



## VEGETABLE CROPPING PATTERN ANALYSIS - A CASE STUDY IN KANCHEEPURAM AND THIRUVALLUR DISTRICTS, TAMIL NADU, INDIA

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### ABSTRACT

This paper addressed the status of diversified crop cultivation in two districts of the state Tamil Nadu, India. Here, the cropping intensity, nature and extent of vegetable crop diversification in district level have been analyzed using mathematical methods and Modified Entropy Index (MEI). The overall diversity index at district level was more than 0.60 [MEI > 0.60], that is the indication of the farming community cultivated a number of crops. From the study it is found that in both the districts they cultivate a number of crops, but there is a big disparity in the area allocated for individual crops. From the time series analysis, it is observed that the farming community cultivated mainly two crops (Egg plant and Okra) covering nearly half of the gross vegetables cropped area.

**Keywords:** Diversity Index; Modified Entropy Index; Production; Profitability.

### INTRODUCTION

Changing economic environment in the nation as a whole and particularly in the agriculture sector warrants that the government price and trade policies should become more powerful instruments for directing area allocation in the decision making of farmers for various crop cultivation. Crop diversified farms are generally more economically and ecologically resilient [1-3]. While monoculture farming has advantages in terms of efficiency and ease of management, crop loss in any one

year could put a farmer out of business and seriously threaten the stability of a farming community [4]. By growing a diversity of crops, farmers resist economic risk and are less vulnerable to the radical price fluctuations associated with alterations in supply and requirement. Due to urbanization and industrialization, the farming community living in the nearby districts of Chennai city [Tamil Nadu state capital] face a number of problems such as an increase in production cost, labor shortage, increased labor cost, market price fluctuation, water marketing and agricultural land reduction for growing population etc., Primarily the number of people involved in the agricultural activities is reducing rapidly compared to the urban community, the socio-economic status of the farming community in the sub-urban districts are quite low. Based on their economic status, the farming community is being pushed to cultivate short duration crops like vegetables to get regular income for sustenance of the family and for self-reliance. Hence the farmers are trying to maximize the net profitability through sustainable short duration vegetable production in the existing agricultural land holding.

By keeping these issues in mind, this study was carried out to analyze the spatial, temporal variation of vegetable production in the two districts which are closer to Chennai city. For this kind of study, already a number of diversity indices were used for the spatio-temporal analysis of agricultural crop diversification in Tamil Nadu, Karnataka and West Bengal [1, 3, 5-7]. From among the indicators proposed, Modified Entropy Index



(MEI) provides a uniform and permanent scale and as such, it is used as a standard to compare and rank the degree of diversification both spatially and temporally [7]. While there has been research published on diversified crop cultivation in global level; there has been no survey based study on how diversity level affects the profitability to the farming community. This paper focuses on that gap in the previous literatures.

## MATERIALS AND METHODS

The two districts namely Kancheepuram and Thiruvallur adjoining to Chennai city were chosen for the study and the distance between Chennai and the chosen district headquarters is around 70km and 50km respectively. Figure 1 and Table 1 illustrate the location map and other details of Kancheepuram, Thiruvallur districts. The rainfall and temperature in the selected districts are favorable for vegetable crop production. Time series data pertaining to area, production, productivity of different vegetable crops at the district and block levels were obtained for the period of 2001 to 2010<sup>(2)</sup>. To examine the nature and extent of individual vegetable diversification level within all crops taken together, the Modified Entropy index (MEI) was worked out at the district level. The MEI is framed such that the maximum diversification will have an index value of 1 and minimum diversification with the index value of 0. Simple statistical tools were used to analyze the data. The block level data for the year 2010-11 data were also analyzed to determine the cropping intensity and to find areal variations of vegetable cultivation among the blocks.

$$MEI = - \sum_{i=1}^{i=N} p_i * (\ln(p_i) / \ln N)$$

Where, N is the number of vegetable crops and  $p_i$  is the proportionate area of every single vegetable in the total vegetable cropped area.

*Cropping Intensity* = (Gross Cropped Area/Net Sown Area) \*100.

## RESULTS AND DISCUSSION

The nature and extent of vegetable cropping pattern and the drivers of crop choice were analyzed in the chosen districts by collecting secondary and primary data. The Modified Entropy Index was used to find the diversity level of vegetables in the selected districts for the period of ten years and the results are discussed below. From the analysis, it was observed that in all the cases, the values of diversity index were between the ranges from 0.61 to 0.83 for the last decade and it's an indication of the high diversification level in the selected districts; it also indicates that this high value was achieved by cultivating a number of crops and not concentrating on a single crop.

To study more about the cropping practices, the year wise modified entropy index was computed for all the vegetables grown in the districts and shown in Table 2 and 3. From the figure 2 it is clear that the diversity index for both the districts is high (i.e.  $DI > 0.60$ ) for all the years from 2001 to 2010 and ranges between 0.588 and 0.77. At Kancheepuram, the average MEI over the years for the total vegetable crops was 0.6905 with least value in the year 2003-04 and highest in the year 2002-03. In Thiruvallur, the average MEI over the years for the total vegetable crops was 0.7022 with least value in the year 2004-05 and highest in the year 2001-02. From the diversity index analysis, during 2010-2011, the diversity index was more than 0.60 [ $MEI > 0.60$ ] for both the districts; they cultivated sixteen crops, but the area allocated for each vegetable was quite low except tapioca, eggplant and okra also found that the farming community, has cultivated Egg Plant, Okra and some gourds to a large extent also identified that only two out of ten vegetables had the mean index value ranging between 0.104 and 0.125 and all other vegetables had the mean index values in-between 0.011 to 0.056. The decrease in the index values was an indication that there existed some disparity in the area allocated for every vegetable crop and that there were inequities in area allocation among all the cultivated vegetables (the index values for eggplant-0.13, okra- 0.109, tomato-0.01, pumpkin-0.02, bottle gourd-0.009 and drumstick-0.009).

The time series values of the index for eggplant and okra indicated a relatively stable value for the past ten years. In general, the trend of the MEI was almost same within the eggplant with all values lying in the range of 0.102 to 0.135 while tomato has a range between 0.004 to 0.063, for pumpkin 0.003 to 0.077, for bottle gourd 0.002 to 0.043, for bitter gourd 0.008 to 0.081, for black eyed pea 0.005 to 0.089, drumstick 0.003 to 0.091 and for cucumber is 0.004-0.068. Figures 3 and 4 shows the percentage of different vegetable cultivated area during the year 2010-11 in both the districts. Table 5 represents the cropping intensity at block level. The block wise data were analyzed for the year 2010-2011 and the results are represented in figures 5 and 6 which show the cropping intensity of vegetables in every block.

From the cropping pattern analysis, it was clear that the inter block variation of a real crop share is significant in both the districts. Out of 13 blocks, 9 blocks were characterized by eggplant domination where areal proportion is more than 65%. Some blocks like Acharappakkam, Thiruporur, Uthiramerur, Walajabad, Chithamur, Kundrathur, Lather, Madhuranthakam and Sriperumpudur are highly concentrated on eggplant. Thirukazhukundram and Kattankulathur blocks have highly concentrated on okra cultivation. Likewise, in Thiruvallur district, out of 14 blocks, 6 blocks were characterized by eggplant dominance where areal proportion is more than 40%. Some blocks like



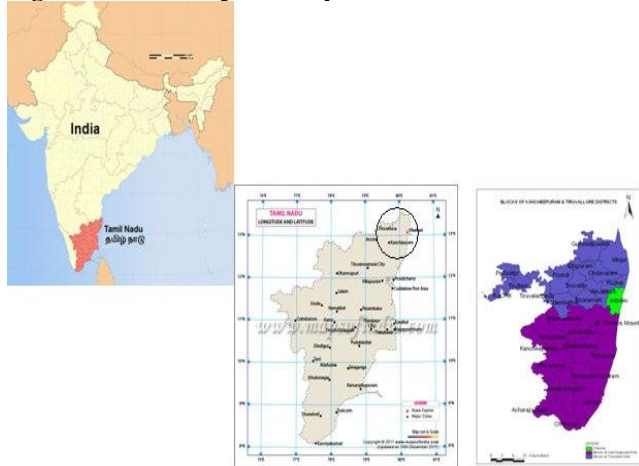
Ellapuram, Thiruvallur, Gummidipoondi, Minjur, Poondi and R. K. Pet are highly concentrated on eggplant cultivation. Black eyed pea cultivation is highly concentrated only on Tiruttani block. Sholavaram and Thiruvalangadu blocks are highly concentrated on okra cultivation.

In general, both the districts have a lot of fertile land, surface and ground water bodies for better cultivation. The sholavaram tank, puzhal lake, poondi reservoir is the major surface water bodies available in Thiruvallur District. Madhuranthaham tank and Thenneri tank are, the bigger tanks available in Kancheepuram district. Even though, they have better land and water resources, their choice of area allocation for different crops did not lead to a higher income.

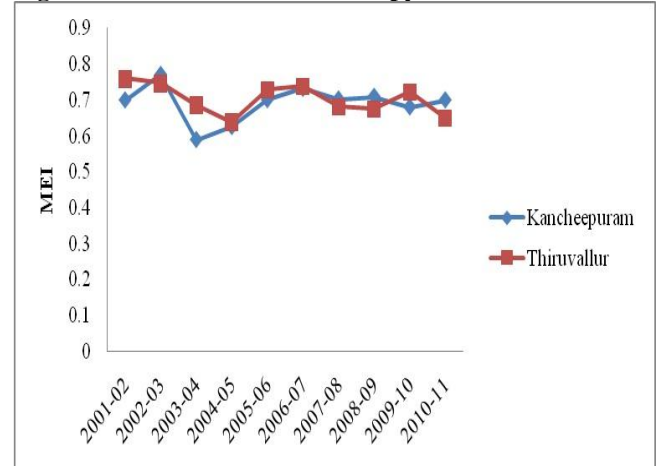
The average land holding of the farming community is 2 acres and the area allocated for every vegetable is less than 1 acre. From the field survey, it was identified that the farming community in the selected districts is interested in eggplant and okra cultivation, even though they did not get more profit from it. The

reason for that is, they are shorter duration vegetables; so these vegetables can be cultivated for more than one season based on their interest; the production cost for them is quite low compared to gourds. The farmers have cultivated the gourds in two ways, one is on the field and the other one is a continuous pitting method based on their economic status. Cultivation of gourds requires high initial cost based on cultivation method. Because of their poor economic status, most of the farming community was not concentrating on gourd cultivation and they said that, throughout the year, the demand for eggplant and okra is high when compared to other seasonal vegetables. Even though, the resistance to pest and diseases is quite low for eggplant, they are interested in its cultivation; as the trend is now towards adding eggplant in all the vegetarian food the demand for it is high. Table 4 shows the production cost and profit gained through the eggplant, okra and bitter gourd cultivation. Table 5 shows the block wise variation of cropping intensity in both Kancheepuram and Thiruvallur districts.

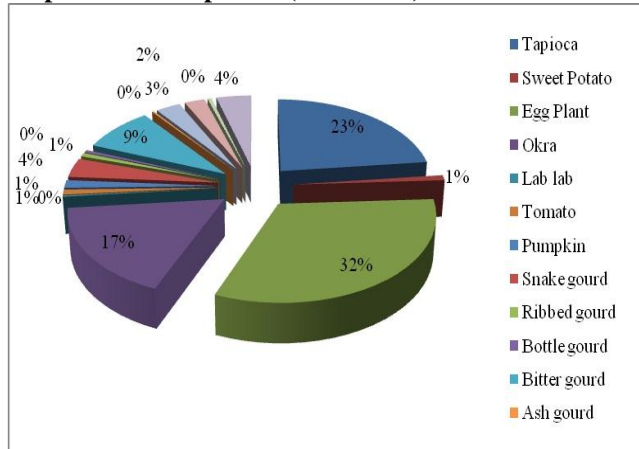
**Fig 1. Location map of Study Area**



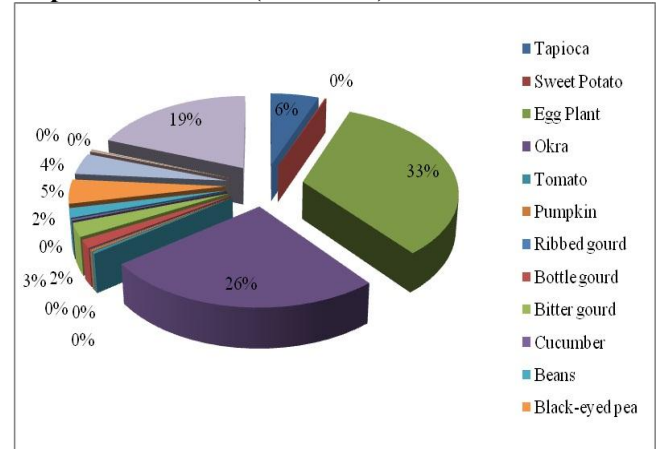
**Fig 2. Calculated Modified Entropy Index**

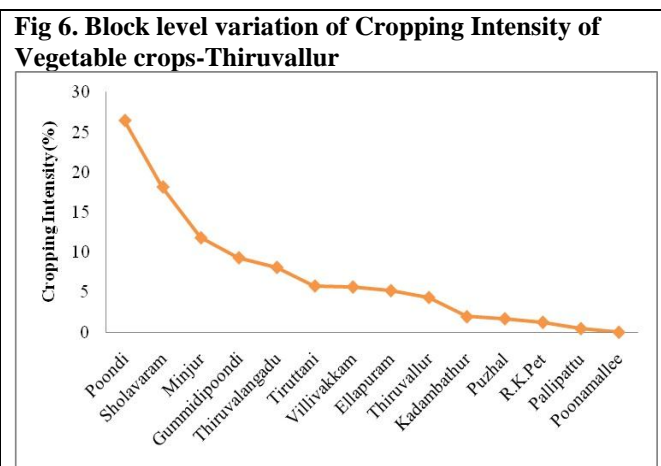
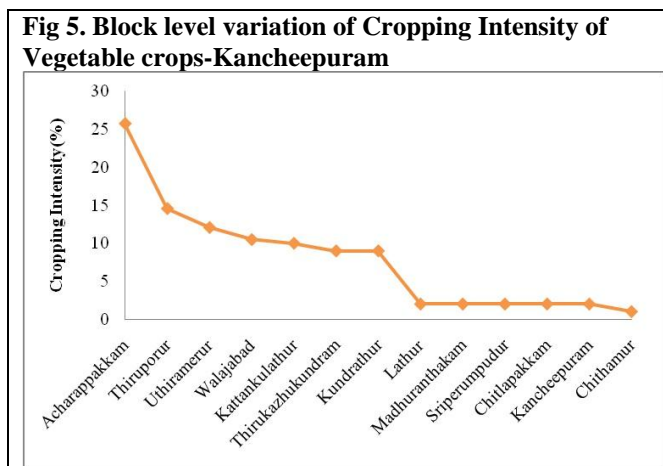


**Fig 3. Percentage of area under different vegetable crops in Kancheepuram (2010-2011)**



**Fig 4. Percentage of area under different vegetable crops in Thiruvallur (2010-2011)**





**Table 1. Details about the study area**

Sl.No	Minutiae	Kancheepuram	Thiruvallur
1	Geographical Area (Km <sup>2</sup> )	4433	3422
2	Latitude	11° 00' to 12° 00'	12°15' to 13°15'
3	Longitude	77° 28' to 78° 50'	79°15' to 80°20'
4	Number of Blocks	13	14
5	Number of Revenue Villages	1214	820
6	Productivity for vegetables (t/ha)	19.49	16.87
7	Average Rainfall (mm)	1213	1104
8	Average Temperature in summer (C)	36.6	37.9
9	Average Temperature in winter (C)	19.8	18.5

**Table 2. Calculated Modified Entropy Index for the selected vegetables in Kancheepuram district**

Sl.No	Year	Egg plant *	Okra *	Tomato *	Pumpkin *	Bottle gourd*	Bitter gourd*	Black-eyed pea*	Drums tick*	Cucum ber*
1	2001	0.126	0.114	0.004	0.067	0.015	0.035	0.005	0.004	0.068
2	2002	0.125	0.114	0.034	0.077	0.012	0.033	0	0.012	0.076
3	2003	0.125	0.124	0.039	0.018	0.005	0.04	0	0.005	0.032
4	2004	0.123	0.121	0.026	0.005	0.013	0.042	0.007	0.008	0.047
5	2005	0.126	0.125	0.029	0.012	0.002	0.042	0.1	0.004	0.045
6	2006	0.126	0.12	0.05	0.019	0.012	0.062	0.04	0.091	0.062
7	2007	0.122	0.116	0.063	0.036	0.01	0.068	0.057	0.01	0.031
8	2008	0.109	0.124	0.031	0.015	0.016	0.081	0.003	0.015	0.02
9	2009	0.135	0.135	0.008	0.025	0.008	0.076	0.02	0.02	0.048
10	2010	0.131	0.109	0.016	0.022	0.009	0.076	0.033	0.009	0.037
<b>Sum</b>		<b>1.248</b>	<b>1.202</b>	<b>0.3</b>	<b>0.296</b>	<b>0.102</b>	<b>0.555</b>	<b>0.265</b>	<b>0.178</b>	<b>0.466</b>
<b>Mean</b>		<b>0.125</b>	<b>0.120</b>	<b>0.03</b>	<b>0.030</b>	<b>0.010</b>	<b>0.056</b>	<b>0.027</b>	<b>0.018</b>	<b>0.047</b>
<b>SD</b>		<b>0.007</b>	<b>0.007</b>	<b>0.018</b>	<b>0.024</b>	<b>0.004</b>	<b>0.019</b>	<b>0.032</b>	<b>0.026</b>	<b>0.018</b>

\*The values are MEI for the selected vegetables

**Table 3. Calculated Modified Entropy Index for the selected vegetables in Thiruvallur District**

Sl. No	Year	Egg plant*	Okra*	Tomato*	Pumpkin*	Bottle gourd*	Bitter gourd*	Black-eyed pea*	Drumstick*	Cucum ber*
1	2001	0.132	0.106	0.057	0.025	0	0.045	0.089	0.003	0.03
2	2002	0.102	0.119	0.019	0.015	0.01	0.032	0.048	0.043	0.01



3	2003	0.132	0.121	0.016	0.061	0.016	0.022	0	0.029	0.017
4	2004	0.112	0.094	0.029	0.015	0.014	0.031	0	0.005	0.01
5	2005	0.128	0.099	0.013	0.007	0.043	0.047	0.007	0.007	0.009
6	2006	0.129	0.099	0.004	0.03	0.028	0.049	0.049	0.008	0.008
7	2007	0.128	0.091	0.008	0.014	0.043	0.041	0.124	0.014	0.004
8	2008	0.125	0.074	0.008	0.008	0.024	0.008	0.082	0.012	0.008
9	2009	0.13	0.115	0.013	0.003	0.042	0.034	0.065	0.011	0.009
10	2010	0.132	0.126	0.008	0.006	0.023	0.034	0.051	0.047	0.006
<b>Sum</b>		<b>1.25</b>	<b>1.044</b>	<b>0.175</b>	<b>0.184</b>	<b>0.243</b>	<b>0.343</b>	<b>0.515</b>	<b>0.179</b>	<b>0.111</b>
<b>Mean</b>		<b>0.125</b>	<b>0.104</b>	<b>0.018</b>	<b>0.018</b>	<b>0.024</b>	<b>0.034</b>	<b>0.052</b>	<b>0.018</b>	<b>0.011</b>
<b>SD</b>		<b>0.010</b>	<b>0.016</b>	<b>0.016</b>	<b>0.017</b>	<b>0.015</b>	<b>0.012</b>	<b>0.041</b>	<b>0.016</b>	<b>0.007</b>

\*The values are MEI for the selected vegetable.

**Table 4. Production cost and profit for selected vegetables**

Highly cultivated Crops in the selected districts	No of season possible/Year	Duration (Days)	Production cost (Rs / acre)	Profit (Rs/acre)
Egg plant	2	55-60	45000-50000	75000-80000
Okra	3	45	20000- 25000	50000-55000
Bitter Gourd	1	115	30000-60000	115000-120000

**Table 5. Block wise cropping intensity**

Sl.No	Blocks in Kancheepurm District	Cropping Intensity (%)	Blocks in Thiruvallur District	Cropping Intensity (%)
1	Acharappakkam	26	Poondi	26
2	Thiruporur	15	Sholavaram	18
3	Uthiramerur	12	Minjur	12
4	Walajabad	10	Gummidipoondi	9
5	Kattankulathur	10	Thiruvallangadu	8
6	Thirukazhukundram	9	Tiruttani	6
7	Kundrathur	9	Villivakkam	6
8	Lathur	2	Ellapuram	5
9	Madhuranthakam	2	Thiruvallur	4
10	Sriperumpudur	2	Kadambathur	2
11	Chitlapakkam	2	Puzhal	2
12	Kancheepuram	2	R. K. Pet	1
13	Chithamur	1	Pallipattu	0
14	-	-	Poonamallee	0

## CONCLUSION AND RECOMMENDATION

The nature and extent of vegetable crop diversification have been analyzed by using Modified Entropy Index methods and the results have shown that except for eggplant and okra, all other crops had a lesser value of diversification index (index values for eggplant-0.13, okra- 0.109, tomato-0.01, pumpkin-0.02, bottle gourd-0.009 and drumstick-0.009). The farming community is mainly concentrated on Eggplant and Okra than other vegetables in the last decade. It was interesting to note that throughout the study period, eggplant ranked first and okra remained second in the overall vegetable cultivation. The comparative pattern of the area allocated for different crops in the selected districts gives some clear results. They cultivated mainly two crops covering

nearly half of the gross vegetables cropped area. An inter block variation of a real crop share is also significant in the selected districts. From the field survey, it can be concluded that the economic status, demands for the produce, crop period are the important factors for the choice of crop selection than the market price. The finding suggests that the measures have to be taken to cultivate at least six to eight vegetables (as shown in table 2 and 3) with the existence of land holdings at a large extent in all the blocks. From the study, it can be concluded that even though the farming community have less land holding, they can increase the profitability and can break away from the threat of crop failure through diversified vegetable crop cultivation practices. This study is a case in point to support the same.





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## CONFLICT OF INTEREST:

The authors declare that they have no conflict of interest.

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