

Agricultural concentration and cropwise changes in Thanjavur district, Tamilnadu using geographical information system.

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Abstract

The paper presents an overview of agricultural cropping concentration and crop wise changes in Thanjavur district. The study area is mainly for plain area topography and "Rice bowl of Tamilnadu". The study area is mainly suitable for climatic conditions, so the agriculture production is high. But recently the agricultural production is slowly decreased. Data of cropping pattern or concentration is taken for 10 years crop wise changes and used for analysis. The data's collected were all secondary sources of information from statistical office and soil survey offices in Thanjavur district. The study area extends to an area of 3397sq k.ms. The District is divided into 8 taluks and 14 blocks with a total population of 2,402,781 persons according to 2011 census. The district is located in the Eastern coast of Tamil Nadu. The study area is consist of 14 toposheets and the scale of 1:50,000. Based on the data of crop-wise changes the data analysed using GIS for mapping.

Keywords: Crop concentration, Crop wise changes, Geographic information system and Thanjavur.

INTRODUCTION

Agriculture in Thanjavur is the main source of livelihood. Cultivation has been the major occupation of the local inhabitants of Thanjavur since the land is ideally suited for growing crops like rice and wheat. Thanjavur is a deltaic region where rice is the major food crop that is grown in the fields. Rice production has increased in the recent years and thus it is being largely exported to the neighboring states, which is further boosting up the economy of Thanjavur. The total rice production has been maintained between 10.615 Lakh Metric Tonnes (L.M.T) and 7.077 L.M.T. level respectively during 1999-2000 when compared with the year 1992-93. The land suitability for irrigation and farming has also grown subsequently.

A consensus has emerged that developing countries are more vulnerable to climate change than developed countries, because of the predominance of agriculture in their economies, the scarcity of capital for adaptation measures, their warmer baseline climates and their heightened exposure to extreme events (Parry et al. 2001). Thus, climate change may have particularly serious consequences in the developing world, where some 800 million people are undernourished. Of great concern is a group of more than 40 'least-developed' countries, mostly in sub-Saharan Africa, where domestic per capita food production declined by 10% in the last 20 years (Investing in development ,2005).

The balance of scientific evidence now suggests that over the last century humans have begun to have a discernible influence on the world's climate, causing it to warm (IPCC, 1996,1998). In the coming decades, global agriculture will need to confront this

challenge in addition to that of a growing population, which is projected to double its present level by about the 2080s (World Bank, 1994).

The responses of crop yield to climate change are estimated from crop growth models. The economic consequences of these potential changes in crop yields are then simulated using a world food trade model. The analysis provides estimates of changes in terms of production and prices of major food crops and the number of people at risk of hunger. The method used has been reported elsewhere (Rosenzweig and Parry, 1994; Fischer et al., 1996).

Despite technological advances such as improved crop varieties and irrigation systems, weather and climate are still key factors in agricultural productivity. For example, weak monsoon rains in 1987 caused large shortfalls in crop production in India, Bangladesh, and Pakistan, contributing to a reversion to wheat importation by India and Pakistan (World Food Institute, 1988).

The department of agriculture has been taking effective measures in order to improve the agriculture of Thanjavur. Several irrigation projects are being implemented within this city much for the benefit of the farmers. Other crops, which are grown in the rich land of Thanjavur are cholam, wheat, ragi, red gram, green gram, sugarcane, maize. The major part of Thanjavur land is used for agriculture. The total percentage of land fit for cultivation is 58%. The city of Thanjavur consists of tertiary, alluvial and cretaceous types of soil. The major portion of Thanjavur land consists of alluvial deposits. The eastern region of Thanjavur abounds in alluvial type of soil fit for agriculture. This region thereby produces the maximum number of crops. Organic farming is gradually being known to the farmers of Thanjavur. In order to maximize agricultural produce organic farming is being implemented.

Aims and objectives

The present study is going to analyze the crop concentration and crop wise changes in Thanjavur district. The following objectives are as follows.

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1. To study the taluk wise crop concentrations in Thanjavur district.
2. To analyze the general cropping season in Thanjavur district.
3. To study the agricultural crop wise changes in Thanjavur district 1995 to 2010.
4. To use GIS in crop mapping.

Study area

The area under investigation lies in between the Long. 78 ° 45' 50" E to 79 ° 35' 55" E and Lat. 10 ° 10' 0" N to 11 ° 10' 6" N. The study of the landforms are mainly for agricultural region. The city is connected by land, and air transportation. Thanjavur district lies as the East coast of Tamil Nadu. It extends to an area of 3396.57 sq kms.

The district is bounded on the north by the Cuddalore on which separate it from Perambalur district and on the East it is bounded by the Thiruvarur and Nagapattinam and on the south by the Palk Strait and west by Pudukkottai and Tiruchirappalli district. The district can be divided into 3 main divisions and 12 deltaic regions. The upland area is mainly for deltaic region (Fig. 1).

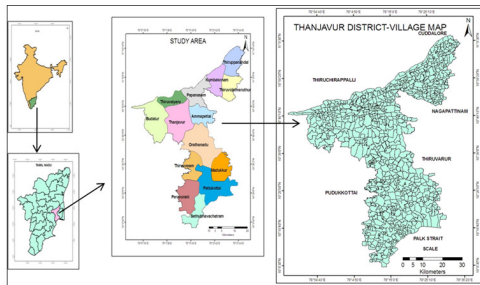


Fig 1. Location map of the study area

METHODOLOGY

The present study is based on secondary data from statistical offices, agricultural offices and soil survey offices of Thanjavur district. The data is processed by using suitable

statistical techniques and cartographic techniques to identify the natural character of the district. The study area consist of 14 toposheets of 58N/1, N/2, N/3, N/4, N/5, N/6, N/7, N/8, N/9, N/11, 58J/13, J/14, 58M/8 and M/12 which are the scale of 1:50,000. The data relating to the maps are prepared by using GIS techniques.

**Analysis of the data
Crop concentration**

The relationship between density of individual crops in the corresponding density for the taluk wise as a whole has been studied. The objectives of the study of crops concentration pattern is mainly to differentiate the areas of high and low density of the individual crops in the different parts of the taluk. Crop concentration was determined by the following formula. The details are given in the table (1 & 2).

Index of concentration =

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

Table 1. Concentration in zone wise

Types of zone	Concentration	Levels of concentration
Zone A	High	High level concentration
Zone B	Medium	Medium level concentration
Zone C	Low	Low level concentration

The crop concentration has been identified in taluk wise for the year 2010 under the zone by high concentration (A), medium concentration (B), and low concentration (C). The other categories of crop have included are vegetables, fruits, nuts and other type of trees. The map of concentrations are easily identified in crop wise changes of taluk level to Thanjavur district.

Table 2. Levels of concentration taluk-wise

Crop name	Index value	Levels of Concentration	Taluk under zone
Paddy	> 1.2	A	Orathanadu, Thiruvaiyaru, Thanjavur
	1 – 1.1	B	Kumbakonam, Pabanasam, Thiruvudaimaruthur
	< 0.9	C	Pattukottai, Peravurani
Pulses	> 0.08	A	Pabanasam, Kumbakonam, Thanjavur
	0.04 – 0.07	B	Orathanadu, Thiruvaiyaru, Peravurani
	< 0.03	C	Pattukottai, Thiruvudaimaruthur
Oilseeds	> 1	A	Kumbakonam, Pabanasam, Peravurani
	0.06 - 0.09	B	Thiruvudaimaruthur, Orathanadu, Thiruvaiyaru
	< 0.05	C	Pattukottai, Thanjavur
Sugarcane	> 0.09	A	Pabanasam, Thiruvudaimaruthur, Kumbakonam
	0.06 - 0.08	B	Thanjavur, Orathanadu, Peravurani
	< 0.05	C	Pattukottai, Thiruvaiyaru
Cotton	> 0.04	A	Thanjavur, Kumbakonam, Pabanasam
	0.02 - 0.03	B	Orathanadu, Pattukottai, Peravurani
	< 0.01	C	Thiruvaiyaru, Thiruvudaimaruthur
Others	> 0.02	A	Pattukottai, Peravurani, Thiruvaiyaru
	1 - 1.1	B	Kumbakonam, Orathanadu,
	< 0.9	C	Thanjavur, Pabanasam, Thiruvudaimaruthur

Paddy

Paddy crop is most suitable and important food crop in the study area. Paddy is the first rank crop. The concentration of paddy crops is in all three zones. The zones are easily identified in 3 levels. The levels are high, medium and low level concentrations. High concentrations are found in the taluks of Orathanadu, Thiruvaiyaru and Thanjavur. Medium level concentrations is identified in the taluks of Kumbakonam, Pabanasam and Thiruidaimaruthur. Low concentrations are found in the taluks of pattukottai, and Peravurnai. The paddy crop concentrations and productions vary palace to place is shown (Fig.2).

Pulses

Pulses are very important and second food crops in the study area. High concentrations are found in the area are Pabanasam, Kumbakonam, and Thanjavur. Medium concentrations of the areas are Orathanadu, Thiruvaiyaru, and Peravurani. Low level of concentrations found in the taluks of Pattukottai, Thiruidaimaruthur. The pulses variety of green gram, block gram, and Red gram etc.. The paddy and pulses crops concentration is shown (Fig.2).

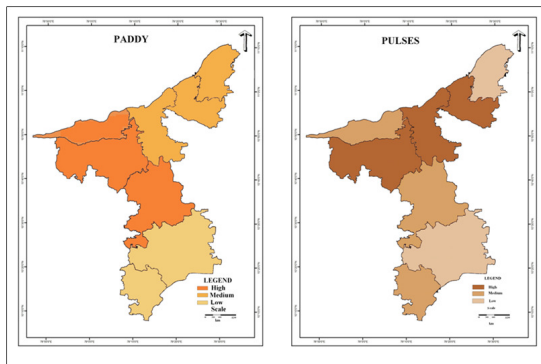


Fig 2 Paddy and pulses concentration

Oilseeds

The Oil seeds are the third food crop of the study area. High concentrations are found in the areas of Kumbakonam, Pabanasam, and Peravurani. Medium concentrations of the areas have Thiruidaimaruthur, Orathanadu, and Thiruvaiyaru. Low concentrations of the areas are Pattukottai, and Thanjavur. The oil seeds are gingili, suriyagandhi, and coconut. The oil seeds are cultivated in summer season (Fig.3).

Sugarcane

Sugarcane is the Fourth important crop. Sugarcane is highly concentration in the area of Pabanasam, Thiruidaimaruthur, and Kumbakonam. Medium concentrations of the areas are Thanjavur, Orathanadu, Peravurani. Low level concentrations of the areas are Pattukottai, Thiruvaiyaru. The sugarcane highly concentrated in North Eastern side of the blocks as these areas are only located in and around sugarmills. The oilseeds and sugarcane crops are shown (Fig.3).

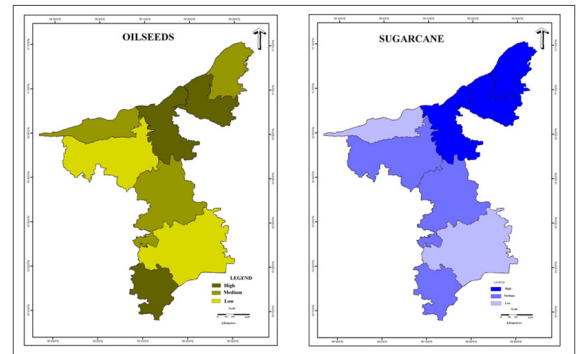


Fig 3. Oilseeds and sugarcane concentration

Cotton

Cotton stands in the fifth rank in crop production. Thanjavur, Kumbakonam, and Pabanasam are found to be the high concentration area. Orathanadu, Pattukottai, and Peravurani are in the medium level concentration. Low level of concentrations are found in Thiruvaiyaru, and Thiruidaimaruthur. The cotton crop is cultivated in summer season (Fig.4).

Other crops

The other crops category have included are vegetables, fruits, nuts and trees. High concentrations are found in the areas of Pattukottai, Peravurani, and Thiruvaiyaru. Medium concentrations are the areas of Kumbakonam and Orathanadu. Low level concentrations of found in Thanjavur, Pabanasam and Thiruidaimaruthur. In general all this category of concentration is found in all other blocks too (fig4).

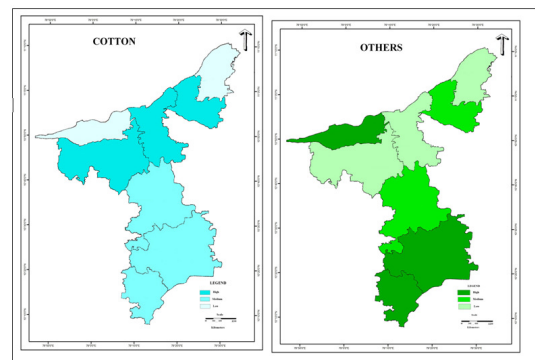


Fig 4. Cotton and other crops concentration

Cropping calendar

The cropping calendar has prepared to identify the season wise cropping pattern in Thanjavur district. The paddy crops are cultivated in three seasons, i.e., Kuruvai, Samba, and Thaladi. The month of January and June is highly sowing stage of crops and Harvesting is done in May and November. These crops are under the categories of both Irrigated and Rainfed crops. The cropping calendar is given below table (3).

Table 3. Cropping calendar



*Sources by soil survey office, Thanjavu

Crop-wise changes from 1995-2010.

The researcher has identified the area wise changes of agriculture crops in cropping pattern and production too. The crops are taken for the account from 1995 to 2010 to analyzed using simple statistical methods and maps. From 1995 to 2010 the paddy crops area has increased from 181 to 150 hectares, the pulses crops

have increased from 23 to 40 hectares. The oil seeds have increased from 19 to 29 hectares. Sugarcane crop has increased from 13 to 16 hectares. Cotton and other crops have increased from 1 to 2 hectares in 1995 and 2010 respectively. These are the major crops of this region. From 1995 to 2010 the agricultural and other major crops are gradually decreased in the study area. The crop wise changes are given in table (4) and fig (5).

Table 4. Agriculture crop-wise changes

Sl.No	Agricultural Crops	1995			2010		
		Area in '000' Hec	Production '000' tonnes	% of the total area	Area in '000' Hec	Production In '000' tonnes	% of the total area
1.	Paddy	181	450	70.7	150	598	53.57
2.	Pulses	23	18	5.07	40	13	14.29
3.	Oilseeds	19	15	5.86	29	15	10.35
4.	Sugarcane	13	1378	5.08	16	1936	5.71
5.	Cotton	2	0.5	0.39	1	1	0.76
6.	Others	33	-	12.89	44	4	15.72

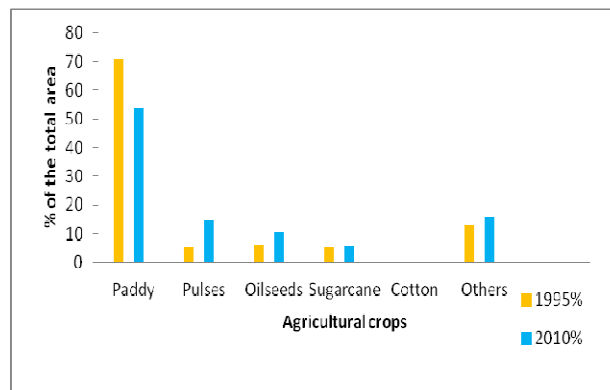


Fig 5. Agriculture crop-wise changes

CONCLUSION

The study area is plain topography hence the agriculture activities are major source of economy for the villagers. The major crop of paddy is highest production as this district is well suit climatic conditions, ground water and surface water conditions are well adequately developed in this region. The crops concentrations are identified in 3 levels. The paddy crop concentrations are high, medium and low (>1.2 high; 1-1.1 medium; and < 0.9 low), Pulses (> 0.08 high; 0.04 – 0.07medium; and < 0.03 low), Oil seeds are (> 1high; 0.06 - 0.09 medium; and < 0.05low). Sugarcane (> 0.09 high; 0.06 - 0.08 medium; < 0.05 low) Cotton (> 0.04 high 0.02 - 0.03 medium ; <0.01low) and other crop are (> 0.02 high; 1 - 1.1medium ; < 0.9 low).

The crops wise changes are identified for the last 15 years from the data acquired. From 1991 to 2010 the paddy cultivation is found that, the changes of area of cultivation is 181 to 150 hectares. Pulses crops are from 23 to 40 hectares, Oil seeds are from 19 to 29 hectares, Sugarcane is from 13 to 16 hectares, Cotton is from 1 to 2 hectares, and other crops are 33 to 44 hectares are identified. Finally the crops wise changes are identified that the paddy crops are decreased in cultivation and productions. The main reason for this decrease is migration of people and poor climatic conditions due to climatic changes. Hence the government should take the appropriate steps to stable the paddy cultivation to save the steaming population. Besides these the National level River joining project to be executed to avoid water scarcity for drinking and agriculture. The urban area slowly moving to the water source areas and it occupies the agricultural land in the form of real estates.

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