

Examining the Prospective zones for Maize and Sorghum in Tamil Nadu

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ABSTRACT: An analytical study was conducted in Tamilnadu to determine the Efficient Cropping Zone for Maize and Sorghum crops. Ten years data (2010-2011 to 2020-2021) on Area, Production and Productivity for Maize and Sorghum Crops were collected From Directorate of Economics and Statistics, Government of India. Relative Spread Index (RSI) and Relative Yield Index (RYI) were worked out to determine the Most Efficient Cropping Zone. It was found that 9 districts in Tamil Nadu were identified as Effective cropping zone for Maize and 7 districts are Efficient Cropping Zone for Sorghum. Dindugal and Theni Districts of Tamil Nadu were identified as Most Effective Cropping Zone for Maize and Sorghum. In some districts, the RSI is higher for a particular crop but the RYI is lower, indicating that crop's unsuitability. However, because of things like market demand and produce value, farmers often plant crops that are inappropriate for their region which relates in high RSI with low RYI.

Keywords: ECZ, RSI, RYI, Maize, Sorghum.

INTRODUCTION

In Tamil Nadu agriculture is the most predominant sector of the state economy, as 70% of the population is engaged in agriculture and allied activities for their livelihood. The state has as an area of 1.3 lakh sq.km with a gross cropped area of around 63 l.ha. Maize (*Zea mays* L.) is an important grain crop in India, and in Tamil Nadu, it is the second most significant crop after rice, which occupies 3.33 lakh hectares and sorghum (sorghum bicolor l. Moench), also known as great millet, is one of the important cereals of arid and semiarid regions occupies 4.5 lakh hectares (Sanbagavalli *et al.*, 2020).

Cereal grains are grown in greater quantities than any other type of crop (Kokilavani & Geethalakshmi 2013). For crop development and productivity, agricultural efficiency is dependent on natural resources such as soil, water, fertilizers, minerals, and so on. Temperature, precipitation, soil, and the distribution of

pests, insects, diseases, and weeds all have an impact on agricultural efficiency. These factors influence the overall agro-ecological setting for crop nutrition and efficiency (Kasar and Zolekar 2022).

Crop productivity has to be increased and sustained, if efficient places for the crops have been identified. Variable climate, changes in rainfall patterns, groundwater depletion, shorter growing seasons, and cropping patterns have contributed to a spatial shift in crop potential throughout this age. Many numbers of climate resilient native crops have been replaced with new one and also the identification of potential crops and zones would help in increasing the productivity, ensures better utilization of available resources and avoids wastage of resources in the inefficient zones (Kokilavani and Dheebakaran 2019). As a result, new technologies have emerged that refer to both time and space sequences of crops, as well as the identification of the regions of most efficient crops.

Efficient Cropping Zones (ECZ) is a methodology that uses calculated Relative Yield Index (RYI) and Relative Spread Index (RSI) to identify the crop's potential area, resulting in an efficient cropping zone (Veeraputhiran *et al.*, 2003). By this we can identify the region suited for particular crops based on the findings of this study. If a crop does not fall within an efficient cropping zone, it can be replaced by other suitable crops with strong yield potential. Keeping all the things in view, the current research was undertaken to determine the most efficient cropping zone for maize and sorghum in Tamil Nadu.

MATERIAL AND METHODOLOGY

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

Where RSI: Relative Spread Index

$$RYI = \frac{\text{Mean Yield of a particular crop in a District (Kg/ha)}}{\text{Mean yield of the crop in the state (Kg/ha)}} * 100$$

Where in RYI: Relative Yield Index

All the districts of Tamil Nadu were investigated for efficient cultivation zones for the crops maize and sorghum. Ten years 2010–11 to 2020–21 (10 years) statistics on area, production, and productivity, as well as total cultivable area, were collected for Maize and Sorghum in districts of Tamil Nadu from Season and Crop Report and the Government of India Directorate of Economics and Statistics. The formula given by Kanwar (1972) was used to find out Relative Spread Index (RSI) and Relative Yield Index (RYI) for Maize and Sorghum to identify efficient crop zone for the Maize and Sorghum in all the districts of Tamil Nadu. The Relative Spread Index and Yield Index were worked out by using the following Formula's.

Table 1: The criteria for the Effective Cropping Zone.

RSI	RYI	Cropping Zone
>100 (High)	>100 (High)	Most Efficient Cropping Zone (MECZ)
>100 (High)	< 100 (Low)	Area Efficient Cropping Zone (AECZ)
< 100 (Low)	>100 (High)	Yield Efficient Cropping Zone (YECZ), (Kokilavani and Dheebakaran, 2019)
< 100 (Low)	< 100 (Low)	Not Efficient Cropping Zone (NECZ)

RESULT AND DISCUSSION

A. Efficient Cropping Zone for Maize

Out of all the districts in Tamil Nadu, 8 districts come under MECZ, followed by 10 districts come under YECZ, 6 districts come under AECZ and 7 districts come under NECZ for Maize.

The Most Efficient Cropping Zone (MECZ) with high RSI and RYI for maize was identified in the Tamil Nadu districts of Ariyalur, Erode, Dindugal, Perambalur, Salem, Theni, Thiruvallur, Thiruchirappalli, and Thiruppur, according to a review of maize crop area and productivity data (Table 1). The reason behind this was that the maize crop is well established, receiving adequate water throughout the growing stage, and the crop is more widely distributed among the farming population in these districts. These findings are in line with the findings of Kokilavani and Dheebakaran (2019). In these areas, both the RSI and the RYI were greater than 100 per cent. YECZ districts with high RYI and low RSI values include Coimbatore, Karur, Krishnagiri, Namakkal, Pudukkottai, Sivagangai, Thanjavur, Thiruvallur, Vellore, and Villupuram. Because the agricultural output in this location is high, improved extension approaches may be used to promote the crop, or the reasons for the poor spread may be investigated. It was suggested by Kokilavani and Geethalakshmi (2013) that Cuddalore, Dharmapuri, Madurai, Thoothukudi, Tirunelveli, and

Virudhunagar be included in the Area Efficient Cropping Zone (AECZ), which has a high RSI and low RYI. Though the spread is high, the yield is low for enhancing the yield. Better technological interventions are needed to increase the yield in these areas. Kanchipuram, Kanniyakumari, Nagapattinam, Ramanathapuram, Nilgiris, Thiruvallur, and Thiruvannamalai are in the No Efficient Cropping Zone (NECZ). This shows that the crop is not suitable for the climatic conditions of this region. Hence, alternate crops with suitable climatic conditions were suggested.

B. Efficient cropping zone for sorghum

With respect to sorghum crops in Tamil Nadu, 7 districts fell under MECZ, 10 under YECZ and 5 under AECZ and 9 under NECZ. Dharmapuri, Dindugal, Madurai, Theni, Thiruchirappalli, Thoothukudi, and Virudhunagar were among the MECZs with high sorghum area and productivity. The adoption of new technology and more efficient use of available resources are the reasons for the high RSI and RYI. Districts with high RYI and low RSI include Ariyalur, Krishnagiri, Perambalur, Ramanathapuram, Thiruvallur, Thirunelveli, Thiruvannamalai, Vellore, and Villupuram. It shows that the district's yield potential is strong, but the spread is low. As a result, some efforts need to be done, mostly to enlarge the crop's area. AECZ includes Coimbatore, Karur, Namakkal, Salem, and Thiruppur. With low RSI and RYI, Cuddalore, Erode,

Kanniyakumari, Kanchipuram, Nagapattinam, Pudukkottai, Thanjavur, Nilgiri, and Thiruvavur fall under the NECZ. With respect to sorghum crops in

Tamil Nadu 7 districts fell under MECZ, 10 under YECZ and 5 districts under AECZ and 9 under NECZ.

Table 2: Computed value of RSI and RYI for Maize and Sorghum in all the districts of Tamil Nadu (average of 10 years).

S. No.	District Name	Maize		sorghum	
		RSI	RYI	RSI	RYI
1	Ariyalur	238.7	109.7	29.7	101.2
2	Coimbatore	71.6	110.8	253.8	72.6
3	Cuddalore	104.5	67.6	9.7	96.1
4	Dharmapuri	49.9	104.9	157.1	114.5
5	Dindugal	237.2	109.0	329.8	122.7
6	Erode	156.6	118.4	14.3	48.0
7	Kanchipuram	0.16	91.2	0.2	78.1
8	Kanniyakumari	0.2	57.8	0.0	45.6
9	Karur	29.7	106.9	347.8	59.9
10	Krishnagiri	17.4	111.8	31.2	163.9
11	Madurai	144.3	81.0	149.3	158.0
12	Nagapattinam	0.1	87.7	0.0	42.5
13	Namakkal	68.9	136.0	454.9	68.4
14	Perambalur	766.1	112.8	95.4	113.4
15	Pudukkottai	54.2	124.7	7.0	92.8
16	Ramanathapuram	6.82	95.6	33.2	116.2
17	Salem	199.7	149.3	233.8	98.2
18	Sivagangai	1.5	105.1	3.4	103.2
19	Thanjavur	6.7	112.5	1.0	70.2
20	The Nilgiris	0.0	0.0	0.0	8.3
21	Theni	124.2	123.3	144.3	275.6
22	Thiruvallur	0.7	119.8	0.3	105.3
23	Thiruvavur	0.02	47.2	0.0	14.2
24	Thothukoudi	254.4	58.3	108.0	143.2
25	Thiruchirapalli	110.5	104.3	291.0	101.1
26	Thirunelveli	119.4	92.3	29.5	164.5
27	Thiruppur	215.9	132.8	274.2	25.4
28	Thiruvannamalai	7.5	92.8	2.7	100.1
29	Vellore	26.3	112.0	63.4	123.2
30	Villupuram	61.1	130.7	3.8	100.2
31	Viruthunagar	312.9	93.2	175.5	173.6

Table 3: Efficient cropping zone of Maize and sorghum in Different Districts of Tamil Nadu.

Districts	Maize			Sorghum		
	RSI	RYI	ECZ	RSI	RYI	ECZ
Ariyalur	H	H	MECZ	L	H	YECZ
Coimbatore	L	H	YECZ	H	L	AECZ
Cuddalore	H	L	AECZ	L	L	NECZ
Dharmapuri	L	H	AECZ	H	H	MECZ
Dindugal	H	H	MECZ	H	H	MECZ
Erode	H	H	MECZ	L	L	NECZ
Kanchipuram	L	L	NECZ	L	L	NECZ
Kanniyakumari	L	L	NECZ	L	L	NECZ
Karur	L	H	YECZ	H	L	AECZ
Krishnagiri	L	H	YECZ	L	H	YECZ
Madurai	H	L	AECZ	H	H	MECZ
Nagapattinam	L	L	NECZ	L	L	NECZ
Namakkal	L	H	YECZ	H	L	AECZ
Perambalur	H	H	MECZ	L	H	YECZ
Pudukkottai	L	H	YECZ	L	L	NECZ
Ramanathapuram	L	L	NECZ	L	H	YECZ
Salem	H	H	MECZ	H	L	AECZ

Sivagangai	L	H	YECZ	L	H	YECZ
Thanjavur	L	H	YECZ	L	L	NECZ
The nilgiris	L	L	NECZ	L	L	NECZ
Theni	H	H	MECZ	H	H	MECZ
Thiruvallur	L	H	YECZ	L	H	YECZ
Thiruvarur	L	L	NECZ	L	L	NECZ
Thhothukoudi	H	L	AECZ	H	H	MECZ
Thiruchirapalli	H	H	MECZ	H	H	MECZ
Thirunelveli	H	L	AECZ	L	H	YECZ
Thiruppur	H	H	MECZ	H	L	AECZ
Thiruvannamalai	L	L	NECZ	L	H	YECZ
Vellore	L	H	YECZ	L	H	YECZ
Villupuram	L	H	YECZ	L	H	YECZ
Viruthunagar	H	L	AECZ	H	H	MECZ

H – High; L- Low; ME – Most Efficient; AE – Area Efficient; YE- Yield Efficient; NE – Not Efficient

CONCLUSION

In this context to Tamil Nadu state, Dindugal and Theni were found to be efficient cropping zone for both the crops (Maize and Sorghum). Suitable weather conditions prevailed in these regions further enhanced to occupy MCEZ. For MECZ High Climate Resilient Agricultural Practices for the concerned crops may be introduced to explore the high productivity which will prevent the crop from the loss due to the climate Variations. Under this Context the productivity goes towards Positive sides which will increases the economic status and livelihood of the Farming community. By identifying the efficient places for the cultivation of crops is very much useful to increase the productivity in order to meet the challenges of growing population. Adoption of recommended cultivation practices and Climate Resilient Practices in order to face the Climate change is the need of ours.

FUTURE SCOPE

The present study was conducted for maize and sorghum crops alone. The results of the above study could be efficiently used by the farming community in deciding the cropping options in their respective zones.

Conflict of Interest. The authors affirm that they do not have any conflicts of interest.

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