



## **Potential Zones of Turmeric and Coriander Cultivation in Tamilnadu**

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### **Authors' contributions**

*This work was carried out in collaboration between both authors. Both authors read and approved the final manuscript.*

### **Article Information**

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### **ABSTRACT**

The research paper attempts to delineate district level efficient cropping zones of turmeric and coriander over Tamilnadu (2001-2015) after analysing the trend on cultivation of both the crops at state level (1985-2015). Trend analysis of area and production revealed that both were increasing for turmeric and decreasing for coriander; but productivity had a downscale with turmeric and an upscale with coriander. Delineation of Efficient Cropping Zones of Coriander resulted in Tiruchirappali, Perambalur, Virudhunagar, Cuddalore, Ramanathapuram and Thoothukudi districts as better performers, whereas, Erode, Namakkal, Coimbatore, Salem and Dharmapuri districts were excelling in Turmeric cultivation.

**Keywords:** *Coriander; turmeric; Relative Spread Index (RSI); Relative Yield Index (RYI); efficient cropping zones.*

### **1. INTRODUCTION**

India is the proud "land of spices", holding a rich heritage of the spices and condiments sector. Turmeric is called as the "golden spice" for its

alluring yellow colour used in food, cosmetic and medicinal industries. Similarly, coriander is commonly consumed either as fresh leaf or as seed spice in Indian cuisine. These two spices have a great market among other crops

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contributing to the national GDP, and the identification of efficient cropping zones of both the crops could benefit the policy makers, stake holders and researchers on planning the developmental activities over the potential zones.

Turmeric (*Curcuma longa*), belongs to the ginger family (*Zingiberaceae*) which is a perennial herbaceous plant, identified with its native to southern India and Indonesia. Turmeric is also called as "Indian saffron" known for its brilliant yellow colour [1]. Dating back to the Vedic culture, turmeric was used as a culinary spice and had some religious significance in India. Now a days, the crop is extensively cultivated in the tropics and its known names are cultural and countries specific, called as "haldi" over northern parts and "manjal" over southern parts of India [2]. The purpose of turmeric is not only limited to the culinary purposes but also used as a cosmetic ingredient in almost every Indian household. Turmeric has been used in medicinal field for more than thousands of years, first used as a dye and later utilized as major part of Ayurveda, unnani, and traditional Chinese medicine [3].

Turmeric crop is an important spice crop in India and Indian turmeric is the most sought one globally, due to high curcumin content, an important bioactive compound, hence, it is often called as "golden spice" [4]. India is the largest producer and exporter of turmeric in the world and nearly consumes 80 per cent of the produced quantity domestically. Turmeric occupies about 82 per cent and 6 per cent of the total cultivable area under spices and condiments in World and India, respectively (APEDA) [5]. The area and production of turmeric has increased over the years. According to spice board of India, the cultivable area increased from 162.9 thousand ha in 2001-02 to 177.5 thousand ha in 2005-06. Similarly, the production has increased from 552.3 thousand tons in 2001-02 to 846.7 thousand tons in 2005-06 (Spices Board India) [6]. Andhra Pradesh, Tamil Nadu, Orissa, Maharashtra, Assam, Kerala, Karnataka and West Bengal are the states efficiently cultivating turmeric in India, of which Andhra Pradesh occupies 40 per cent of total turmeric cropping area followed by Orissa and Tamil Nadu with 17 per cent and 13 per cent, respectively. Andhra Pradesh stood 1<sup>st</sup> in terms of production, about 60 per cent of total turmeric production in India followed by Tamil Nadu (13 per cent) and Orissa (12 per cent) [7]. In Tamil Nadu, Erode is known as "Yellow City or Turmeric City," the world's largest producer and

the most important trading centre for turmeric followed by Sangli, Maharashtra, which is second only to size and importance as a production and trading site for turmeric [8].

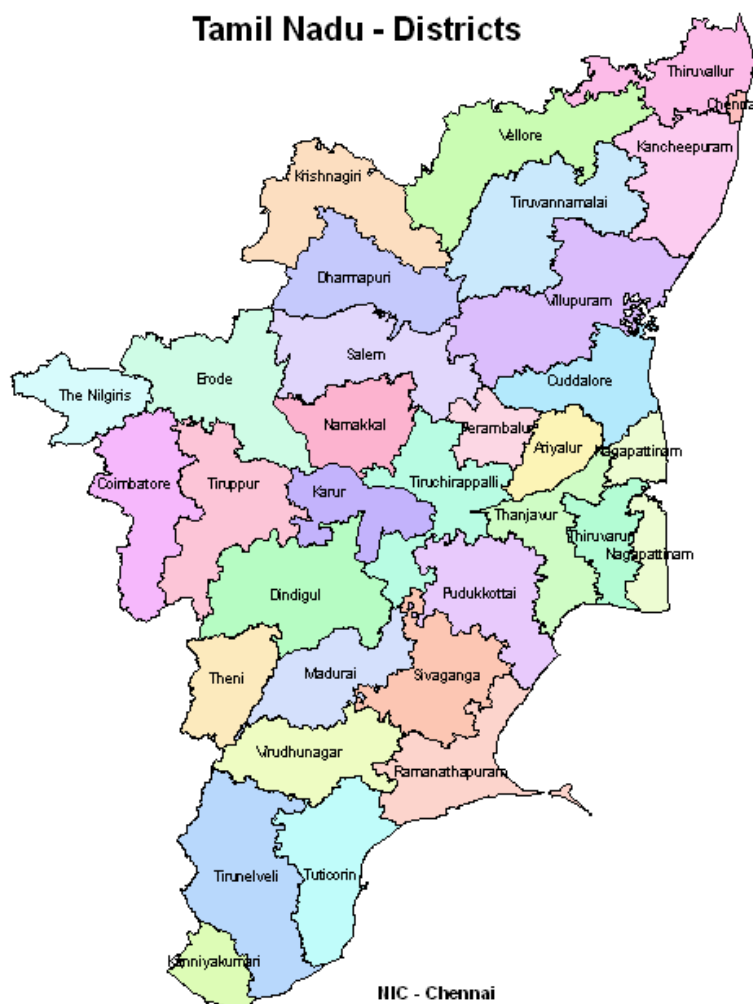
Coriander belongs to parsley family, and is having prime position in flavouring food, an important spice crop having pleasant aroma in the entire plant. Besides the properties, coriander is an important ingredient in almost all food flavourings, in bakery products, meat products, soda & syrups, puddings, candy preserves, liquors and medicines [9]. Approximately 80 per cent of the world's total coriander seeds are produced in India, mainly cultivated in Northern states such as Rajasthan, Madhya Pradesh, Uttar Pradesh and Southern States such as Andhra Pradesh, Karnataka and Tamil Nadu [10]. According to Sharma et al. [11], the productivity of coriander seed in India has increased since the last decadal years, which was 626 kg/ha in 2007-08 to 908 kg/ha in the year 2010-11 and area under coriander has increased based on the house-hold domestic demands. Reason behind the overall production increase of coriander in India was mainly due to advancement of production technology by the National Agriculture Research System (NARS) and educating the farmers through various training programmes.

In last decade, spices production as well as exports has undergone a drastic increase. Higher production was achieved through various means such as introduction of high yielding varieties, new developed production techniques, integrated nutrient management and sowing of crops as per soil/land suitability. Hence, the trend analysis gives insight on the status of crop along with the efficiency of production technologies. Also, this investigation was carried out to identify the efficient cropping zones of turmeric and coriander over Tamilnadu (2001-2015) that helps us to understand the zone wise potential production level with knowledge on planning adequate market facilities by the government.

## 2. MATERIALS AND METHODS

### 2.1 Study Area

Analysis on trends of coriander and turmeric cultivation was done for the entire state of Tamilnadu (1985-2015) followed by district level identification of the efficient cropping zones (2001-2015). Tamilnadu state is the southern part of India landlocked by Andhra Pradesh, Karnataka and Kerala states in its Northern and



**Fig. 1. Districts map of Tamilnadu used during the study period (2001-2015)**

North-west boundaries, whereas the East and Southern sides are influenced by Bay of Bengal and Indian Ocean, respectively. The efficient cropping zone identification for both the crops was done in the study period of 15 years (2001-2015) when there were 32 districts, at present 38 districts after bifurcation.

**2.2 Data**

Area, Production and Productivity data for 30 years (1985-2015) of all the districts and total cultivable area of Tamilnadu for 15 years (2000-2015) was collected from crop production statistics information system and respective season and crop reports (SCR).

**2.3 Trend Analysis**

Trend analysis of collected area, production and productivity was done for both crops

after which the trend line was plotted as follows

$$Y_t = abt e^{ut}$$

Where,

- $Y_t$  = Dependent variable in period t (Area/ Production/ Productivity)
- a = Intercept
- b = Regression coefficient= (1+g)
- t = Years which takes values, 1, 2, ..., n
- ut = Disturbance term for the year

**2.4 Efficient Cropping Zone**

Efficient Cropping Zones evaluation for Coriander and Turmeric crops was done using Relative Spread Index (RSI) and Relative Yield Index (RYI) based on the formulas given below along with the classification criteria of ECZ from Table 1 [12,13],

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

$$RYI = \frac{\text{Mean yield of a particular crop in a district}}{\text{Mean yield of the crop in the state}} \times 100$$

**Table 1. Criteria for classification of ECZ**

RSI	RYI	Cropping Zone
>100 (High)	>100 (High)	Most Efficient Cropping Zone (MECZ)
>100 (High)	< 100 (Low)	Efficient Cropping Zone (ECZ)
< 100 (Low)	>100 (High)	Not Efficient Cropping Zone (NECZ)
< 100 (Low)	< 100 (Low)	Highly Inefficient Cropping Zone (HICZ)

## 2.5 Mapping

District level Efficient Cropping Zones of Coriander and Turmeric crops over Tamilnadu state for 5 year average time periods (2001-2005, 2006-2010, 2011-2015) were mapped and then compared with the base period (1995-2000). Average ECZ maps for the entire study period (2001-2015) was also prepared. All the maps were created using Arcgis v10.3 software.

## 3. RESULTS AND DISCUSSION

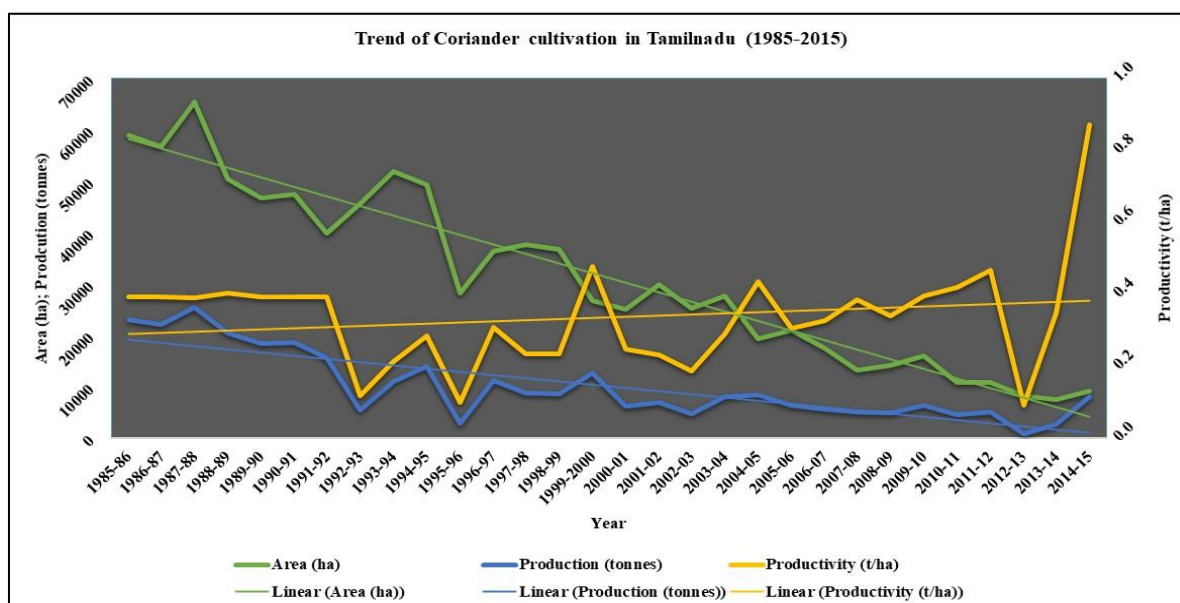
### 3.1 Trend Analysis

#### 3.1.1 Coriander

Trend analysis of area, production and productivity of coriander crop over the entire

state of Tamilnadu (1985-2015) is given in Fig. 2, where production and area under the crop are declining. Average area, production and productivity of coriander in Tamilnadu for the study period were 31,123.8 ha, 10,059.48 tonnes and 0.33 t/ha, where the maximum values were 65,415 ha (1987-1988), 25460 tonnes (1987-1988) and 0.87 t/ha (2014-2015), respectively. Contradicting with area and production, productivity has an increasing trend with the years reaching maximum during the end of study. Improved varieties and cultivation practises would have benefitted the improvement of crop productivity.

Trend in coriander production over Tamilnadu (1985-2015) revealed that in 25-50 per cent years production had ranged between 5102-8050 kgs, while 51-75 per cent years resulted in 8050 – 14403 kgs (Fig. 3).



**Fig. 2. Trend of Coriander cultivation in Tamilnadu (1985-2015)**

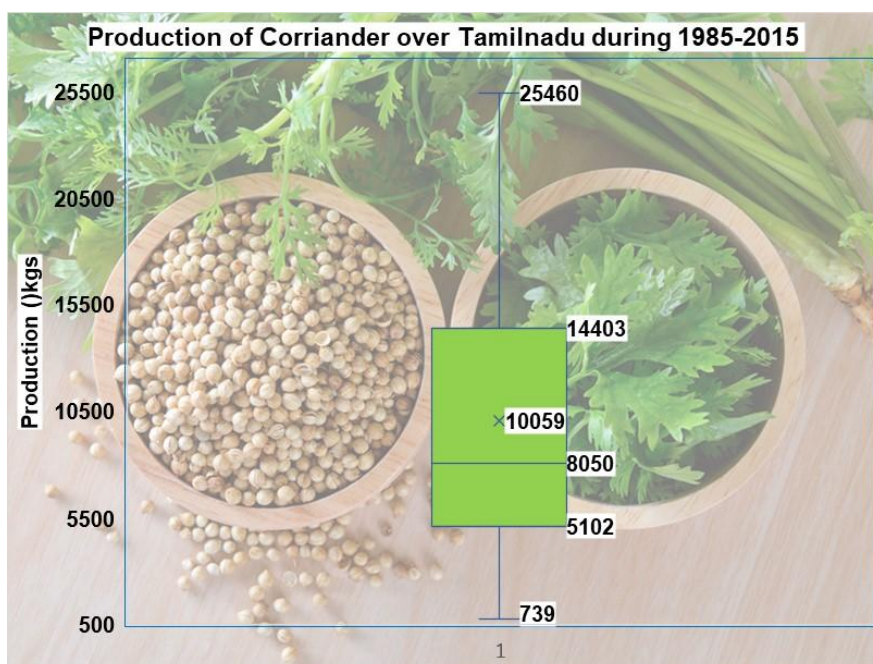


Fig. 3. Production of Coriander cultivation in Tamilnadu (1985-2015)

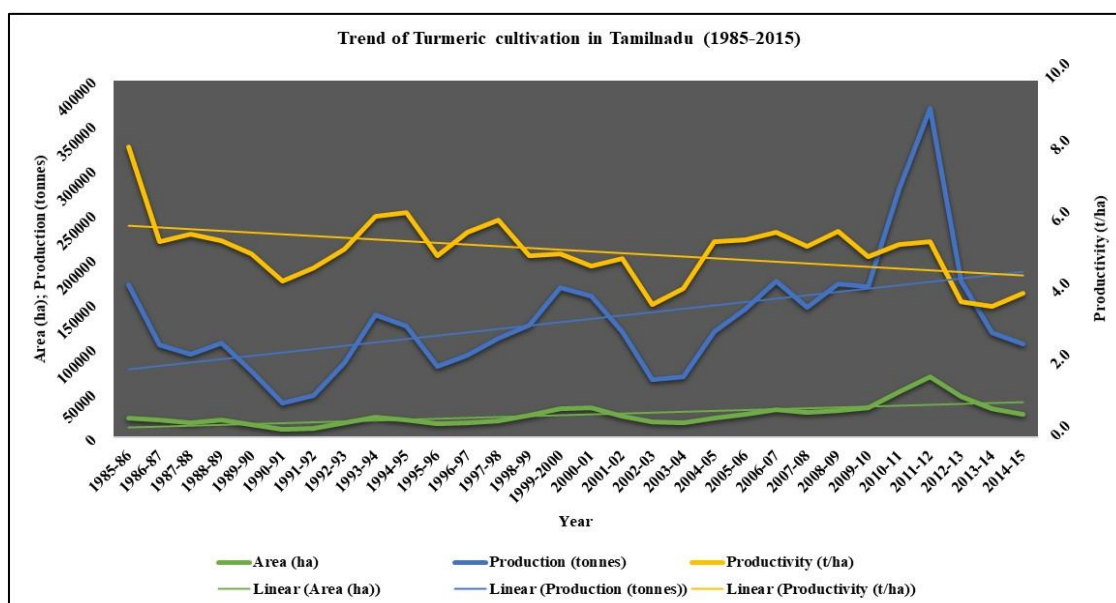


Fig. 4. Trend of Turmeric cultivation in Tamilnadu (1985-2015)

### 3.1.2 Turmeric

Cultivation of Turmeric over Tamilnadu (1985-2015) has seen an increase in area and production, but a downfall of productivity (Fig. 4). The average area, production and productivity of Turmeric were 25,162 ha, 1,30,971 tonnes and 5.23 t/ha, respectively. There had been a maximum area of 67,246 ha during the year 2011-2012, where the production was also in its

peak with 368411 tonnes. But productivity was having a maximum value of 8.1 t/ha during 1985-1986 period, after which it had seen a decline.

Trend in turmeric production over Tamilnadu (1985-2015) revealed that in 25-50 per cent years production had ranged between 0.90-1.18 lakh tonnes, while 51-75 per cent years resulted in 1.18 – 1.68 lakh tonnes (Fig. 5).



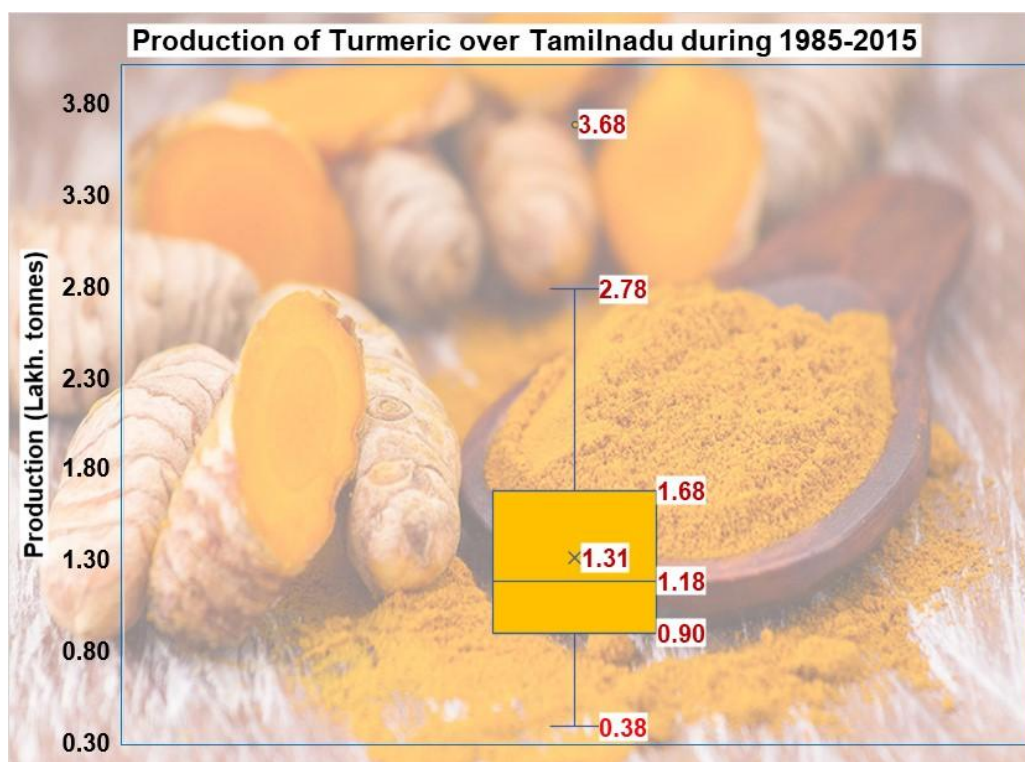


Fig. 5. Production of Turmeric cultivation in Tamilnadu (1985-2015)

### 3.2 Efficient Cropping Zone

#### 3.2.1 Coriander

Efficient Cropping Zone identification for coriander crop in the districts of Tamilnadu was done for 15 year study period (Fig. 6) that has been bifurcated into 5 year average performance. During the base period (1995-2000), Cuddalore, Tiruchirappalli and Virudhunagar districts were most efficient (MECZs), while Perambalur, Ramanathapuram and Thoothukudi districts were efficient (ECZs). Among the MECZs of base period, only Virudhunagar has sustained its position, Cuddalore and Tiruchirappalli districts were facing hardships during the end of study falling into HNECZ and NECZ, respectively, being a serious concern. Surprisingly, Perambalur has entered into MECZ from ECZ on the average scale, though it was affected during 2011-2015 time scale making it NECZ. In spite of a setback, Tiruchirappalli has maintained to be MECZ with the average time scale, along with Perambalur and Virudhunagar (Fig. 7a-7d). Rajasekar et al. [14] have studied the environmental influence on vegetable growth and yield, where they were able to study the hardships faced by Coriander cultivation due to the raising temperatures. They

had also suggested to explore shadenet house cultivation technology than the open field conditions.

#### 3.2.2 Turmeric

Turmeric cultivation is concentrated in the North-west and Western districts. Most Efficient Cropping Zones for Turmeric cultivation in Tamilnadu (2001-2015) were Namakkal, Coimbatore and Erode; Salem and Dharmapuri districts were Efficient Cropping Zones (ECZs) (Fig. 8). Comparing the base period study, Salem and Dharmapuri districts have entered ECZs from MECZs; Erode has upgraded from ECZ to MECZ; Coimbatore had declined into NECZ in 2011-2015 time period, but sustained as MECZ in the average time scale; Namakkal has withstood in its position as MECZ (Fig. 9a-9d). Turmeric production in Erode district has increased as per the study of Gayathri and Sumathi [8], also which could support the results of this paper. Drawback of Coimbatore district into NECZ during the end of study has to be considered as a negative feedback, while the positive one is to be the entry of Perambalur district into ECZ during the same period. Uncertainty in price and devoid of proper storage facilities has made many farmers to drop their hold on Turmeric cultivation [15].

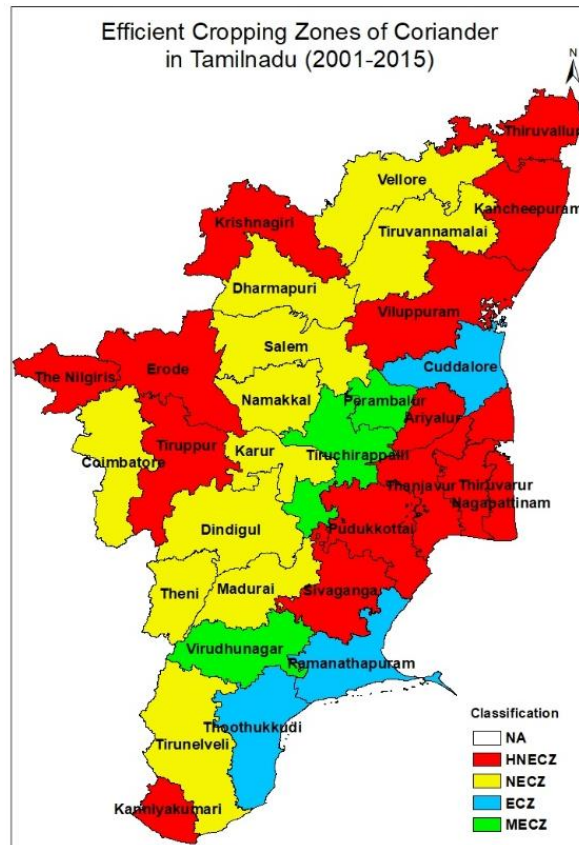


Fig. 6. Efficient cropping zones of Coriander in Tamilnadu during 2001-2015

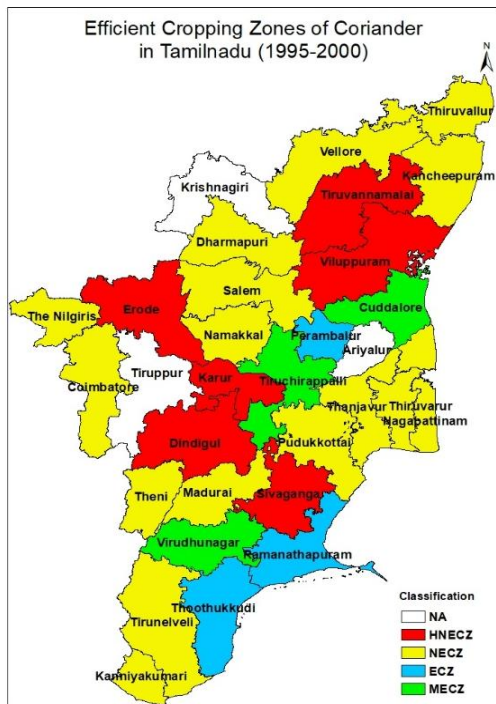


Fig. 7a. Efficient cropping zones of Coriander in Tamilnadu (1995-2000)

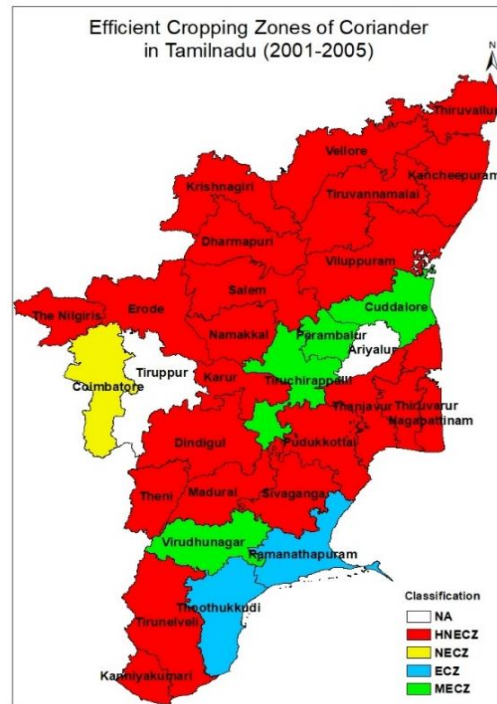


Fig. 7b. Efficient cropping zones of Coriander in Tamilnadu (2001-2005)

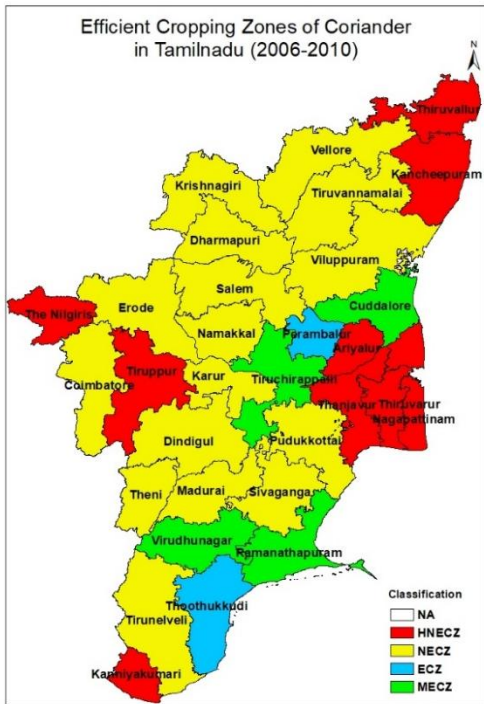


Fig. 7c. Efficient cropping zones of Coriander in Tamilnadu (2006-2010)

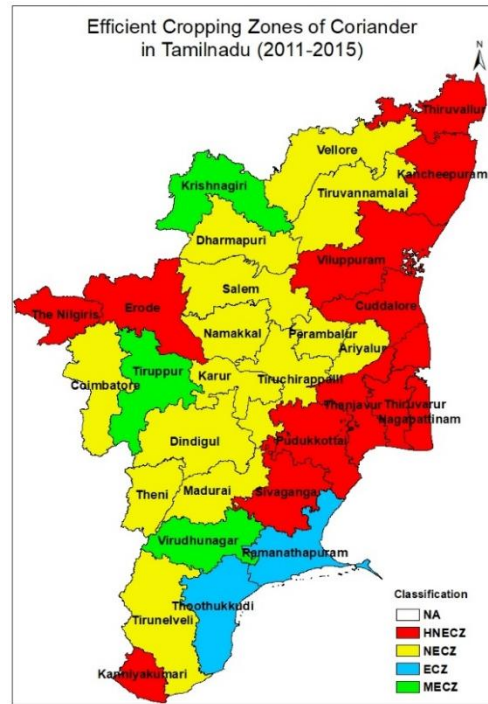


Fig. 7d. Efficient cropping zones of Coriander in Tamilnadu (2011-2015)

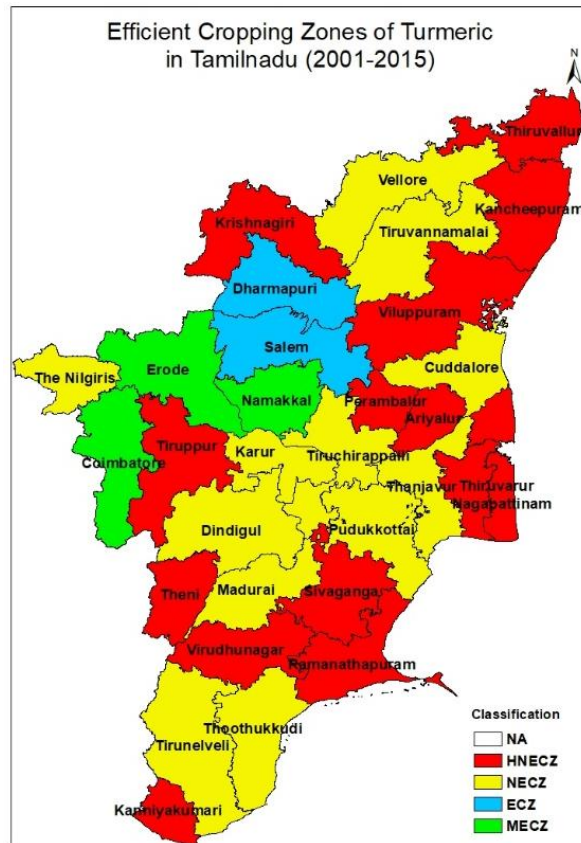


Fig. 8. Efficient cropping zones of Turmeric in Tamilnadu during 2001-2015



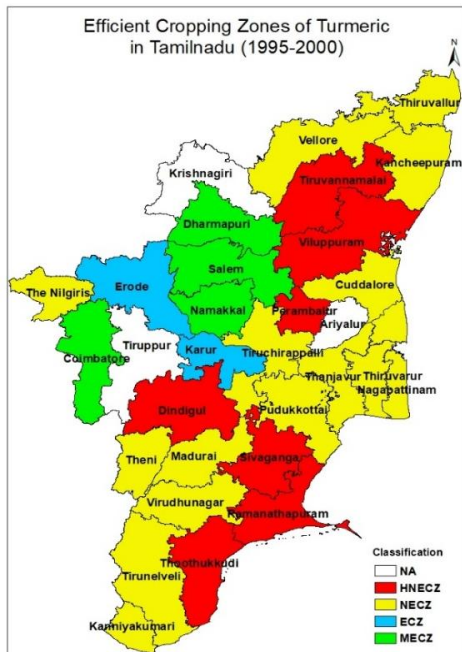


Fig. 9a. Efficient cropping zones of Turmeric in Tamilnadu (1995-2000)

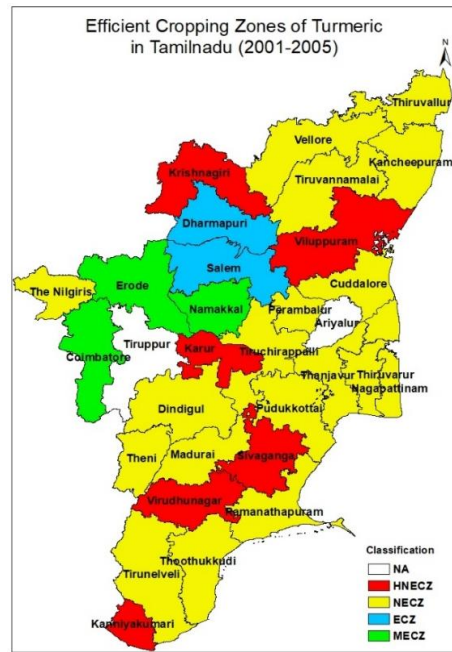


Fig. 9b. Efficient cropping zones of Turmeric in Tamilnadu (2001-2005)

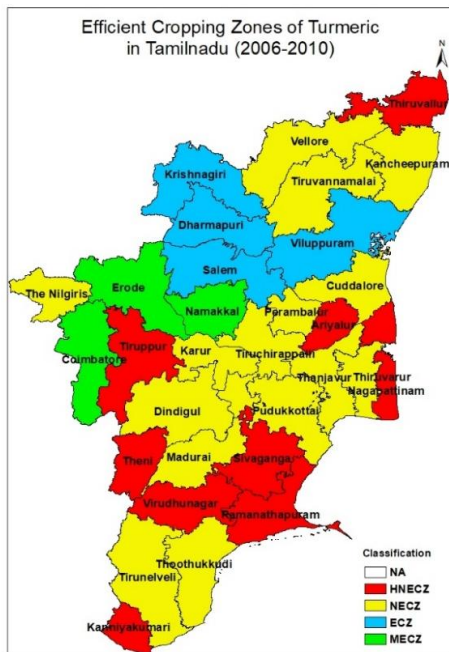


Fig. 9c. Efficient cropping zones of Turmeric in Tamilnadu (2006-2010)

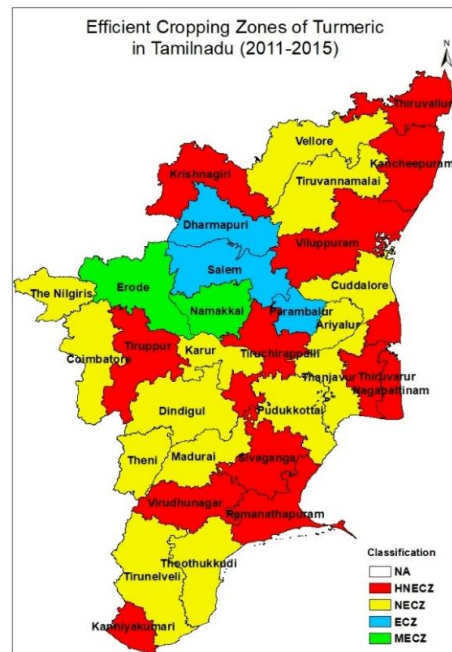


Fig. 9d. Efficient cropping zones of Turmeric in Tamilnadu (2011-2015)

### 3.3 Effect of Climate Variability on MECZ Districts

#### 3.3.1 Climate variability on Erode district

The decadal pattern of climate variability of Erode district, which is the MECZ of Turmeric cultivation is given in Fig. 10. It could be

understood from the graph that the district experiences a steady phase in the trend of all the weather parameters taken for study viz., rainfall, maximum temperature and minimum temperature. Thus, this could help the future cultivation be beneficial in this zone, if the climate effects are normal.

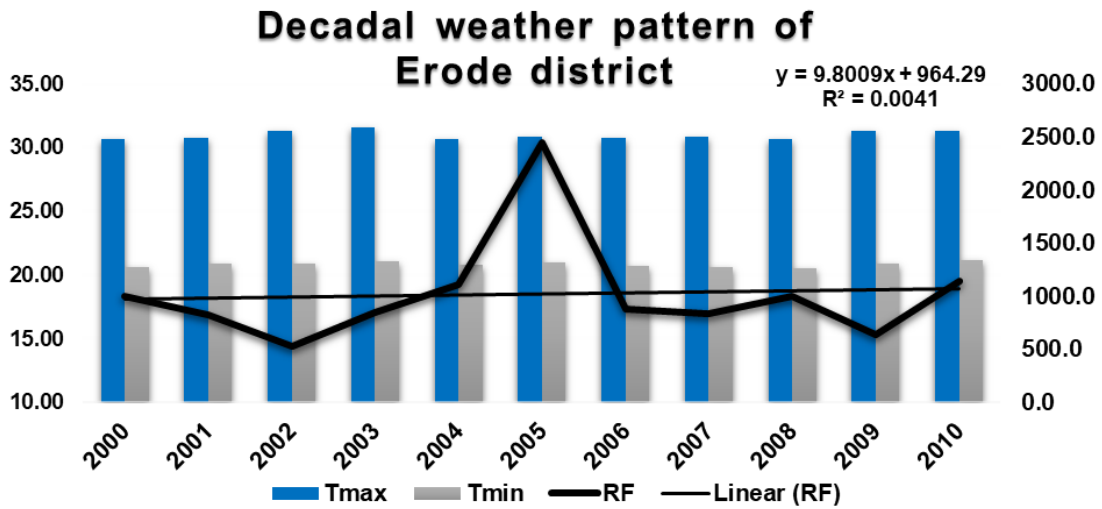


Fig. 10. Climate variability on Erode district of Tamilnadu

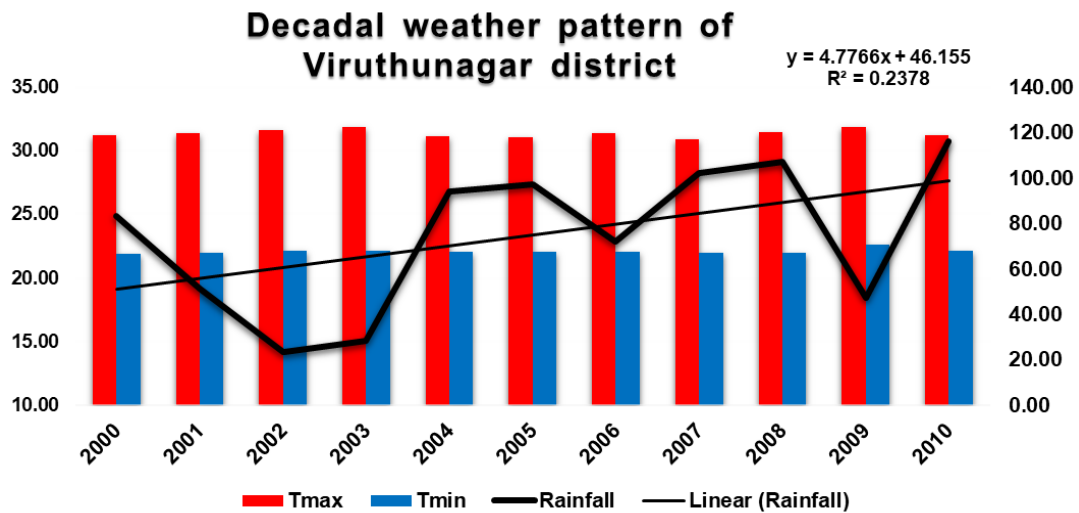


Fig. 11. Climate variability on Viruthunagar district of Tamilnadu

3.3.2 Climate variability on Viruthunagar district

From the Fig. 11, it could be observed that the annual rainfall and minimum temperature are undergoing an increasing trend, while the maximum temperature follows a slight decreasing trend. The increasing rainfall in Southern districts like Virudhunagar, which is a MECZ of coriander production, is surely to benefit in future. Meanwhile the drop in maximum temperature could save the crop from flower dropping conditions and the rainfall could support this. Since, coriander is a predominant spice crop, increase in minimum temperature would enhance the metabolism to slighter scales.

4. CONCLUSION

Status of Coriander and Turmeric crops over Tamilnadu was studied in this research paper. The trend of area and production were decreasing with Coriander but increasing with Turmeric. Productivity was also contradictory where Coriander had an upscale and Turmeric went downscale.

Both the crops have been under different cultivation zones, Coriander being Cauvery Delta and Southern districts oriented and Turmeric cultivation was in North-Western and Western districts. Tiruchirappali, Perambalur, Virudhunagar, Cuddalore, Ramanathapuram and

Thoothukudi districts were good performers on Coriander cultivation. Turmeric was best grown in Erode, Namakkal, Coimbatore, Salem and Dharmapuri districts. Spices are crops of longer shelf life, thus there is a need for proper processing, storage and marketing. Government could concentrate on establishing all the necessary facilities for farmers and industries involved in this sector, so that the quality of Indian turmeric and coriander is enhanced towards the global market.

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## COMPETING INTERESTS

Authors have declared that no competing interests exist.

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