crop (Table 2). Plantain and tapioca are the other important crops that belong to this rank which were seen in twelve and ten panchayats respectively. Rubber is found in eight panchayats, mixed trees in four and paddy and pepper in one each. As third rank crops, seven crops viz. tapioca, coconut, plantain, mixed trees, rubber, paddy and other crops are identified. Plantain is common in eighteen panchayats followed by tapioca in nine, coconut in four, mixed trees, rubber and paddy in each of the two panchayats and one in other crops category.

**Table 2: Ranking of Crops in Thiruvananthapuram District**

Sl.No.	Name of the Crop	Crop Ranking						
		1	2	3	4	5	6	7
1	Paddy	-	1	2	1	2	-	-
2	Coconut	41	28	4	-	-	-	-
3	Rubber	33	8	2	4	2	2	-
4	Plantain	1	12	18	4	3	-	-
5	Mixed trees	3	4	2	3	1	-	-
6	Tapioca	-	10	9	8	1	-	-
7	Vegetables	-	-	-	3	-	-	1
8	Pepper	-	1	-	1	-	1	2
9	Others	-	-	1	1	-	-	-

Source: Krishi Bhavans in Thiruvananthapuram District

### Spatial spread of crops

Spatial analysis of the cropping pattern revealed that, coconut forms the prominent crop in the district, which covers almost all of the coastal panchayats and the midland region. Rubber is mainly seen in midland and highland regions.

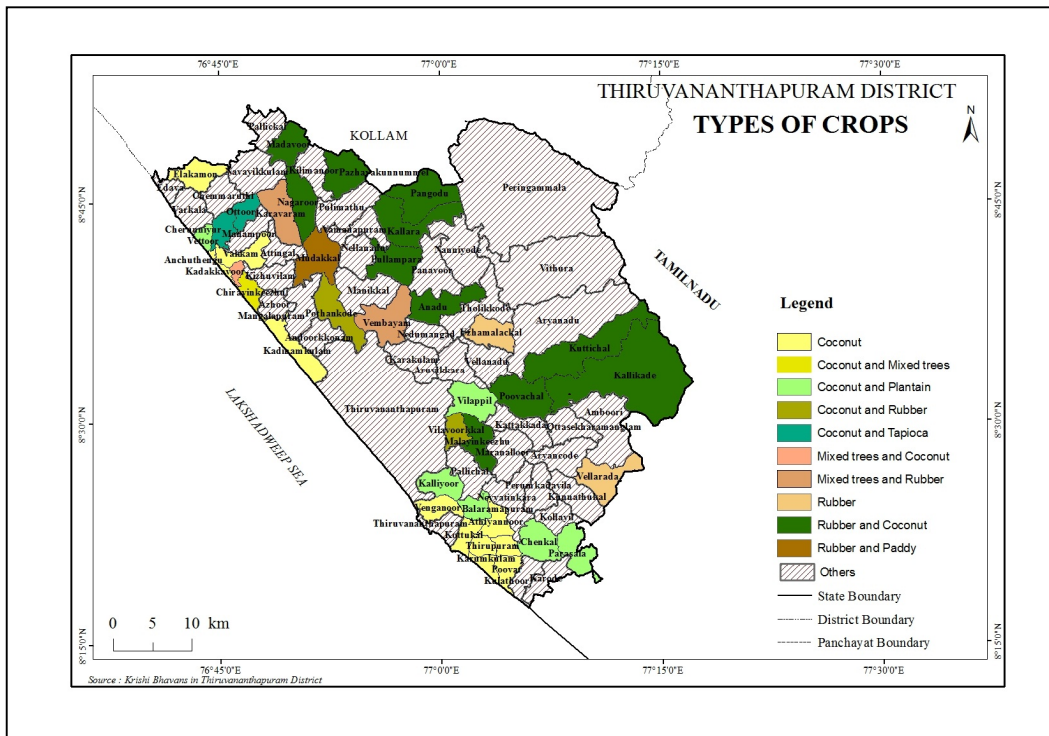
**Table 3: Crop Combination in Various Administrative Divisions of Thiruvananthapuram District**

Crop Types	Crop Combination	Panchayats/ Corporation/ Municipalities
1	Coconut	Anjuthengu,Athiyannur,Elakamon,Kadinamkulam,Kanjiramkulam Karumkulam,Kottukal,Poovar, Thirupuram,Vakkom,Venganoor
1	Rubber	Uzhamalackkal, Vellarada
2	Rubber and Coconut	Uzhamalackkal, Vellarada, Anad, Kallara, Kallikkad, Kuttichal, Madavoor,Malayinkeezhu,Nagaroor, Pangode, Pazhayakunnumel, Poovachal, Pothencode,Pullamppara, Vilavoorkkal
2	Coconut and Plantain	Balaramapuram, Chenkal, Kalliyoor, Parassala, Vettor, Vilappil
2	Coconut and Tapioca	Cherunniyoor, Ottoor, Chirayinkeezhu,Kadakkavoor, Mudakkal
2	Mixed trees and Rubber	Vembayam, Karavaram
3	Coconut, Rubber and Plantain	Aryanadu, Aruvikkara,Kattakada, Kollayil, Ottasekharamangalam, Perumkadavila, Vellanad
3	Coconut, Plantain and Tapioca	Attingal Municipality, Manikkal, Vithura, Panavoor
3	Rubber, Pepper and Coconut	Amboori, Peringamala
4	Coconut, Plantain, Tapioca and Rubber	Azhoor,Karode, Kunnathukal, Maranalloor, Nedumangad Municipality, Neyyatinkara Municipality, Pallichal, Pallickal,Pulimath, Edava, Karakulam, Nanniyode
4	Coconut, Mixed trees, Tapioca, ,Plantain,	Thiruvananthapuram Corporation
5	Coconut, Tapioca, Paddy, Rubber and Plantain	Andoorkonam, Edava
5	Rubber, Coconut, Plantain, Tapioca and Pepper	Tholicode, Varkala Municipality, Aryancode, Chemmaruthi, Nellanad
6	Coconut, Tapioca, Rubber, Paddy, Plantain and Pepper	Killimanoor, Kizhuvilam, Kulathoor
7	Rubber, Coconut, Plantain, Tapioca, Mixed trees, Paddy and Vegetables	Vamanapuram,Navaikulam, Mangalapuram

Source: *Krishi Bhavans in Thiruvananthapuram District*

Among the seasonal crops, tapioca is seen in Chemmaruthi, Navaikulam, Edava, Elakamon, Kizhuvilam, Azhoor, Karode, Kulathoor, Pallichal and Maranalloor panchayats (Table 3).

The crop plantain does not show any spatial trend and is seen cultivated in all parts of the district. But considering the majority, most of these panchayats lie in the midland and lowland regions (Figure 3). Paddy cultivation is seen scattered and is grown in many panchayats but the area covered under this is very less compared to that of the other crops.



The spatial analysis revealed that even though the tree crops like coconut, rubber etc. follow some spatial trends, majority of the seasonal crops are found scattered along the panchayats without having much spatial relevance.

The highlights of the study are:

- The district possesses seven crop combinations regions.
- Two crop combination regions cover more area in the district and include twenty six panchayats.
- Major crops cultivated in the district are coconut, tapioca, rubber, plantain, paddy, vegetables and pepper.
- Coconut is the single dominant crop in eleven panchayats and it occupies the first position in the forty units, where as rubber is the dominant crop only in two panchayats and holds the first position in 33 units.
- Coconut cultivated in almost all parts of the district is more concentrated along midland and lowland areas, where as rubber is seen more common in the midland and highland regions.

## CONCLUSION

A systematic study of crop combinations is of great significance as it gives an integrated assemblage of the various crops grown in an areal unit and a comprehensive and clear understanding of the agricultural mosaic of an agro-climatic region. It is useful for planners for the planning and development of its agriculture.



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