

CROP DIVERSIFICATION INDEX: A CASE STUDY OF TAMIL NADU STATE (2015-2016)

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ABSTRACT - Crop diversification is one of the major components of diversification in agriculture. Crop diversification is intended to give a wider choice in the production of a variety of crops in a given area so as to expand production related activities on various crops and also to lessen risk. Crop diversification in India is generally viewed as a shift from traditionally grown less remunerative crops to more remunerative crops. Diversification is the process to take advantage of emerging opportunities created by technology, new markets, changes in policy etc. to meet certain goals, challenges and threats and to reduce risk (Chand and Chauhan, 2002). The study area is located in-between 8° 5' and 13° 35' of northern latitude and 76° 15' and 80° 20' of eastern longitude with an area of 130,058 km². Tamil Nadu has historically been an agricultural state, while its advances in other fields launched the state into competition with other areas. In this study, statistical techniques are used for deriving the results and cartographic methods are used for mapping the results. Gibbs and Martin's method (1962) is used to demarcate crop diversification regions. Results clearly show a low diversification index value in the coastal districts, moderate in some districts, and higher values in the central districts of Tamil Nadu.

Key words: diversification, Gibbs and Martin, GIS, paddy, sugarcane, groundnut

INTRODUCTION

“Crop diversification has emerged an important alternative to attain the objectives of output growth, employment generation and natural resources sustainability in the developing countries. The recent experience in Asia, particularly southeast Asia, Middle East and North Africa indicates that policy makers and planners are increasingly focusing on crop diversification to promote agricultural development” (Petit and Barghouti, 1992). The crop diversification means competition among various grown crops for space in a given region. It also means raising a variety of crops involving intensity of competition amongst field crops for arable land, the keener the competition, the higher the magnitude of crop diversification. It is a concept which is opposite to crop specialization. It is an indicator of multiplication of crops which obviously involves intensive competition among the growing crops (Jasbir and Dhillon, 1984). Crop diversification also provides relationship between the relative areal strength of the crops grown in a region. The magnitude of crop diversification shows the impact of physical, socioeconomic and technological influence on cropping pattern of an area (Husain, 1996). The crop diversification is the product of action, reaction interaction among the physical and non-physical environment (Sohal, 2003). In the face of shrinking natural resources and an increasing demand for food and agricultural production due to high population and income growth, crop diversification is the main course of future growth of agriculture.

Diversification is gradually taking place as a consequence of either launching macro-economic reforms in agriculture sector or rising domestic demand due to urbanization and increasing income levels. Crop diversification has been recognized as an effective strategy for achieving the objectives of food security, nutrition security, income growth, poverty alleviation, and employment generation, judicious use of land and water resources, sustainable agricultural development and environmental

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improvement. The ability of the country to diversify the cropping pattern for attaining various goals depends on the opportunities available for diversification, the need for diversification and responsiveness of the farmers to these needs and opportunities. The opportunities for crop diversification emerge from technological breakthroughs, changes in demand pattern, development of irrigation, availability of marketing infrastructure and new trade arrangements.

The necessity for crop diversification arise on account of the need for:

- 1) reducing risks associated with yield, market and prices;
- 2) arresting the degradation of natural resources and the environment and
- 3) attaining national goals like employment generation, self-reliance in critical crop products and for earning foreign exchange.

STUDY AREA

Tamil Nadu State is situated at the south-eastern extremity of the Indian Peninsula bounded on the north by Karnataka and Andhra Pradesh, on the east by the Bay of Bengal, on the south by the Indian Ocean and on the west by Kerala State (Figure 1). It lies between 8° 5' and 13° 35' of northern latitude and 76° 15' and 80° 20' of eastern longitude with an area of 130,058 km².

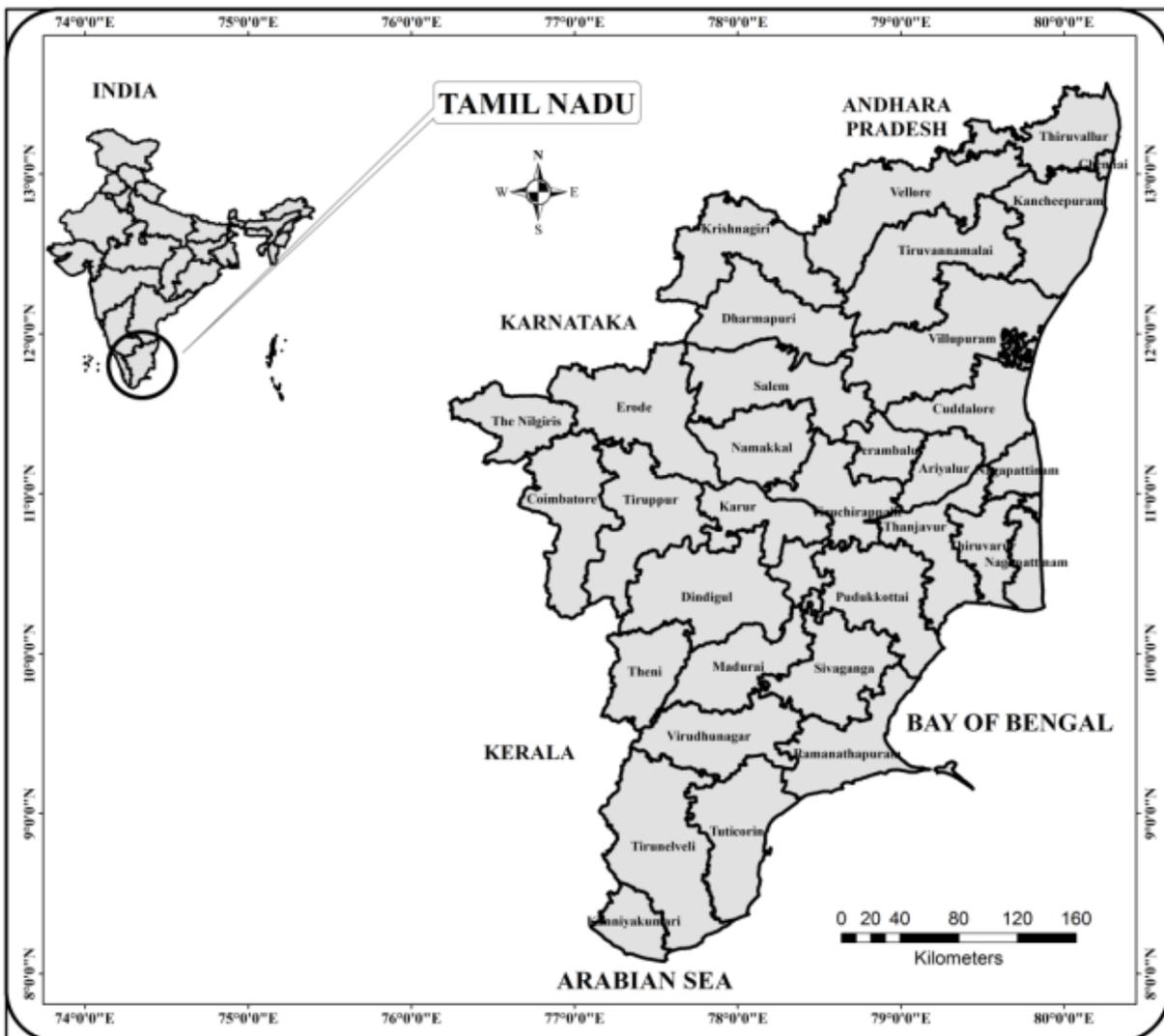


Figure 1. Location of Tamil Nadu State on the Indian Peninsula

Tamil Nadu agriculture is the most overriding sector in the economy of the state. Around 70%

of the state's population is involved in agricultural activities as this is one of the major means of livelihood in Tamil Nadu. In these regions all rivers are east flowing rivers. The Eastern Ghats are not a complete watershed and, as a result, the river pierces through them and notable among them is the river Cauvery. Tamil Nadu lies to the South of the Tropic of Cancer and falls in Torrid Zone. The Bay of Bengal and the Indian Ocean influence the climate of the coastal region. The forest covers nearly 17% of the total area of the region. Tamil Nadu has historically been an agricultural state, while its advances in other fields launched the state into competition with other areas. The study area is the leading producer of paddy, cumbu, corn, maize, rye, green gram, black gram, coconut, groundnuts, oil seeds and sugarcane.

The main objectives of the paper are (1) to study the cropping pattern of Tamil Nadu State; (2) to understand the techniques of crop diversification; (3) to examine the crop diversification index for the districts of Tamil Nadu State.

MATERIAL AND METHODS

The present study is based on secondary sources of data which is collected from the Agriculture Department, State Offices, PWD complex, Chennai -05. Statistical techniques are used for deriving the results and cartographic methods are used for mapping the results. For calculating the index of crop diversification, the following techniques, namely Gibbs and Martin (1962) are used. The above mentioned techniques are explained below:

$$\text{Index of Crop Diversification} = 1 - \frac{\sum X^2}{(\sum X)^2}$$

Where 'X' stands for the percentage of total cropped area under an individual crop.

RESULTS AND DISCUSSION

Cropping Pattern

The distribution of crop in a region or areal unit may be determined on the basis of a real strength of individual crops. The first, second, and third rank crop of an areal unit may be called as the dominant crops of that unit. These crops, if occupying more or less the same percentage of the total cropped area, shall be competing for area with each other and the farmer will decide which crop may fetch him more profit in a given year under the prevailing rainfall and demand, supply and commodity price condition.

Paddy

Paddy productivity in Tamil Nadu has always been the second highest in the country, next only to Punjab. The total paddy area in the period 2015-2016 amounted to 2.05 million hectares. The season-wise areas were 15.7 per cent in Kuruvai (months of sowing in June-July), 74.7 per cent in Samba (months of sowing in July-October) and 9.6 per cent Navarai (months of sowing in December-January).

During the year 2015-2016 (Figure 2), the distribution of paddy crop was high in the coastal part of Tamil Nadu, namely in Kancheepuram, Ramanathapuram, Sivagangai, Thiruvallur, Thanjavur, Nagappattinam, Pudukkottai, Thiruvarur, Thiruvannamalai, Thirunelveli, Cuddalore, and Madurai districts. A moderate distribution was recorded in Villupuram, Trichy, Vellore, Ariyalur and Virudhunagar districts. The distribution was low in the remaining districts.

Cholam

Cholam (sorghum) is cultivated mainly for grain and fodder purposes. Cholam is a major growing area in Tamil Nadu. The total area in 2015-2016 was 11.8 per cent in total area sown by districts. Figure 3 shows that the distribution of Cholam crops was moderate in Namakkal districts and low in Karur, Dindigul, Tiruppur, Tiruchirappalli, Coimbatore, Salem, Virudhunagar, Dharmapuri, Madurai, Theni, Tuticorin, Vellore, Ramanathapuram, Krishnagiri, Tirunelveli,

Perambalur, Ariyalur, Sivaganga, Pudukkottai, Tiruvannamalai and Villupuram. In all the other districts the value was nil.

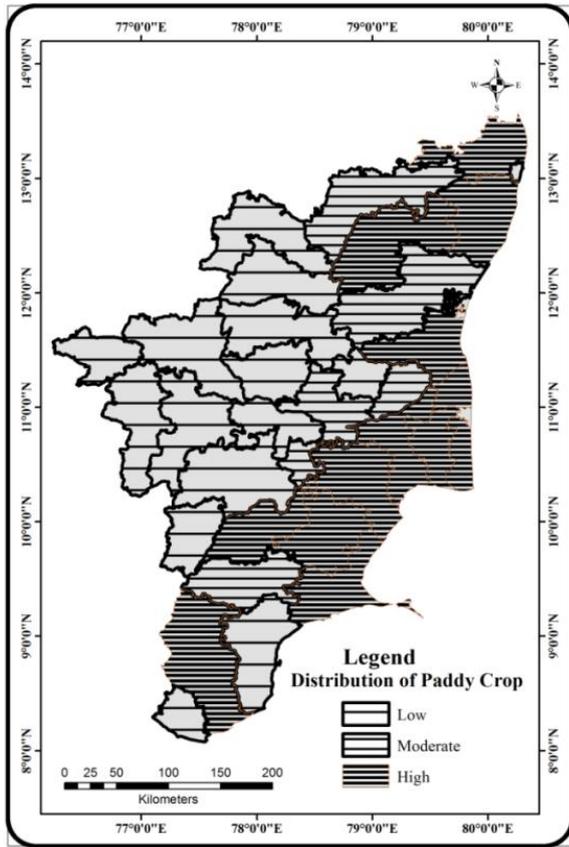


Figure 2. *Distribution of paddy (2015-2016)*

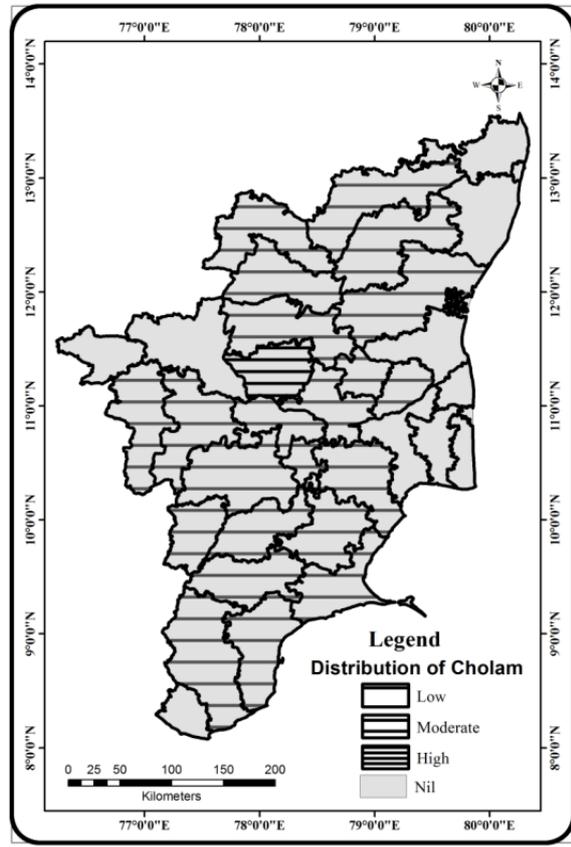


Figure 3. *Distribution of cholam crops (2015-2016)*

Cumbu

Cumbu (pearl millet) is one of the most extensively cultivated cereals in the world, particularly in arid to semi-arid regions. India is the largest producer in the crop and Tamil Nadu covers 1.4 per cent of the country production. The total cultivated area was 0.12 million hectares in the year 2015-2016.

Figure 4 indicates that the distribution of cumbu was low in Tuticorin, Villupuram, Virudhunagar, Tiruvannamalai, Madurai, Theni, Vellore, Cuddalore, Karur, Thiruvallur, Ariyalur, Dharmapuri, Tiruchirappalli, Salem, Dindigul, Ramanathapuram, Krishnagiri, Tiruppur, Perambalur, and Tirunelveli districts while the value was nil in the remaining districts.

Ragi

Ragi (finger millet) is a staple food for the folk of south India. This is a widely cultivated crop in the tropical and subtropical regions of the world. In 2015-2016, the total cultivated area amounted to 3.3 per cent in total area sown by districts.

Figure 5 shows that in 2015-2016 the distribution of ragi crop was low in Krishnagiri, Dharmapuri, Vellore, Erode, Salem, Tiruvannamalai, Villupuram, Thiruvallur, Ramanathapuram, Kancheepuram, Namakkal, Karur, Sivaganga, Virudhunagar, Tuticorin, and Tirunelveli districts and it was nil in the remaining districts.

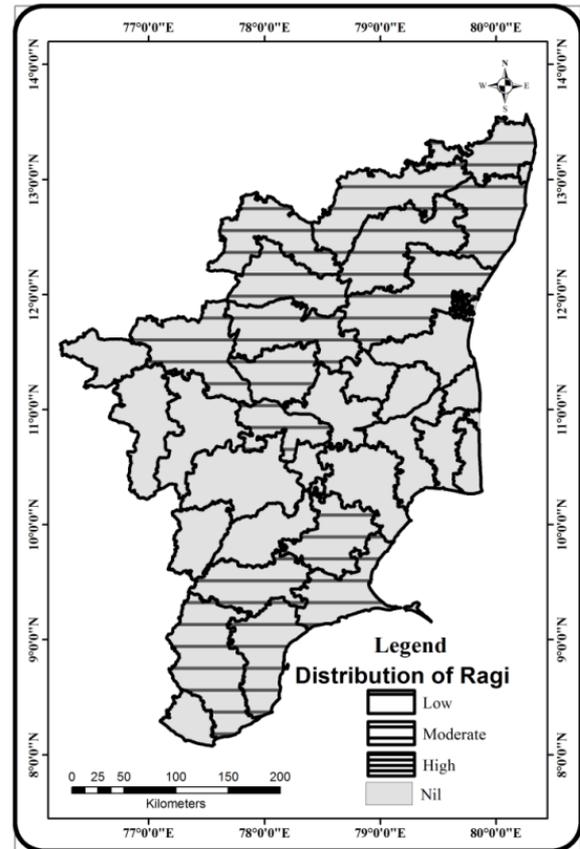
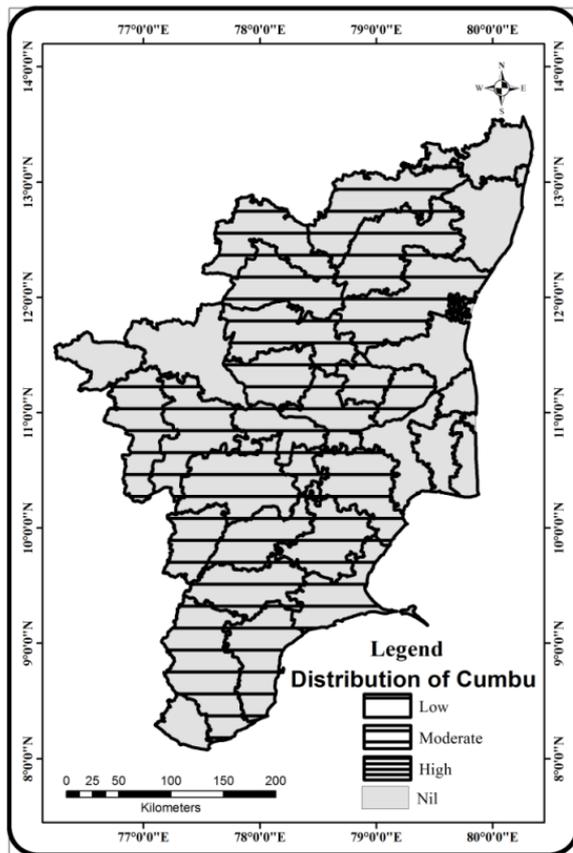


Figure 4. *Distribution of cumbu crops (2015-2016)* **Figure 5.** *Distribution of ragi crops (2015-2016)*

Sugarcane

Sugarcane, a member of the grass family, is a tall tropical and sub-tropical variety with a hard, thick stem which grows to a height of 3.5 meters or more. Sugarcane is cultivated in 11 per cent of the study area and in nearly 6 per cent of the country area cultivated with this crop. About two-thirds of the total area is cultivated in Tamil Nadu.

The distribution of sugarcane in Tamil Nadu, in 2015-2016, is presented in Figure 6. The distribution was low in Villupuram, Erode, Tiruvannamalai, Cuddalore, Namakkal, Perambalur, Ariyalur, Sivaganga, Theni, Thiruvallur, Pudukkottai, Vellore, Dharmapuri, Karur, Tiruppur, Thanjavur, Salem, Madurai, Virudhunagar, Tiruchirappalli, Kancheepuram, Tirunelveli, Dindigul, Nagapattinam, Coimbatore, Krishnagiri, Ramanathapuram, Thiruvavarur, and Tuticorin districts and it was nil in the remaining districts.

Cotton

Cotton is an important commercial crop. Tamil Nadu traditionally grows cotton in an area of about 0.2 million hectares and produces about 0.6 million. Coimbatore is known as the Manchester of south India.

Figure 7 shows that the cotton distribution was low in Perambalur, Virudhunagar, Tiruchirappalli, Ariyalur, Madurai, Dharmapuri, Salem, Vellore, Tuticorin, Cuddalore, Dindigul, Tirunelveli, Villupuram, Thiruvavarur, Theni, Ramanathapuram, Krishnagiri, Namakkal, Nagapattinam, Thanjavur, Tiruppur, Erode, Coimbatore, Sivaganga, Karur, and Tiruvannamalai district and remained nil in the other districts.

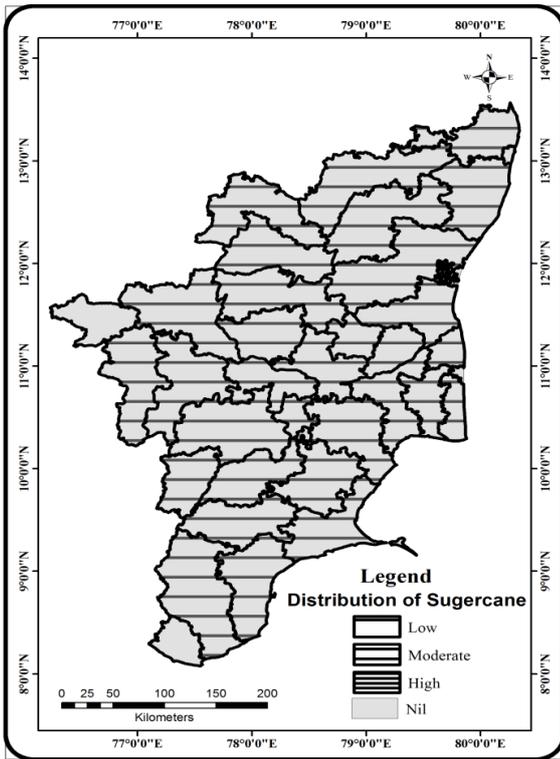


Figure 6. *Distribution of sugarcane crops (2015-2016)*

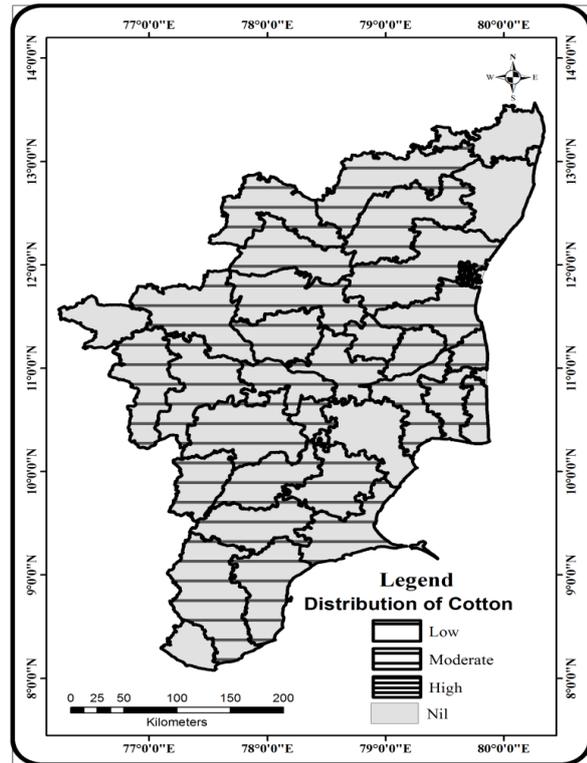


Figure 7. *Distribution of cotton crops (2015-2016)*

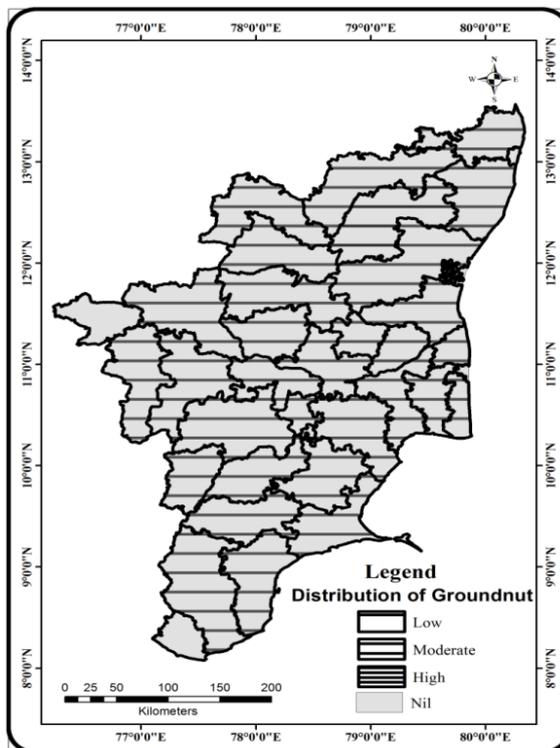


Figure 8. *Distribution of groundnut crops (2015-2016)*

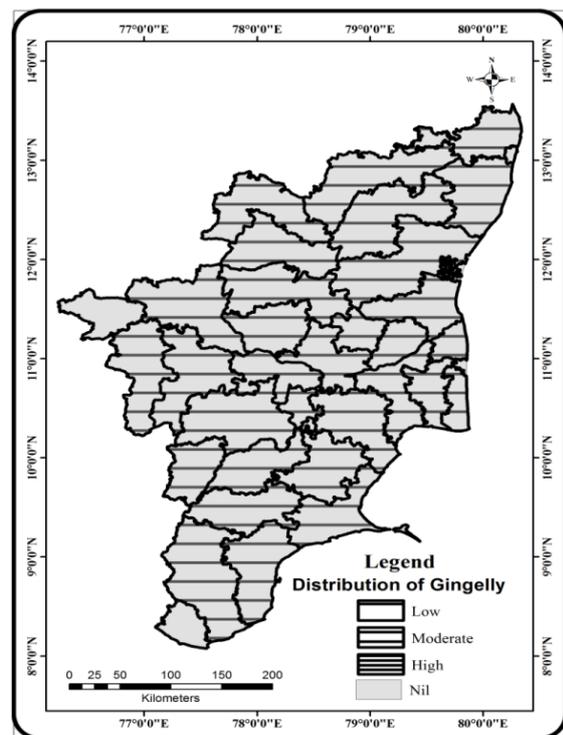


Figure 9. *Distribution of gingelly crops (2015-2016)*

Groundnuts

Groundnuts, also known as peanuts, are the seeds of a low-growing leguminous plant. It is the second most important industrial crop. In the study area, the area cultivated with groundnut crops is about 338,000 hectares.

The distribution of groundnut crops in Tamil Nadu is represented in Figure 8. A moderate distribution was recorded in Tiruvannamalai and a low distribution in Vellore, Namakkal, Erode, Kancheepuram, Ariyalur, Salem, Villupuram, Pudukkottai, Krishnagiri, Tiruchirappalli, Karur, Thiruvallur, Tiruppur, Dharmapuri, Dindigul, Virudhunagar, Sivaganga, Cuddalore, Coimbatore, Perambalur, Madurai, Theni, Ramanathapuram, Thanjavur, Tirunelveli, Nagapattinam, Thiruvarur, and Tuticorin districts. Distribution remained nil in the other districts.

Gingelly

India is the second largest producer of gingelly (Indian sesame) in the world. It is widely preferred for its qualities of high drought tolerance and the highest oil content in the seeds. In Tamil Nadu, in 2015-2016, gingelly production was around 17,179 tonnes from an area of 33,181 hectares, with a productivity of 613 kg/ha.

According to Figure 9, the distribution of gingelly was recorded in Karur, Erode, Thanjavur, Theni, Villupuram, Cuddalore, Salem, Pudukkottai, Kancheepuram, Dharmapuri, Tiruchirappalli, Ariyalur, Tiruppur, Namakkal, Thiruvallur, Madurai, Ramanathapuram, Tirunelveli, Perambalur, Virudhunagar, Krishnagiri, Coimbatore, Dindigul, Tuticorin, Tiruvannamalai, Nagapattinam, Thiruvarur, Sivaganga, and Vellore districts and was nil in the remaining districts.

Crop diversification

Crop diversification may be adopted as a strategy for profit maximization through reaping the gains of complementary and supplementary relationships or in equating substitution and price ratios for competitive products. It also acts as a powerful tool in minimization of risk in farming. These considerations make a strong case for farm/crop diversification in India (Gupta and Tewari, 1985). Crop diversification in India is generally viewed as a shift from traditionally grown less remunerative crops to more remunerative crops.

DISCUSSION

Gibbs and Martin's method is directly related to the magnitude of diversification. The higher the index, the higher the diversification, and the lower the index, the lower the magnitude of diversification. According to Gibbs and Martin's formula, the overall index value of crop diversification of the study region was 0.84 in 2015-2016. It varied from 0 in Nilgiris and Kanyakumari district to 0.80 in Dharmapuri district. The spatial variations in the region under analysis are divided into three categories. These categories are discussed in Figure 10 and Table 1.

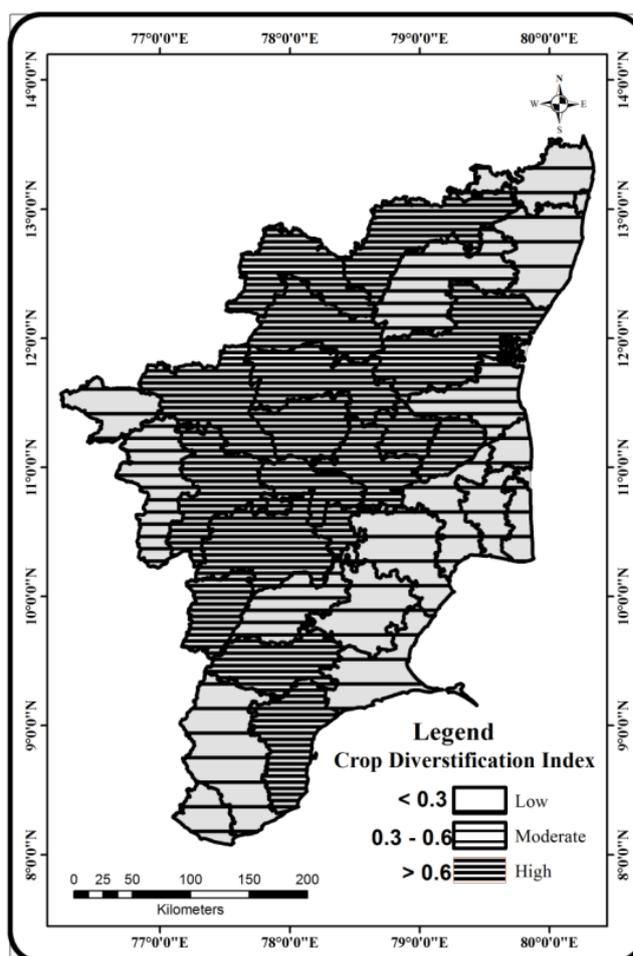


Figure 10. Crop Diversification Index

Table 1. Index of Crop Diversification in Tamil Nadu State in 2015-2016

No.	District	C.D. Index	No.	District	C.D. Index
1	Kancheepuram	0.23	17	Ariyalur	0.68
2	Thiruvallur	0.24	18	Pudukkottai	0.23
3	Cuddalore	0.43	19	Thanjavur	0.18
4	Villupuram	0.62	20	Thiruvarur	0.07
5	Vellore	0.70	21	Nagappattinam	0.07
6	Thiruvannamalai	0.57	22	Madurai	0.52
7	Salem	0.79	23	Theni	0.75
8	Namakkal	0.65	24	Dindugal	0.64
9	Dharmapuri	0.80	25	Ramanathapuram	0.17
10	Krishnagiri	0.67	26	Virudhunagar	0.73
11	Coimbatore	0.41	27	Sivagangai	0.19
12	Thiruppur	0.66	28	Thirunelveli	0.21
13	Erode	0.73	29	Tuticorin	0.73
14	Trichy	0.66	30	Nilgiris	0.0
15	Karur	0.71	31	Kanyakumari	0.0
16	Perambalur	0.69		Tamil Nadu	0.84

(a) Areas with high crop diversification (> 0.60 index value)

This category covered the districts of Villupuram, Vellore, Salem, Namakkal, Dharmapuri, Krishnagiri, Thiruppur, Erode, Trichy, Karur, Perambalur, Ariyalur, Theni, Dindugal, Virudhunagar and Tuticorin. The high diversification index found in the centre districts of Tamil Nadu is due to dry climatic condition and other factors. Drought resistant crops and short time crops are only cultivated in this region due to shortage of ground and surface water.

(b) Areas with moderate level of crop diversification (0.3 to 0.60 index value)

Cuddalore, Thiruvannamalai, Coimbatore, and Madurai districts were included in this category. In these districts, the farmers prefer to grow only those crops which respond well in the prevailing physical conditions of these areas. Due to the suitability of physical environment, the level of crop diversification was moderate in the above mentioned districts.

(c) Areas with low level of crop diversification (< 0.3 index value)

This category included the districts of Kancheepuram, Thiruvallur, Pudukkottai, Thanjavur, Thiruvarur, Nagappattinam, Ramanathapuram, Sivagangai, Thirunelveli, Nilgiris, and Kanyakumari. The index value of crop diversification varied between 0 and 0.24 in Kanyakumari and in Thiruvallur, respectively. The value of the crop diversification index in the coastal districts of Tamil Nadu was low due to sufficient terrain (plain), climatic condition, water facility, soil, technology, etc.

CONCLUSION

Crop diversification is generally viewed as a shift from traditionally grown less remunerative crops to more remunerative crops. This is the case of growing rice in high water table areas replacing oilseeds, pulses and cotton with the advent of modern agricultural technology, especially during the period of green revolution because paddy gives maximum economic returns.

In the study area, paddy is a main crop and other crops are low compared to paddy. Greater Chennai is a metropolitan area where the cultivated area is nil. In Kanyakumari district, only paddy crops are cultivated, while the distribution of other crops is nil. In Nilgiris, paddy distribution is low

and the distribution of other crops is nil due to mountain topography suitable for vegetable and fruits. The crop diversification index is low in coastal districts and moderate in Tiruvannamalai, Madurai, Cuddalore, and Coimbatore districts. In the other central districts of the region there is a high diversification. The nature of crop diversification ranges mainly from a high value related to paddy crops to a low value in the case of other cereal crops.

The broad objectives of this strategy are to increase the per capita income by opening the way for productive employment in the farm and non-farm sectors, and to make economic growth broad-based and sustainable in the long run.

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