



## **Delineation of Efficient Cotton Growing Regions of Tamil Nadu**

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### **Authors' contributions**

*This work was carried out in collaboration among all authors. Author RK designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Authors SP and VG managed the analyses of the study. Authors MK and PJ managed the literature searches. All authors read and approved the final manuscript.*

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### **ABSTRACT**

Cotton is an immensely important crop for the sustainable economy of India and livelihood of the Indian cotton farming community. Identification of potential regions would help in increasing the productivity, ensures better utilization of available resources and avoid wastage of resources in the inefficient zones. Efficient cropping zones of the Cotton crop of Tamil Nadu were keyed out with 30 years data (1985-2015) using Relative Yield Index (RYI) and Relative Spread Index (RSI). The results revealed that in Tamil Nadu, fifteen districts were found for MECZ and three for ECZ. Coimbatore is most essential area for cotton crop. Similarly eight districts are coming under LECZ because RSI were very less compare to RYI. Tiruchirapalli and Ramanathapuram both the district have less RYI and RSI indicating NECZ for cotton crop.

**Keywords:** *Efficient cropping zone; most efficient cropping zone; less efficient cropping zone; inefficient cropping zone; relative spread index and relative yield index.*

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## ABBREVIATIONS

MECZ : Most Efficient Cropping Zone,  
 ECZ : Efficient Cropping Zone,  
 LECZ : Less Efficient Cropping Zone,  
 NECZ : Not Efficient Cropping Zone,  
 RYI : Relative Yield Index,  
 RSI : Relative Spread Index,  
 IPM : Integrated Pest Management

## 1. INTRODUCTION

Cotton is one of the major Kharif crops grown under both irrigated and rain-fed conditions in India. Although India has the largest area under cotton; the average productivity of Indian cotton is one of the lowest in the world; much lower for the vast production area and this is a cause for concern because millions of people depend on cotton cultivation for their economic wellbeing Ramasundaram and Gajbhiye [1]. More than 50 per cent of the cotton area is covered by cotton hybrids and the hybrids contribute about 60 per cent to national production (Santhy et al., 2008). The area, production and productivity of the cotton are subject to fluctuations depending upon various factors viz., Climate condition, Availability of the technology, Lack of the Government support, Industrial development and the Real estate [2-4]. Cotton is grown in the nine major states in three different zones. Punjab, Haryana and Rajasthan in north zone. Maharashtra, Gujarat and Madhya Pradesh in central zone and Andhra Pradesh, Karnataka and Tamil Nadu in the south zone are the major cotton growing states in India. Tamil Nadu is the tenth largest cotton-producing state in India with a production of 5 Lakh Bales [5-7]. Tamil Nadu accounts for more than 6% in the total cotton production in the country and cotton is grown in 70,000 hectares of land in the state. Tamil Nadu is the state in India with the highest cotton yield, which is 1,214 kilograms per hectare. Coimbatore, Vallalur, Madurai, Ramanathapuram, Salem, and Tiruchirapalli are some of the major cotton producing districts in Tamil Nadu.

In crop production, an efficient zone is an area which has suitable soil and climate to obtain the maximum productivity of a crop Narayanan et al. [8]. The productivity levels of crops can be enhanced and sustained through the identification of efficient locations. Most reliable tools for identifying potential area of crop is calculating Efficient Cropping Zones (ECZ) through Relative Yield

Index (RYI) and Relative Spread Index (RSI) of crop. In this context, a study was conducted at Agro Climate Research Centre, Tamil Nadu Agricultural University, Coimbatore during 2018-19 to delineate ECZ for the cotton crop of Tamil Nadu.

## 2. MATERIALS AND METHODS

**Data collection:** Efficient cropping zone for cotton was studied for all the districts of Tamil Nadu. Hence the time series data available at district level, from 1985-2015 (30 years) regarding the area, production and productivity of cotton crop were collected from the directorate of economics and statistics, Government of Tamil Nadu, Chennai.

### 2.1 Method Adopted

The formula propagated by Kanwar [9] was used to find out Relative Spread Index (RSI) and Relative Yield Index (RYI) for each crop to identify efficient crop zone for the selected crops in Tamil Nadu. The details are given here under.

$$RSI = \frac{\text{Area of particular crop expressed as per cent of total cultivable area in the district}}{\text{Area of crop expressed as percentage to the total cultivable area in the State}} \times 100$$

Where in RSI: Relative Spread Index

$$RYI = \frac{\text{Mean yield of a particular crop in a district (Kg/ha)}}{\text{Mean yield of the crop in the State (Kg/ha)}} \times 100$$

Where in RYI: Relative Yield Index

The criteria suggested by Kanwar [9] were used to demark efficient cropping zone as per RSI & RYI values obtained from computation in respect of rice, maize, sorghum, pearl millet, black gram, green gram, groundnut and gingelly.

## 3. RESULTS

Tamil Nadu is one of the biggest centre of textile manufacturing in India. The MECZ considering high RSI and RYI for cotton fell with Vellore, Thiruvannamalai, Salem, Namakkal, Dharmapuri, Sivagangai, Thirunelveli, Theni, Dindigul, Thiruvarur, Karur, Perambalur, Ariyalur, Pudukkottai and Thiruppur (Fig. 4). The reason accredited for superior RSI and RYI values in these districts for the marketing facility which is highly pronounced in these areas and the district Coimbatore is a most potential area for cotton production [10]. Farmers are showing larger

interest in cotton because of normal monsoon, increase in minimum support price and better realization compared to other crops. The districts such as Thoothukudi, virudhanager and Madurai come under ECZ with High RYI and low RSI. Though the yield potential good, the spread is low and hence efforts should be made mainly to increase the area of the crop. Thiruvallur, Kancheepuram, Cuddalore, Villupuram, The Nilgiris, Kanniyakumari, Erode, Nagapatinam and Thanjavur districts come under LECZ. Tiruchirapalli and Ramanathapuram come under NECZ. With respect to Tamil Nadu, fifteen districts fell under MECZ, three districts under ECZ, eight districts under less efficient cropping zone and five districts under NECZ. Since, our

farmers are practicing subsistence type of farming, the districts identified as MECZ, for the various crops discussed above has to be continued as MECZ in future also, along with prevailing agro climatic factors, marketing facilities, infrastructural development and remunerative price has to be provided. In order to bring ECZ areas under MECZ for the cotton crop, improved cultivars, advanced cultural practices, better management practices and availability of need based quality inputs at reasonable price must be tried. In order to popularise the crop in the NECZ, farmers are to be trained in innovative technologies to explore higher productivity, which can be done by strengthening the extension services.

**Table 1. Criteria for efficient cropping zone**

RSI	RYI	Cropping zone
>100 (High)	>100 (High)	Most Efficient Cropping Zone (MECZ). The zone with good spread and more yield of crop. Sustainability options have to be identified and imposed.
<100 (Low)	>100 (High)	Efficient Cropping Zone (ECZ). The zone with good spread and low yield. The constraints in area spread have to be identified. The ECZ is renamed as Yield Efficient Cropping Zone(YECZ) in Agro Climate Research Centre's Crop Scientist unpublished Report, 2018.
> 100 (High)	<100 (Low)	Less Efficient Cropping Zone (LECZ).The zone with high spread and Low yield. The constraints in yield have to be identified.
< 100 (Low)	< 100 (Low)	Not Efficient Cropping Zone (NECZ). The zone with low spread and low yield. Suitability of alternate crops may be assessed. Table

**Table 2. District wise efficient cropping zone in Tamil Nadu**

**MOST EFFICIENT CROPPING ZONE (MECZ)**

District	RSI	RYI	Cropping zone
Vellore	150.39	103	MECZ
Thiruvannamalai	122.29	126	MECZ
Salem	140.1	115	MECZ
Namakkal	149.1	142	MECZ
Dharmapuri	135.87	123	MECZ
Thiruppur	228.63	177	MECZ
Karur	880.96	121	MECZ
Perambalur	276.72	101	MECZ
Ariyalur	205.57	161	MECZ
Pudukkottai	220.87	120	MECZ
Theni	104.84	150	MECZ
Dindigul	231.4	144	MECZ
Thiruvarur	369.46	120	MECZ
Sivagangai	636	108	MECZ
Thirunelveli	169.28	114	MECZ

**EFFICIENT CROPPING ZONE (ECZ)**

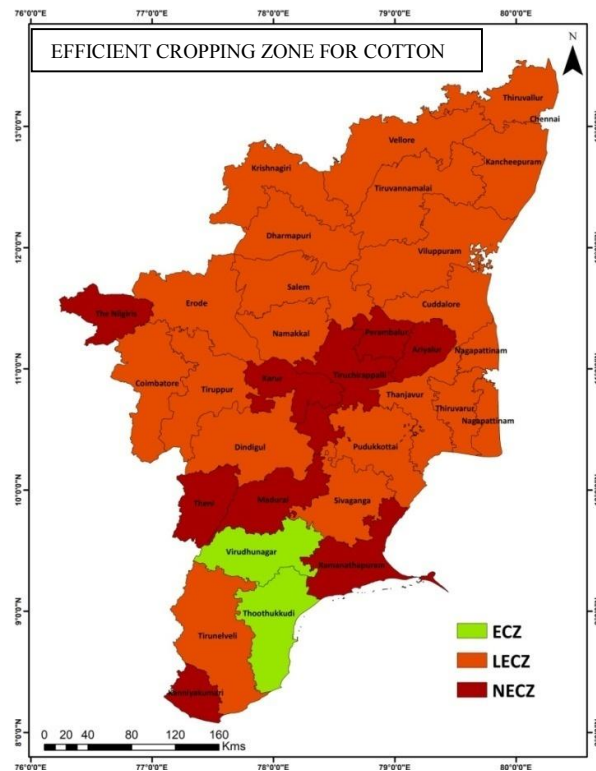
District	RSI	RYI	Cropping zone
Madurai	196.94	74	ECZ
Virudhunagar	416	78	ECZ
Thoothukudi	275.2	70	ECZ

**LESS EFFICIENT CROPPING ZONE (LE CZ)**

District	RSI	RYI	Cropping zone
Kancheepuram	1.26	111	LE CZ
Cuddalore	0.82	109	LE CZ
Villupuram	51.53	120	LE CZ
Krishnagiri	30.05	104	LE CZ
Coimbatore	87.54	116	LE CZ
Erode	45.55	144	LE CZ
Thanjavur	22.2	139	LE CZ
Nagapattinam	69.31	124	LE CZ

**NOT EFFICIENT CROPPING ZONE (NE CZ)**

District	RSI	RYI	Cropping zone
Tiruchirapalli	96.09	94	NE CZ
Thiruvallur	0.04	56	NE CZ
Ramanathapuram	38.75	57	NE CZ
The Nilgiris	11.48	80	NE CZ
Kanniyakumari	0.028	62	NE CZ



**Fig. 1. Efficient cropping zone for cotton (1985-1994)**





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