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An Identification of Efficient Cropping Zone for Cotton in Tamil Nadu

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ABSTRACT

The study was conducted at Agro Climate Research Centre, Coimbatore, Tamil Nadu during the year 2025 to identify efficient cropping zones for cotton in Tamil Nadu state, India. The district wise data on area, production and productivity of cotton for the period 1985 to 2024 were collected from the Department of Statistics in Tamil Nadu and and the Indiastat database. The relative spread index (RSI) and relative yield index (RYI) were computed and the potential cropping districts for cotton were identified. The results revealed that the RSI was maximum in Virudhunagar district (559.7), followed by Perambalur (386.0), Madurai (290.3), Ariyalur (289.1), Thoothukudi (288.4) and Thirunelveli (205.1). The relative yield index was maximum in Thiruppur district (163.7) followed by Theni (150.1), Krishnagiri (147.5) and Namakkal (138.7). Based on RSI and RYI indices Ariyalur, Dharmapuri, Coimbatore, Salem, Theni, Thirunelveli and Tenkasi were identified as the Most Efficient Cropping Zones. Conversely, Thiruchirappalli, Madurai, Virudhunagar, Perambalur and Thoothukudi were classified as area efficient cropping zones; in these regions, the cultivated area was significantly high, yet productivity remained low, suggesting a critical need for farmer training in innovative technologies. Furthermore, Tiruvallur, Ramanathapuram, The Nilgiris and Kanyakumari were categorized as non-efficient cropping zones, while the remaining 16 districts were identified as yield-efficient cropping zones. Decadal relative spread index (DRSI) and relative yield index (DRYI) analyses (1985–2024) revealed widening spatial divergence. Highly stable rainfall in Kancheepuram supported the highest productivity (DRYI 201.0), whereas extreme variability in Perambalur (RSI 724.3) and Ramanathapuram led to regressive yield trends.

KEYWORDS: Cotton, RSI, RYI, MECZ, YECZ

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1. INTRODUCTION

Cotton (*Gossypium hirsutum* L.) has been one of the most important cash and fibre crops cultivated in India. It was popularly known as "White Gold" and the "King of Fibre Crops" due to its immense economic value and industrial significance (Vekariya et al., 2021). The crop had primarily been cultivated for its fibre and oil, which played a vital role in the national economy (Mustafa and Iqbal, 2021). Cotton was a major commercial crop, with approximately 64% of the fibre used in apparel manufacturing, 28% in household furnishings, and the remaining 8% in various industrial products (Kadam et al., 2025). The crop contributed substantially to both the agricultural and industrial sectors, serving as an essential raw material for the textile industry, particularly in Tamil Nadu, where it supported large-scale industries in the northwestern districts (Anonymous, 2024).

Globally, cotton accounts for around 23% of total fibre production, with a consumption of approximately 326 lakh bales (170 kg each) per year. India leads the world in cotton acreage, with 113.60 lakh hectares under cultivation, representing nearly 36% of the global area of 316.20 lakh hectares. About 62% of India's cotton is produced in rainfed areas, while 38% is cultivated under irrigation. During the 2024–25 cotton season, productivity in India was around 448 kg ha^{-1}, making the country one of the largest producers, consumers, and exporters of cotton worldwide (Anonymous, 2024).

In India, cotton cultivation provides a direct livelihood to nearly six million farmers, while an estimated 40–50 million people are engaged in cotton trading, processing, and related industries, highlighting its socio-economic importance (Anonymous, 2024a; Anonymous, 2024; Blaise and Kranthi, 2019). Over the years, India has emerged as the largest producer of cotton, occupying the top position in both total cultivated area and production. Among major cotton-exporting nations, India ranks third, with an export volume of 5.5 million bales, behind the United States (16.25 million bales) and Brazil (10.70 million bales) (Anonymous, 2021). In Tamil Nadu, cotton cultivation occurs across both irrigated and rainfed regions (Mayilsami and Selvaraj, 2016; Raman and Chandran, 2017). The main sowing season is September-October, though in southern districts, sowing of rainfed crops may extend to November. In parts of Karnataka and Andhra Pradesh, desi cotton varieties are sown in August–September. Summer sowing in Tamil Nadu occurs during February-March, while in the rice fallows of Andhra Pradesh and Tamil Nadu, sowing extends from mid-December to mid-January. These variations are primarily influenced by regional climatic conditions, irrigation availability, and soil characteristics, which affect crop performance and yield stability.

Despite widespread cultivation, several factors including climatic variability, soil fertility, irrigation facilities, pest incidence, and management practices have contributed to yield disparities among regions (Koppad and Khan, 1996; Visscher et al., 2024; Nguyen et al., 2025; Ali et al., 2025). The scope for horizontal expansion of cotton cultivation is limited due to land constraints, and productivity improvements depend on regional adaptability and efficient resource utilization (Ramasundaram and Gajbhiye, 2001). In many cases, realized yields are lower than potential yields, while in some regions, smaller cultivated areas achieve higher productivity. Identification of efficient cropping zones for cotton is critical to optimize production potential. Targeted interventions, such as precision farming, integrated nutrient and pest management, and improved irrigation scheduling, can enhance productivity, resource efficiency, and sustainability. Better cotton should be promoted to help the farmers increase the yield, reduce the cost and conserve natural resources and social benefits (Zulfiqar and Thapa, 2018). To address these disparities, this study aimed to delineate efficient cotton cropping zones and promote 'Better Cotton' practices, with the objective of optimizing production potential, reducing cultivation costs and ensuring long-term socio-economic sustainability within the sector.

2. MATERIALS AND METHODS

The study was carried out at the Agro Climate Research Centre, Coimbatore, Tamil Nadu during the year 2025 to identify efficient cropping zones for cotton in Tamil Nadu state. The district wise data on area and productivity of cotton for different districts of Tamil Nadu were collected from the indiastat.com. From these 40 years (1985 to 2024) data relative spread index (RSI) and the relative yield index (RYI) were computed by using Kanwar's (1972) formula.

RSI=(Area of cotton crop expressed as % of total cultivable area in the District/Area of crop expressed as % to the total cultivable area in the State)×100 ....……..(1)

RYI=(Mean yield of a cotton crop in a District (kg ha^{-1})/ Meean yield of the crop in the State (kg ha^{-1})×100 …..(2)

3. RESULTS AND DISCUSSION

3.1. Relative spread index (RSI)

The data of the relative spread index for cotton (Figure 1) indicated that among 32 districts, the RSI was maximum recorded in Virudhunagar (559.7), followed by Perambalur (386.0), indicating extreme rainfall irregularity in these districts. Similarly, Madurai (290.3), Ariyalur (289.1), and Thoothukudi (288.4) also showed very high RSI values, confirming that southern and central interior districts experienced highly uneven rainfall distribution.

Table 1: Criteria for efficient cropping zone

Relative spread index (RSI)	Relative yield index (RYI)	Category
>100	>100	Most efficient cropping zone (MECZ)
<100	>100	Yield efficient cropping zone (YECZ)
>100	<100	Area-efficient cropping zone (AECZ)
<100	<100	Non- efficient cropping zone (NECZ)

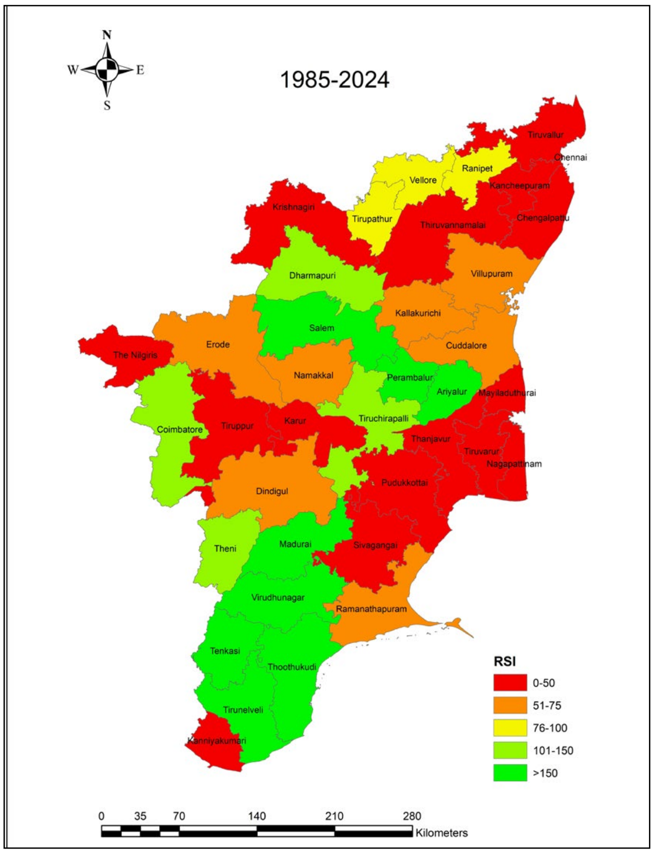

Figure 1: Relative spread index of cotton in Tamil Nadu (1985–2024)

Moderate to high rainfall variability was observed in Tirunelveli (205.1), Salem (151.7), Tiruchirapalli (148.5), Tenkasi (155.4), and Dharmapuri (122.4). In contrast, the lowest RSI values were recorded in Tiruvallur (0.1) and Kanniyakumari (0.1), followed by The Nilgiris (0.2), indicating highly stable rainfall distribution in these districts. Overall, the RSI results highlight that rainfall variability is extremely high in districts like Virudhunagar, Perambalur, Madurai, Ariyalur, and Thoothukudi, whereas districts such as Tiruvallur, Kanniyakumari, and Nilgiris exhibit the least rainfall variability. Higher RSI indicates the major cotton cultivating area. The soil type, rainfall pattern and other climatic factors of that area were highly favorable for cotton cultivation.

3.1.1. Decadal relative spread index (DRSI)

Analysis of the decadal Relative Spread Index (RSI) from 1985 to 2024 revealed significant differences in rainfall variability across districts in Tamil Nadu. Over these four decades, Virudhunagar consistently exhibited the highest RSI values, with readings of 633.3 (1985–1994), 548.2 (1995–2004), 349.6 (2005–2014), and 588.1 (2015–2024) (Figure 1.1, Figure 1.2, Figure 1.3, Figure 1.4). Similarly, Perambalur demonstrated exceptionally high rainfall variability, reaching the highest RSI value of 724.3 during 2005–2014, the peak in the entire dataset. Even in the 2015–2024 period, Perambalur maintained a very high RSI value of 520.4, indicating ongoing rainfall variability. In contrast, Thiruvallur consistently recorded the lowest RSI values across all decades (0.1, 0.1, 0.2, and 0.0), indicating a highly stable and evenly distributed rainfall pattern. Similarly, Kanniyakumari and The Nilgiris also displayed very low RSI values over the years, suggesting a relatively stable rainfall distribution. Overall, the comparative analysis strongly indicates that districts like Virudhunagar and Perambalur experienced significant rainfall variability, whereas districts such as Thiruvallur, Kanniyakumari, and

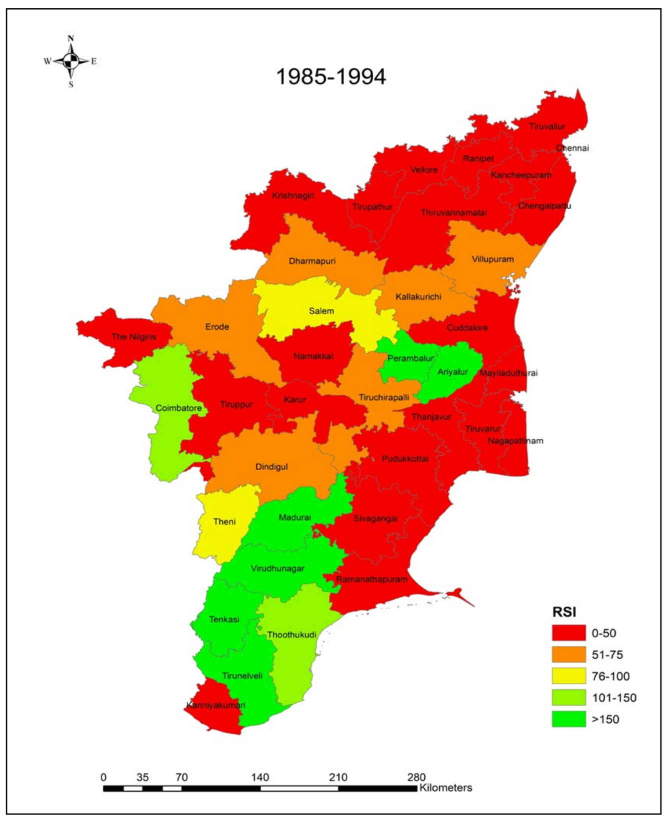

Figure 1.1: Relative spread index of cotton in Tamil Nadu (1985–1994)

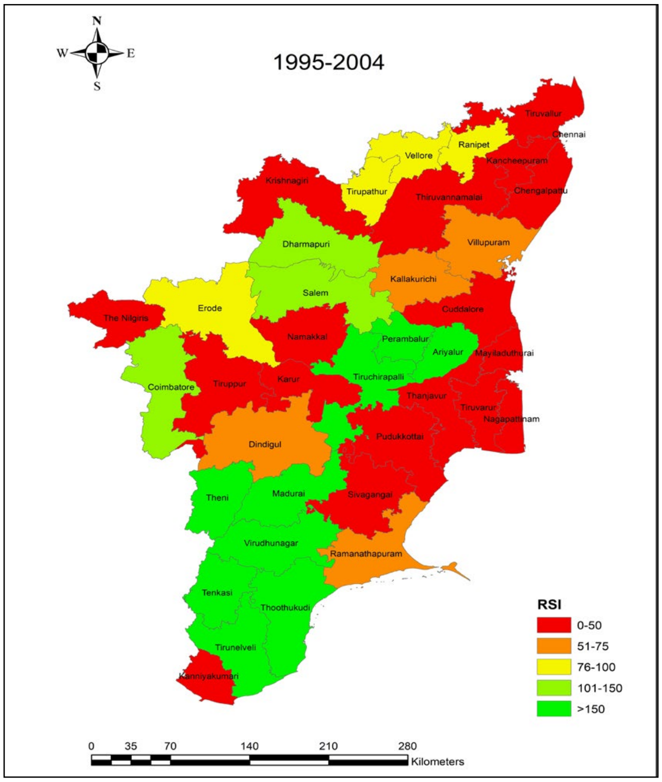

Figure1.2: Relative spread index of cotton in Tamil Nadu (1995–2004)

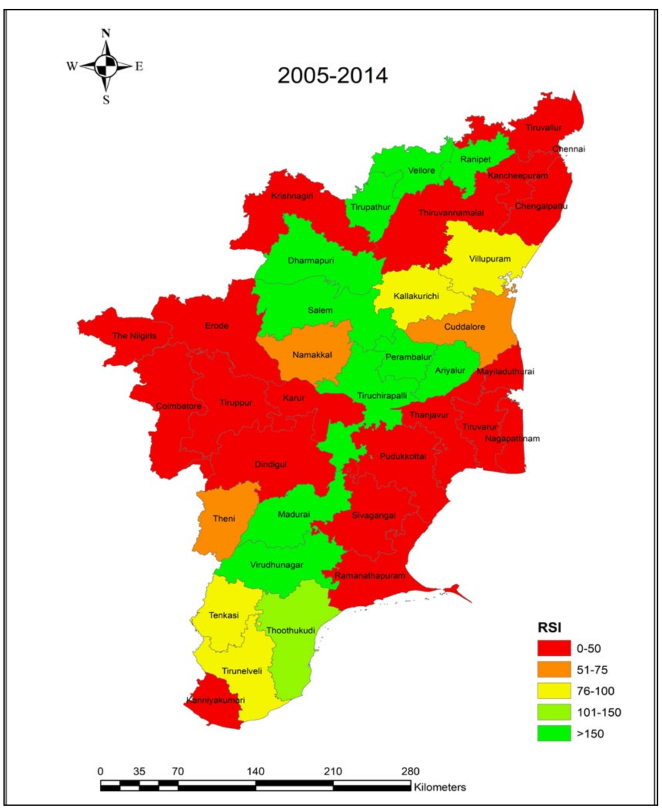

Figure 1.3: Relative spread index of cotton in Tamil Nadu (2005–2014)

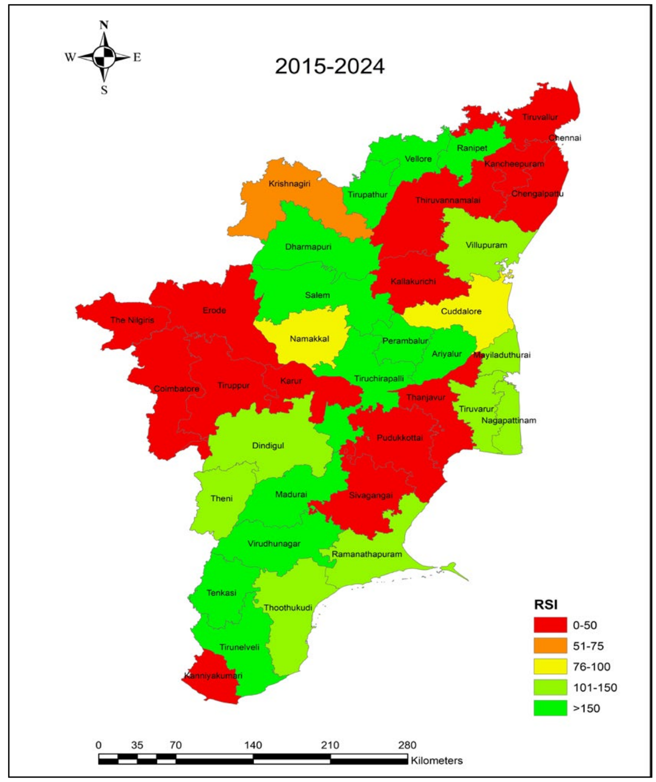

Figure 1.4: Relative spread index of cotton in Tamil Nadu (2015–2024)

Nilgiris exhibited the least variability, highlighting distinct spatial differences in rainfall distribution across Tamil Nadu over the past four decades.

3.2. Relative yield index (RYI)

The relative yield index (RYI) analysis (Figure 2) revealed that Tiruppur (163.7) achieved the highest value, signifying the most robust yield performance among all districts, followed by Theni (150.1) and Krishnagiri (147.5). Other districts, including Namakkal (138.7), Dindigul (138.2), Dharmapuri (134.8), Thanjavur (131.4) and Thiruvannamalai (131.1), also recorded high RYI values, reflecting consistently elevated productivity levels across these regions. Moderate yield performance was observed in districts such as Salem (129.3), Erode (129.6), Villupuram (126.4) and Tiruvarur (126.0). Conversely, the lowest RYI value was recorded in Ramanathapuram (50.7) indicating significantly poor yield performance, while other low-productivity districts included Thoothukudi (69.6), Madurai (72.1), Virudhunagar (75.4), Kanniyakumari (77.6) and Tiruvallur (78.6). These persistent spatial differences in yield are likely attributable to varying levels of agricultural intensification, mechanization and land suitability (Bowden et al., 2023). Overall, the RYI results indicated that while the northern and western clusters possessed high-yield potential, the southern coastal belt remained a low-productivity region, potentially due to climate sensitivity

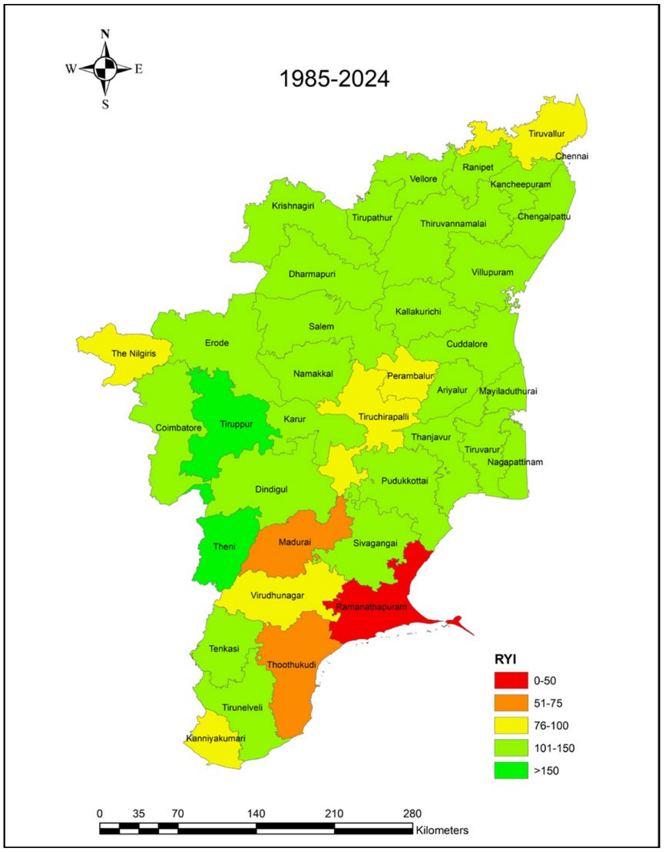

Figure 2: Relative yield index of cotton in Tamil Nadu (1985–2024)

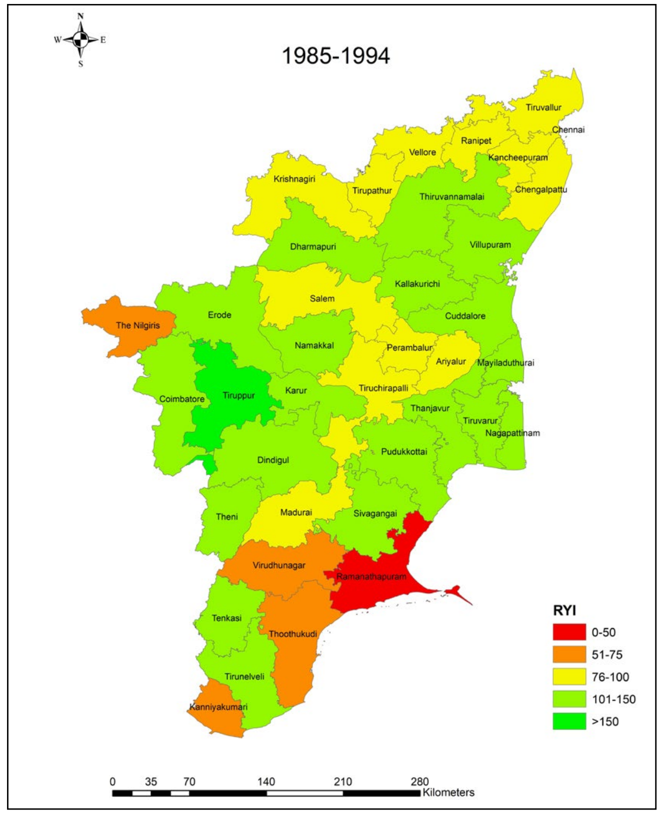

Figure 2.1: Relative yield index of cotton in Tamil Nadu (1985–1994)

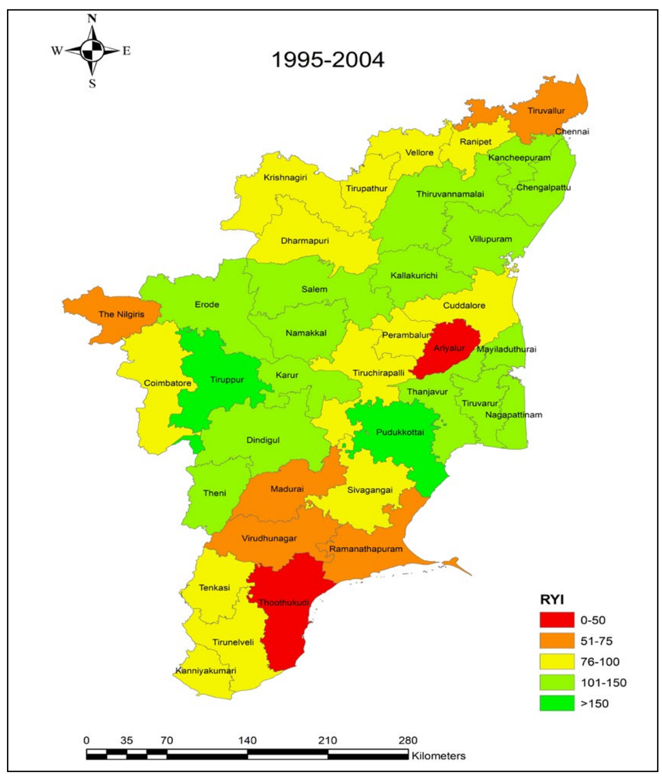

Figure 2.2: Relative yield index of cotton in Tamil Nadu (1995–2004)

and environmental stressors (Ramachandran et al., 2017).

3.2.1. Decadal relative yield index (DRYI)

The decadal relative yield index (DRYI) analysis spanning 1985 to 2024 (Figures 2.1–2.4) revealed a significant and widening spatial divergence in agricultural productivity across Tamil Nadu. A longitudinal assessment showed that Kancheepuram emerged as the leading performer in the most recent decade (2015–2024), achieving a peak RYI of 201.0, whereas Tiruppur demonstrated historical strength with a maximum productivity of 189.1 during the 1995–2004 period. This growth in the northern and western clusters, including Vellore (160.1) and Krishnagiri (150.7), was likely linked to more effective management of cropping intensities and the adoption of high-yielding crop varieties (Bowden et al., 2023; Pazhanivelan et al., 2025). Conversely, Ramanathapuram consistently yielded the lowest values, declining from 44.6 to a critically low value of 33.4 in the most recent decade, reflecting a regressive trend potentially exacerbated by climate sensitivity and environmental stressors in the southern coastal belt (Ramachandran et al., 2017). Furthermore, the single lowest point recorded in Ariyalur (16.5) during the 1995–2004 period illustrated how severe localized yield failures occurred, highlighting the need for a deeper investigation into socio-economic

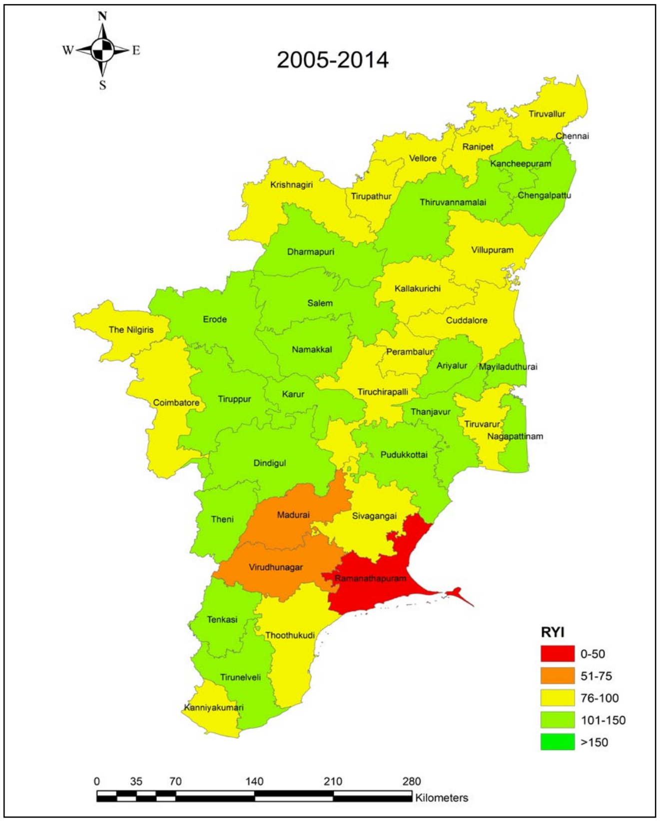

Figure 2.3: Relative yield index of cotton in Tamil Nadu (2005–2014)

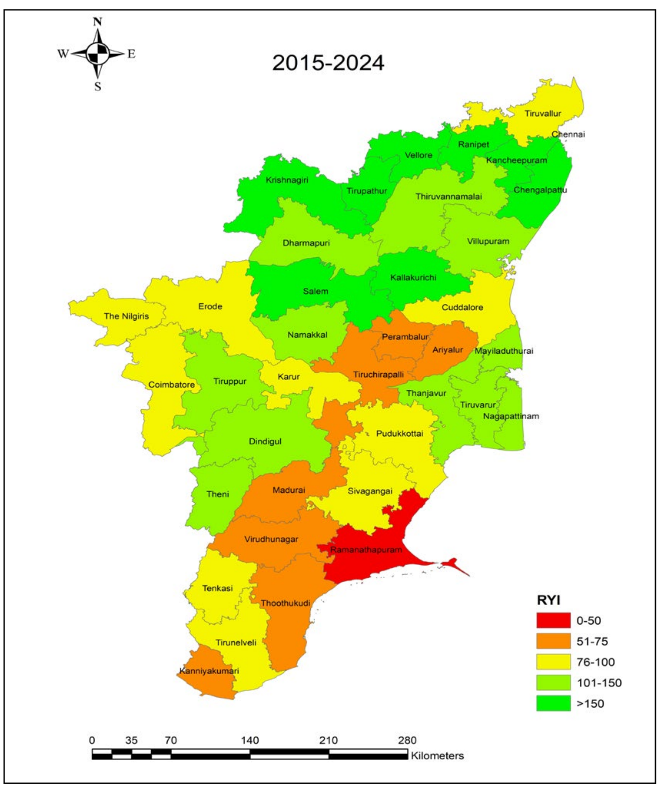

Figure 2.4: Relative spread index of cotton in Tamil Nadu (2015–2024)

and climatic drivers using advanced spatial tools to address these persistent productivity gaps (Prashnani et al., 2024; Pazhanivelan et al., 2025) (Table 2).

3.3. Most efficient zone

From the computed data (Table 3), Ariyalur, Dharmapuri, Coimbatore, Salem, Thirunelveli, Tenkasi and Theni districts have high RSI and high RYI. These six districts were found to be MECZ, mainly because it has black cotton soil and have a larger number of textile industries in Tamil Nadu (Figure 3). Similar result was found in Coimbatore district reported earlier in 2002 (Sanbagavalli et al., 2002). Four districts like Thiruchirapalli, Madurai, Perambalur, Virudhunagar and Thoothukudi come under the area-efficient cropping zone (Figure 4). In this zone the cropping area was very high but the yield was very low. So, farmers need to be trained in innovative technologies to explore higher productivity. Tiruvallur, Ramanathapuram, The Nilgiris and Kanyakumari come under an NECZ (Non-efficient cropping zone, Figure 5). The remaining 16 districts *viz.*, Thiruppur, Erode, Dindigul, Namakkal, Thanjavur, Thiruvannamalai, Nagapattinam, Karur, Pudukottai, Villupuram, Thiruvarur, Kancheepuram,

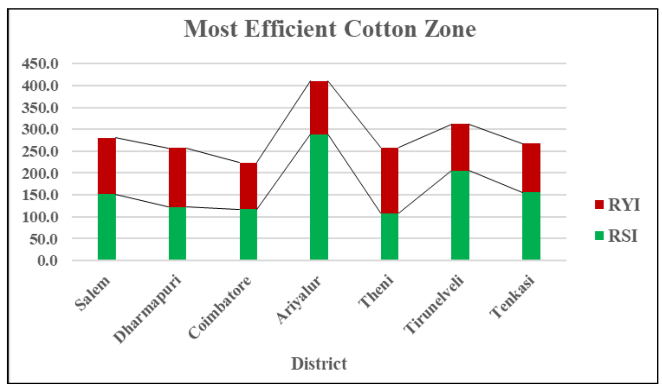

Figure 3: Most efficient cotton zone in Tamil Nadu (1985–2024)

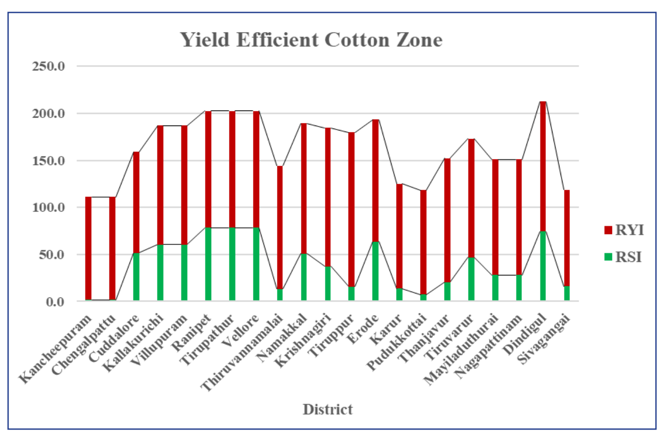

Figure 4: Yield efficient cotton zone in Tamil Nadu (1985–2024)

Table 2: District wise decadal relative spread index and relative yield index of cotton in Tamil Nadu (1985–2024)

Sl. No.	District	1985–1994		1995–2004		2005–2014		2015–2024	
		RYI	RSI	RYI	RSI	RYI	RSI	RYI	RSI
1.	Kancheepuram	94.8	1.3	123.3	2.2	108.4	0.7	201.0	0.8
2.	Tiruvallur	82.5	0.1	64.3	0.1	96.0	0.2	84.8	0.0
3.	Cuddalore	128.2	41.2	91.5	24.0	76.0	74.7	93.2	98.3
4.	Villupuram	117.7	57.0	124.6	56.1	94.3	83.8	117.6	115.5
5.	Vellore	94.2	25.6	87.7	97.6	92.0	153.2	160.1	176.3
6.	Thiruvannamalai	118.3	3.0	116.4	24.9	107.3	16.4	125.9	8.9
7.	Salem	88.6	92.7	103.4	149.7	113.4	253.3	150.4	235.9
8.	Namakkal	124.8	36.6	121.0	44.0	128.3	64.5	112.8	82.3
9.	Dharmapuri	125.4	63.8	95.1	127.3	107.3	199.9	148.9	264.1
10.	Krishnagiri	81.3	29.4	81.6	41.7	81.6	43.1	150.7	54.6
11.	Coimbatore	121.3	143.0	95.6	128.5	94.1	36.6	76.3	17.2
12.	Tiruppur	156.7	6.3	189.1	8.3	134.7	11.7	117.8	30.7
13.	Erode	121.6	58.5	122.1	92.2	138.6	33.2	88.1	26.5
14.	Tiruchirapalli	75.3	69.8	94.6	167.5	83.6	292.3	69.1	350.5
15.	Karur	106.8	12.4	110.5	20.0	104.9	5.7	80.9	26.6
16.	Perambalur	88.9	292.1	89.5	256.7	88.9	724.3	74.1	520.4
17.	Ariyalur	78.7	169.6	16.5	194.6	123.2	312.1	73.9	444.3
18.	Pudukkottai	115.4	12.9	157.6	6.2	102.4	1.4	81.1	2.5
19.	Thanjavur	118.9	18.7	127.9	17.6	125.7	15.9	104.2	31.0
20.	Tiruvarur	107.0	19.3	133.4	28.1	88.9	28.0	114.4	120.2
21.	Nagapattinam	118.4	15.2	118.8	26.7	103.3	18.3	105.2	135.7
22.	Madurai	75.8	266.1	51.0	262.7	67.5	242.9	62.7	367.1
23.	Theni	131.7	87.5	112.2	174.2	146.2	60.4	126.5	134.2
24.	Dindigul	129.5	74.9	139.9	73.1	119.4	39.2	114.6	136.5
25.	Ramanathapuram	44.6	47.7	55.9	64.4	52.2	49.2	33.4	113.5
26.	Virudhunagar	65.0	633.3	67.2	548.2	74.6	349.6	64.1	588.1
27.	Sivagangai	102.0	12.7	98.7	15.4	90.5	14.8	81.5	31.9
28.	Tirunelveli	101.2	294.1	98.3	173.2	104.6	87.9	83.2	232.5
29.	Tenkasi	101.1	292.1	98.2	172.1	104.3	86.7	83.1	231.4
30.	Thoothukudi	58.1	148.0	42.0	257.3	79.9	113.3	62.9	133.2
31.	The Nilgiris	65.8	0.1	65.0	0.1	93.9	0.3	81.1	4.6
32.	Kanniyakumari	61.7	0.1	95.0	0.1	78.0	0.6	59.7	0.8

Cuddalore, Sivagangai, Kirshnagiri and Vellore, were found to be YECZ of cotton in Tamil Nadu (Figure 6). Similar results were also reported earlier in 2020 and the same methodological study was found in various crops like rice (Narayanan et.al., 2003; Kokilavani and Geethalakshmi 2013; Kokilavani and Dheebakaran, 2019), groundnut (Subrahmaniyan et al., 2005), maize (Abinaya et al., 2022; Kokilavani and Geethalakshmi, 2013; Kokilavani and Dheebakaran 2019), redgram and sorghum (Abinaya et al., 2022).

3.3.1. Decadal analysis of most efficient zone

The decadal efficient cotton zone analysis of Tamil Nadu districts revealed notable spatial and temporal changes from 1985–1994 to 2014–2024 (Figure 7, Figure 8, Figure

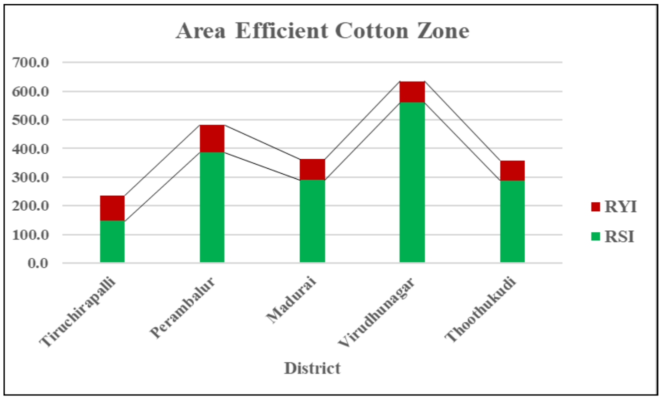

Figure 5: Area-efficient cotton zone in Tamil Nadu (1985-2024)

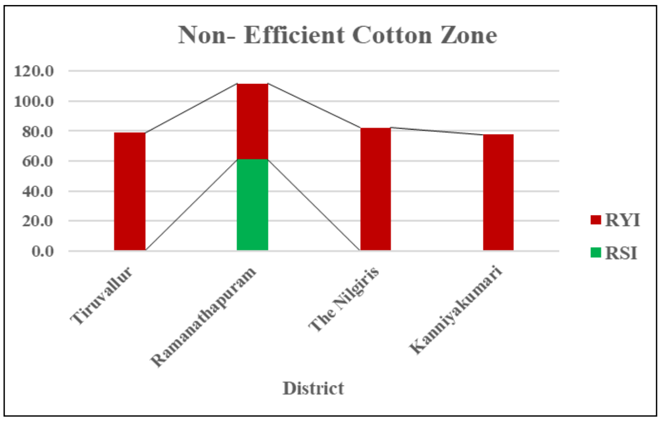

Figure 6: Non-efficient cotton zone in Tamil Nadu (1985–2024)

9, Figure 10, Figure 11, Figure 12, Figure 13, Figure 14, Figure 15, Figure 16, Figure 17, Figure 18, Figure 19, Figure 20, Figure 21 and Figure 22). During 1985–1994 several districts such as Thiruvannamalai, Namakkal, Thiruppur, Thanjavur, Nagapatinam and Theni were categorized under the YECZ indicating a comparatively higher cotton yield efficiency whereas districts such as Thiruvallur, Kancheepuram, Vellore, Salem, Krishnagiri, Ramanathapuram, The Nilgiris and Kanniyakumari remained under the Non-Efficient Cotton Zone (NECZ). In the same decade a few districts including Coimbatore, Thirunelveli and Tenkasi were identified as the Most Efficient Cotton Zones (MECZ) reflecting superior cotton efficiency. Considerable transitions were observed over the subsequent decades particularly between 2005 and 2014 and 2014–2024. Districts such as Salem, Villupuram, Vellore, Dharmapuri, Thiruvarur, Nagapatinam, Theni and Dindigul shifted towards the Most Efficient Cotton Zone (MECZ) by 2014–2024 suggesting improvement in cotton efficiency possibly due to better agronomic practices, irrigation support and favorable climatic conditions. However, some districts such as Cuddallore, Sivagangai, Pudukkottai, Karur and Erode shifted towards the Non-efficient cotton zone (NECZ) in the later decades indicating a decline in cotton efficiency. Prominently, several districts such as Perambalur, Madurai, Virudhunagar and Thoothukudi consistently remained in the area efficient cotton zone (AECZ) throughout all decades demonstrating stable area-based cotton efficiency. Overall, the results clearly show that while YECZ and NECZ dominated the

Table 3: Category-wise efficient cropping zone of cotton in Tamil Nadu (1985–2024)

Sl. No.	District	RSI	RYI	Category
1.	Kancheepuram	1.9 (L)	109.3 (H)	YECZ
2.	Thiruvallur	0.1 (L)	78.6 (L)	NECZ
3.	Cuddalore	51.8 (L)	107.1 (H)	YECZ
4.	Villupuram	60.5 (L)	126.4 (H)	YECZ
5.	Vellore	78.5 (L)	123.9 (H)	YECZ
6.	Thiruvannamalai	13.2 (L)	131.1 (H)	YECZ
7.	Salem	151.7 (H)	129.3 (H)	MECZ
8.	Namakkal	50.7(L)	138.7 (H)	YECZ
9.	Dharmapuri	122.4 (H)	134.8 (H)	MECZ
10.	Kirshnagiri	37.1 (L)	147.5 (H)	YECZ
11.	Coimbatore	117.7 (H)	106.3 (H)	MECZ
12.	Thiruppur	15.9 (L)	163.7 (H)	YECZ
13.	Erode	63.6 (L)	129.6 (H)	YECZ
14.	Thiruchirapalli	148.5 (H)	88.4 (L)	AECZ
15.	Karur	13.8 (L)	111.4 (H)	YECZ
16.	Perambalur	386.0 (H)	95.8 (L)	AECZ
17.	Ariyalur	289.1 (H)	121.2 (H)	MECZ
18.	Pudukottai	7.5 (L)	111.0 (H)	YECZ
19.	Thanjavur	20.6 (L)	131.4 (H)	YECZ
20.	Thiruvarur	47.0 (L)	126.0 (H)	YECZ
21.	Nagapattinam	28.1 (L)	123.0 (H)	YECZ
22.	Madurai	290.3 (H)	72.1 (L)	AECZ
23.	Theni	107.9 (H)	150.1 (H)	MECZ
24.	Dindugal	74.3 (L)	138.2 (H)	YECZ
25.	Ramanathapuram	60.9 (L)	50.7 (L)	NECZ
26.	Virudhunagar	559.7 (H)	75.4 (L)	AECZ
27.	Sivagangai	16.3 (L)	102.5 (H)	YECZ
28.	Thirunelveli	205.1 (H)	107.1 (H)	MECZ
29.	Tenkasi	155.4 (H)	112.2 (H)	MECZ
30.	Thoothukudi	288.4 (H)	69.6 (L)	AECZ
31.	The Niligiris	0.2 (L)	82.0 (L)	NECZ
32.	Kanyakumari	0.1 (L)	77.6 (L)	NECZ

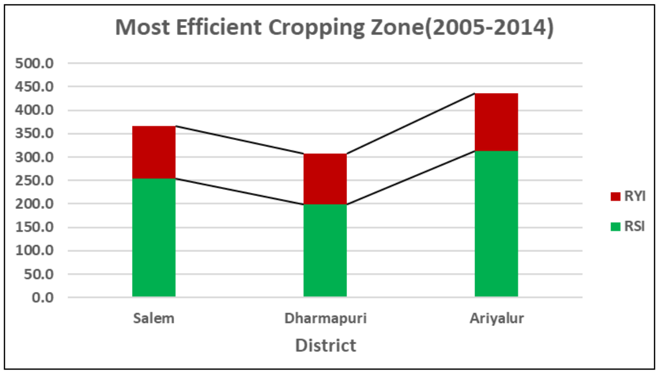

Figure 9: Most efficient cotton zone in Tamil Nadu (2005–2014)

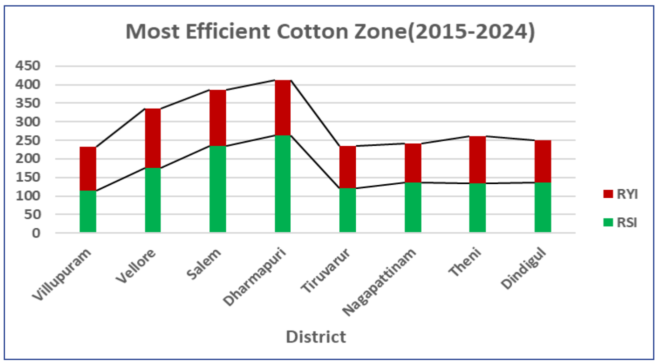

Figure 10: Most efficient cotton zone in Tamil Nadu (2015–2024)

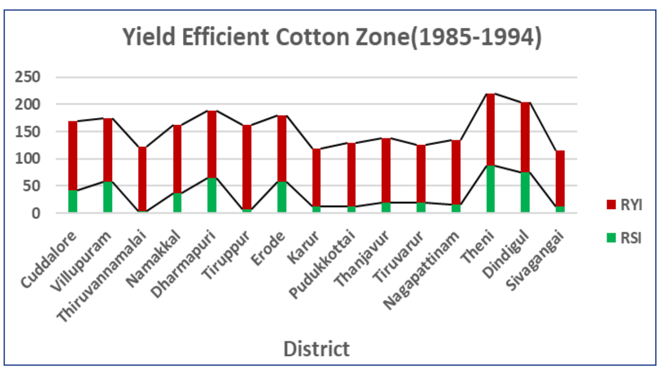

Figure 11: Yield efficient cotton zone in Tamil Nadu (1985–1994)

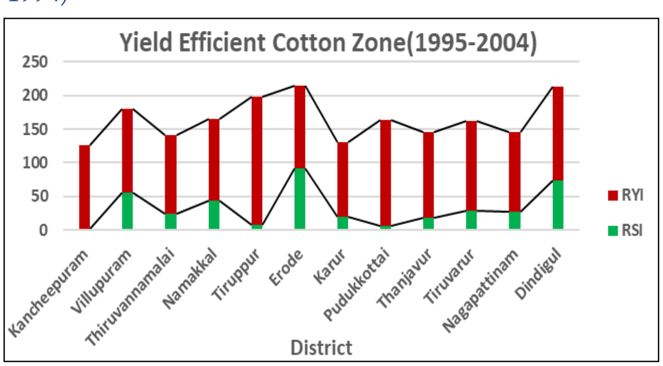

Figure 12: Yield efficient cotton Zone in Tamil Nadu (1985–1994)

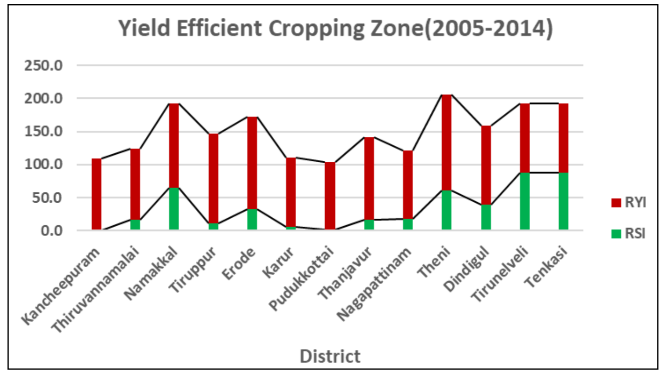

Figure 13: Yield efficient cotton zone in Tamil Nadu (2005–2014)

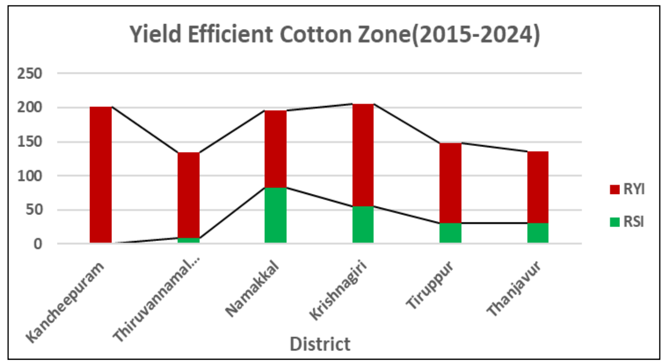

Figure 14: Yield efficient cotton zone in Tamil Nadu (2015–2024)

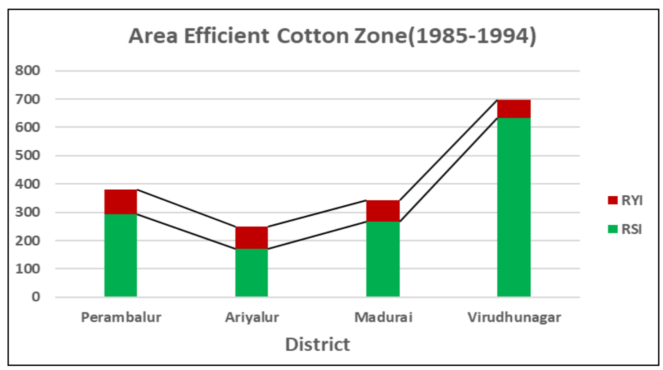

Figure 15: Area-efficient cotton zone in Tamil Nadu (1985–1994)

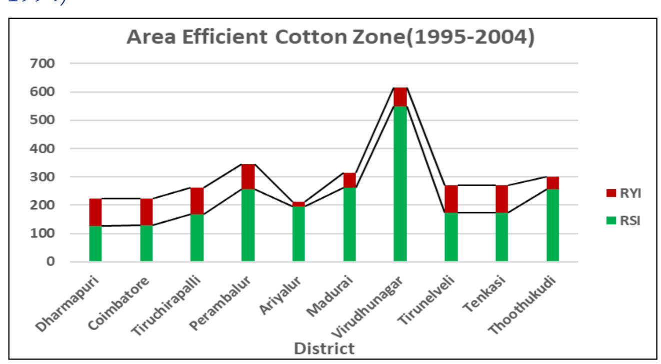

Figure 16: Area-efficient cotton zone in Tamil Nadu (1985–1994)

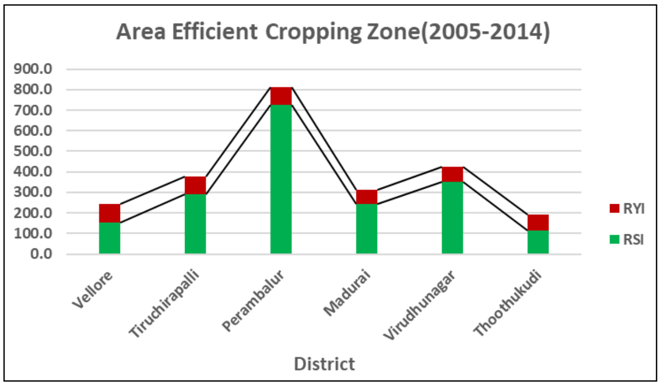

Figure 17: Area-efficient cotton zone in Tamil Nadu (2005–2014)

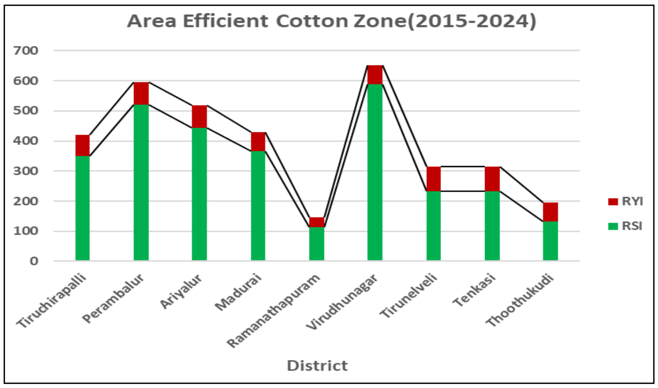

Figure 18: Area-efficient cotton zone in Tamil Nadu (2015–2024)

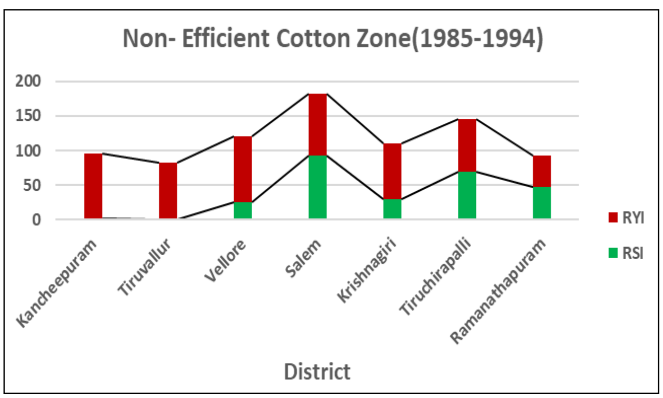

Figure 19: Non-efficient cotton zone in Tamil Nadu (1985–1994)

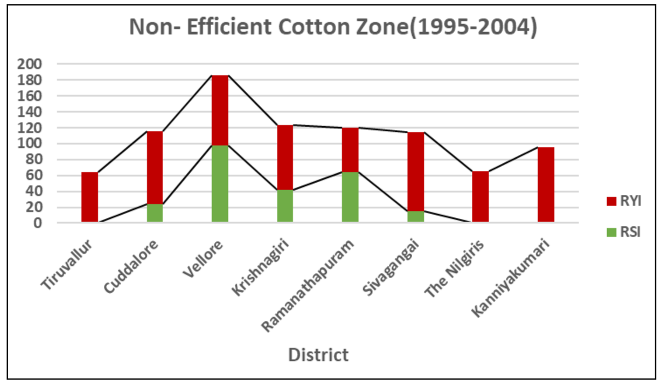

Figure 20: Non-efficient cotton zone in Tamil Nadu (1995–2004)

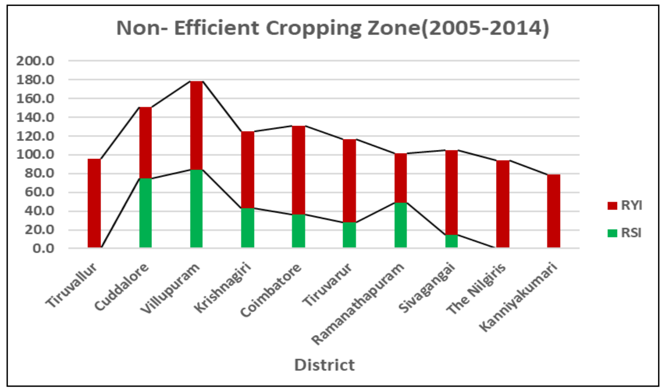

Figure 21: Non-efficient cotton zone in Tamil Nadu (2005–2014)

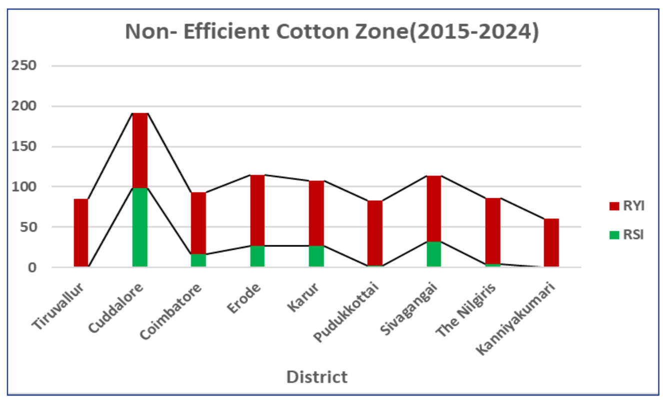

Figure 22: Non-efficient cotton zone in Tamil Nadu (2015–2024)

earlier decades the recent decade (2014–2024) recorded an increased representation of MECZ and AECZ districts highlighting shifting cotton efficiency patterns across Tamil Nadu over time.

4. CONCLUSION

Among the 32 districts studied, four districts viz., Tiruvallur, Ramanathapuram, The Nilgiris and Kanyakumari fell under the non-efficient cropping zone, characterized by coastal and hilly terrains. In these districts, the promotion of alternate crops was deemed necessary. Conversely, five districts like Tiruchirappalli, Madurai, Perambalur, Virudhunagar and Thoothukudi were categorized within the area-efficient cropping zone. In this zone, although the cropping area was significantly high, the recorded yields remained low. Consequently, it was concluded that farmers in these regions required training in innovative technologies to enhance productivity levels.

5. FURTHER RESEARCH

Future research should focus on incorporating long-term climate variability and high-resolution spatial data to improve the accuracy of cotton cropping zone identification in Tamil Nadu. Further studies may also integrate soil characteristics, water availability and socio-economic factors to refine the suitability assessment. In addition, the application of advanced geospatial and climate modelling techniques can support dynamic updating of cotton-growing zones under changing climate scenarios.

6. ACKNOWLEDGEMENT

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