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Identification of efficient cropping zone for major pulse crops in Tamil Nadu

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Abstract

An analytical study was carried over to identify the efficient cropping zone for cultivation of major pulses like Bengalgram, Pigeon pea, Greengram, Blackgram and Horsegram in Tamil Nadu. The data on area, production and productivity of the crops for the period from 1985-86 to 2015-16 (excluding 2014-15) were collected and analysed for their Relative Yield Index (RYI), Relative Spread Index (RSI). Based on the pooled result of the indices for thirty years the efficient cropping zones for the crops were identified. Cuddalore district for Blackgram, Salem, Virudhunagar and Tirunelveli districts for Greengram, Salem, Dharmapuri and Theni districts for Redgram, Coimbatore district for Bengalgram, Salem, Dharmapuri and Dindigul districts for Horsegram were identified as the most efficient cropping zones for the respective pulse crops.

Keywords: Efficient cropping zone, relative yield index, relative spread index, Tamil Nadu, pulse crops

Introduction

In India variety of pulse crops are cultivated, among which the major pulses are Bengalgram, Pigeon pea, Greengram and Blackgram. Pulses are consumed for its source of plant protein, which contains various amino acids. Although this crop group is more important from the nutritional point of view, there has been no significant increase in area and production from 1950-51 to 2009-10; however, significant growth in area and production has been recorded during 2010-2011 to 2014-15. In order to meet the projected demand of 32 million tonnes of pulses by 2030, as per the Vision 2030 paper prepared by the Indian Institute of Pulses Research, Kanpur, a growth rate of 4.2% has to be ensured (Tiwari and Shivhare, 2016).

For both large and small farmers, pulses represent important economic opportunities to boost income and reduce risk by diversifying their crop and income stream portfolio. Pulses may also be produced with minimal resources; this production rate can be enhanced and sustained by recognising the efficient cropping zones for the crop production. Cultivating proficient crops in a suitable area increases the production rate in addition fetches more income. Scientific information based crop cultivation for a region are not stable over years, thus the suitability must be verified frequently. Statistical analysis of spatial and temporal crop data is an effective tool in understanding the logic behind existing cropping pattern. One among the technique for defining the suitable crop region is to study relative yield and relative spread of each crop on district and regional basis. Hence, with these ideas in view, this study was planned to find out district wise efficient cropping zones for major pulse crops.

Materials and Method

The study was carried out over Tamil Nadu, India to delineate efficient cropping zone for major pulse crops. The data on area, production, productivity and total cultivable area of the Bengalgram, Redgram, Greengram, Blackgram and Horsegram were collected for the period from 1985-86 to 2015-16 (excluding 2014-15) from respective Season and Crop Report. Relative Yield Index and Relative Spread Index (Kanwar, 1972)^[2] were computed for five years once from the collected data. The formula for deriving RSI and RYI are:

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

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

From these indices four classes of cropping zones are classified in Table.1 (Cheema *et al.* 1998)^[1].

Table 1: Criteria for efficient cropping zone

RYI	RSI	Cropping Zone
>100 (High)	>100 (High)	Most efficient cropping zone (MECZ) with maximum yield of crop.
>100 (High)	< 100 (Low)	Efficient cropping zone (ECZ). The constraints are to be identified.
< 100 (Low)	>100 (High)	Not efficient cropping zone (NECZ).
< 100 (Low)	< 100 (Low)	Not efficient cropping zone (NECZ).

Result and Discussion

Black gram

From the computed data (Table. 2), it is interpreted that the frequently occurred most efficient cropping zone (MECZ) considering RSI and RYI for Blackgram falls with Cuddalore and efficient cropping zone (ECZ) are Kancheepuram, Villupuram, Vellore, Thiruvannamalai, Salem, Dharmapuri, Coimbatore, Erode, Tiruchirappalli, Pudukottai, Madurai, Dindigul, Virudhunagar and Sivagangai districts. This might be due to the facts that blackgram is grown as a rainfed marginal land crop or as a mixed crop. To improve black gram yield, it must be grown as pure crop with adequate agronomic practices (Sanbagavalli *et al.* 2002)^[3].

Green gram

For Green gram (Table. 3), the most efficient cropping zone (MECZ) considering RSI and RYI falls with Salem and Virudhunagar and Tirunelveli districts. Efficient cropping zone (ECZ) are Kancheepuram, Cuddalore, Namakkal, Dharmapuri, Tiruchirappalli, Dindigul and Sivagangai districts. This might be due to the facts that Greengram is grown as a rice fallow pulse crop in these districts and in other districts it is grown as a rainfed marginal land crop or as a mixed crop. To improve greengram yield, it must be grown as pure crop with adequate agronomic practices.

Red gram

For redgram (Table. 4), the most efficient cropping zone (MECZ) considering RSI and RYI falls with Salem and Theni districts. Efficient cropping zone (ECZ) are Erode, Dindigul and Tirunelveli districts. Constrains such as high pest and disease incidence, inadequate availability of labour were reasons for less production in adaptation in many areas. Cost effective cultivation and appropriate plant protection measures can be adopted to achieve higher production.

Bengal gram

For Bengalgram (Table. 5), the most efficient cropping zone (MECZ) considering RSI and RYI falls with Coimbatore district. To improve Bengal gram yield, more research work has to be done by the scientists to release suitable drought tolerant varieties and in situ moisture conservation practices based on the location.

Horse gram

For Horse gram (Table 6.), the most efficient cropping zone (MECZ) considering RSI and RYI falls with Salem, Dharmapuri and Dindigul Districts and efficient cropping zone (ECZ) are Cuddalore, Pudukottai and Madurai districts. So in order to bring other districts under MECZ, government should provide better marketing facilities and higher price for the farmers to boost the yield.

Table 2: Efficient cropping zones of blackgram in Tamil Nadu

Blackgram	RYI	RSI	RYI	RSI	RYI	RSI	RYI	RSI	RYI	RSI	RYI	RSI
	1985-90		1991-95		1996-00		2001-05		2006-10		2011-16	
Kancheepuram	98.44	15.14	100.00	34.08	109.82	18.52	100.00	41.87	158.19	18.01	102.16	10.69
Thiruvallur	0.00	0.00	0.00	0.00	113.96	31.65	100.00	39.87	137.17	14.54	102.84	11.24
Cuddalore	121.65	115.81	109.13	227.84	98.64	356.68	91.92	299.94	102.99	300.99	114.09	197.25
Villupuram	0.00	0.00	109.51	3.11	100.00	23.96	127.23	113.43	148.55	109.26	130.65	118.79
Vellore	99.80	19.92	100.00	24.83	100.00	36.00	96.68	73.35	119.33	15.87	100.00	16.22
Thiruvannamalai	98.22	15.79	109.00	56.45	89.90	47.97	90.37	99.38	136.16	25.41	98.82	59.33
Salem	115.89	84.99	109.21	99.04	190.42	148.69	157.82	88.57	142.65	16.60	120.95	17.99
Namakkal	0.00	0.00	0.00	0.00	155.86	78.27	162.53	65.41	169.33	6.91	108.48	10.56
Dharmapuri	102.90	15.41	102.97	34.44	116.04	18.56	115.88	36.00	135.06	19.03	112.67	30.75
Krishnagiri	0.00	0.00	0.00	0.00	0.00	0.00	90.22	3.64	96.60	8.96	119.16	19.06
Coimbatore	100.59	40.66	89.99	37.34	115.66	26.51	100.00	15.56	133.72	13.65	117.17	6.77
Thiruppur	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	102.56	8.73	105.44	16.19
Erode	100.11	9.51	100.00	19.24	100.00	17.54	100.12	19.62	143.05	12.36	114.13	5.48
Tiruchirappalli	122.76	40.36	142.92	31.58	124.82	38.81	100.00	44.67	146.91	68.29	125.58	41.67
Karur	0.00	0.00	0.00	0.00	118.63	9.04	100.00	8.94	110.76	23.50	109.87	44.82
Perambalur	0.00	0.00	0.00	0.00	118.63	9.47	100.00	15.20	112.17	7.80	106.83	5.75
Ariyalur	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	102.56	8.59	113.25	31.59
Pudukottai	105.17	88.68	94.89	44.50	109.21	13.31	100.00	19.56	100.00	10.92	109.90	33.04
Thanjavur	93.13	344.51	75.88	282.10	63.72	128.23	116.85	110.26	121.77	132.10	108.14	100.05
Thiruvarur	0.00	0.00	0.00	0.00	64.17	266.24	76.56	376.51	77.66	404.59	96.21	179.60
Nagapattinam	0.00	0.00	88.57	224.81	75.22	509.15	73.91	430.69	62.24	464.40	81.82	200.97
Madurai	97.02	44.06	77.85	32.62	117.53	22.97	106.84	29.19	98.03	22.86	114.03	11.01
Theni	0.00	0.00	0.00	0.00	123.60	14.91	100.00	5.97	100.00	5.23	112.47	8.24
Dindigul	107.96	64.46	122.32	57.46	137.17	68.92	115.55	54.19	120.31	45.58	109.94	35.49
Ramanathapuram	87.09	31.61	100.00	47.11	87.14	46.51	100.00	29.35	92.92	36.62	66.04	18.40
Virudhunagar	112.72	107.55	100.54	121.10	107.29	116.39	123.55	96.76	121.78	94.11	84.35	34.22
Sivagangai	100.10	16.33	100.00	16.04	100.00	9.54	100.00	7.82	100.00	6.62	111.32	9.15

Tirunelveli	77.73	303.76	114.95	201.02	87.56	195.34	100.46	184.78	109.01	172.82	92.94	104.72
Thoothukudi	85.87	166.47	100.17	262.82	81.67	242.40	94.06	189.42	124.28	354.09	61.24	211.02
The Nilgiris	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Kanniyakumari	100.04	87.68	100.00	67.54	100.00	68.16	100.00	69.79	89.80	27.42	98.28	11.71

Table 3: Efficient cropping zones of greengram in Tamil Nadu

Greengram	RYI	RSI	RYI	RSI	RYI	RSI	RYI	RSI	RYI	RSI	RYI	RSI
	1985-90		1991-95		1996-00		2001-05		2006-10		2011-16	
Kancheepuram	94.22	39.18	107.40	77.37	119.83	42.12	100.10	16.92	138.06	4.90	103.27	6.94
Thiruvallur	0.00	0.00	0.00	0.00	151.00	152.08	122.50	256.01	153.13	144.39	149.45	135.98
Cuddalore	123.99	56.17	105.26	89.38	109.03	75.59	69.33	49.68	90.28	29.77	150.22	47.78
Villupuram	0.00	0.00	20.78	0.95	100.00	2.48	100.10	6.36	100.02	2.74	101.74	4.43
Vellore	99.78	30.46	94.07	29.62	100.00	43.11	78.68	72.24	89.06	13.51	115.60	18.55
Thiruvannamalai	20.05	15.01	117.68	55.34	121.04	47.28	95.11	60.51	122.87	11.62	112.53	8.06
Salem	139.62	138.29	117.95	111.96	172.66	137.64	140.58	130.09	163.87	44.78	148.16	79.35
Namakkal	0.00	0.00	0.00	0.00	166.52	112.45	159.89	164.32	202.56	58.25	82.46	78.14
Dharmapuri	123.45	30.24	106.72	44.34	130.33	20.75	101.85	33.61	125.81	9.24	112.32	13.70
Krishnagiri	0.00	0.00	0.00	0.00	0.00	0.00	92.07	5.49	108.25	13.81	112.20	17.04
Coimbatore	57.44	115.48	90.12	99.26	96.03	80.13	84.32	65.76	134.59	45.71	109.74	17.45
Thiruppur	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	100.56	29.36	82.51	39.29
Erode	49.73	74.74	80.24	98.59	88.31	79.00	104.41	75.07	137.41	35.71	100.61	5.38
Tiruchirapalli	110.14	26.63	106.26	23.25	100.09	18.90	100.10	15.65	130.88	8.97	104.65	8.04
Karur	0.00	0.00	0.00	0.00	102.99	4.54	100.10	3.81	100.02	4.60	108.81	12.09
Perambalur	0.00	0.00	0.00	0.00	102.97	6.19	100.10	5.29	100.02	1.32	121.25	0.29
Ariyalur	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	97.18	0.38	114.71	0.16
Pudukkottai	92.87	46.86	87.82	9.85	100.00	4.41	100.10	3.51	100.02	2.84	116.73	0.35
Thanjavur	101.84	334.99	80.23	227.47	69.72	155.92	90.64	105.47	69.81	114.90	89.49	37.28
Thiruvarur	0.00	0.00	0.00	0.00	63.72	305.46	67.26	361.73	57.07	496.76	104.04	281.21
Nagapattinam	0.00	0.00	78.73	214.00	66.97	425.73	78.59	317.81	71.63	422.36	89.09	283.25
Madurai	79.78	160.34	80.19	143.74	89.06	168.43	85.43	164.19	91.81	101.85	110.42	46.26
Theni	0.00	0.00	0.00	0.00	95.90	34.59	100.10	7.28	100.02	10.19	106.63	19.97
Dindigul	121.01	82.45	139.70	88.26	117.45	103.27	121.16	63.25	149.09	49.52	108.44	24.72
Ramanathapuram	100.00	25.79	81.01	6.88	100.00	5.97	100.10	3.40	100.02	6.13	96.12	5.52
Virudhunagar	104.03	107.97	110.72	225.65	105.15	219.19	117.61	271.23	148.07	280.11	89.25	111.74
Sivagangai	100.00	7.88	99.96	8.68	100.00	3.51	100.10	3.22	100.02	2.67	117.74	0.75
Tirunelveli	76.54	78.18	129.51	81.29	89.33	142.76	98.80	160.11	150.86	151.31	103.07	66.30
Thoothukudi	94.05	102.58	107.17	235.41	80.45	234.36	82.97	374.43	123.44	621.02	71.31	405.01
The Nilgiris	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.13	80.53	0.01
Kanniyakumari	100.00	6.72	79.68	1.10	61.73	0.44	101.87	1.27	100.02	0.09	26.59	0.01

Table 4: Efficient cropping zones of redgram in Tamil Nadu

Redgram	RYI	RSI	RYI	RSI	RYI	RSI	RYI	RSI	RYI	RSI	RYI	RSI
	1985-90		1991-95		1996-00		2001-05		2006-10		2011-16	
Kancheepuram	84.23	13.78	99.92	20.13	80.21	2.53	100.00	1.93	100.00	1.49	99.91	3.64
Thiruvallur	0.00	0.00	0.00	0.00	96.80	27.46	100.00	79.68	99.87	153.35	79.48	31.84
Cuddalore	79.59	45.02	82.30	23.92	100.01	16.26	100.00	19.84	116.14	8.06	100.00	2.91
Villupuram	0.00	0.00	114.05	5.28	118.08	20.80	100.00	25.39	120.83	20.73	93.17	11.25
Vellore	97.54	280.65	87.49	381.12	93.68	403.97	97.74	709.06	88.15	832.67	89.15	508.10
Thiruvannamalai	96.31	61.46	89.54	249.22	79.63	143.08	86.14	146.27	109.66	95.40	81.85	49.12
Salem	114.66	317.39	107.95	220.98	104.36	184.35	130.64	113.49	95.85	69.37	96.72	60.06
Namakkal	0.00	0.00	0.00	0.00	125.85	254.10	129.98	165.38	150.23	48.09	72.34	60.13
Dharmapuri	115.83	166.70	119.17	271.62	114.86	196.84	91.60	203.87	113.25	144.99	107.79	229.78
Krishnagiri	0.00	0.00	0.00	0.00	0.00	0.00	85.38	66.42	88.60	300.17	102.51	322.91
Coimbatore	86.75	63.99	75.93	51.25	94.50	34.51	100.00	15.63	87.57	26.93	91.75	16.04
Thiruppur	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	50.65	5.01	99.95	11.83
Erode	100.03	21.36	100.16	33.39	107.92	45.37	95.47	45.32	185.07	79.26	103.14	50.56
Tiruchirapalli	81.79	143.39	84.34	135.34	83.05	109.40	49.12	114.31	76.61	127.43	83.36	65.24
Karur	0.00	0.00	0.00	0.00	66.78	289.83	57.58	401.66	56.93	482.63	108.95	255.17
Perambalur	0.00	0.00	0.00	0.00	95.17	68.07	100.54	84.03	84.10	49.45	83.96	43.99
Ariyalur	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	114.31	13.70	99.95	14.72
Pudukkottai	100.86	255.57	91.37	158.24	78.44	126.72	107.85	122.25	78.14	133.83	76.20	18.82
Thanjavur	100.02	4.20	99.96	5.31	100.01	4.85	100.00	3.18	100.00	4.71	99.58	0.78
Thiruvarur	0.00	0.00	0.00	0.00	25.63	0.01	100.00	1.30	0.00	0.00	65.14	0.14
Nagapattinam	0.00	0.00	32.86	0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Madurai	81.34	103.99	100.19	87.31	92.27	129.97	100.00	117.94	94.65	187.56	111.88	128.75
Theni	0.00	0.00	0.00	0.00	99.99	292.73	156.93	265.41	189.80	317.02	163.54	112.42
Dindigul	100.04	62.69	118.21	64.97	115.24	87.05	89.33	62.08	90.29	75.49	89.50	44.70
Ramanathapuram	99.94	6.01	99.96	2.86	100.01	0.09	41.53	0.02	27.36	1.16	100.02	1.41

Virudhunagar	99.98	62.93	89.14	54.47	72.12	56.18	100.00	53.20	75.16	59.62	102.51	34.32
Sivagangai	100.01	27.28	99.96	32.69	98.81	31.68	100.00	26.66	100.00	18.27	99.95	14.70
Tirunelveli	100.01	8.10	99.96	6.09	100.01	4.10	100.00	3.04	100.00	9.86	99.98	7.89
Thoothukudi	94.74	3.94	99.96	4.69	100.01	6.08	100.00	4.15	87.03	16.91	100.05	4.46
The Nilgiris	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Kanniyakumari	100.01	0.79	53.16	0.40	0.00	0.02	0.00	0.00	0.00	0.00	56.91	0.25

Table 5: Efficient cropping zones of Bengalgram in Tamil Nadu

Bengalgram	RVI	RSI	RVI	RSI	RVI	RSI	RVI	RSI	RVI	RSI	RVI	RSI
	1985-90		1991-95		1996-00		2001-05		2006-10		2011-16	
Kancheepuram	39.58	39.10	20.77	0.07	20.36	0.00	32.87	0.00	64.75	1.27	23.48	6.25
Thiruvallur	0.00	0.00	0.00	0.00	0.00	4.79	38.41	0.14	93.07	2.72	75.49	2.03
Cuddalore	49.16	4.26	37.08	16.91	22.89	1.24	22.56	0.38	20.49	0.00	0.00	0.00
Villupuram	0.00	0.00	45.45	0.07	18.56	0.04	11.45	2.25	34.67	12.36	11.61	0.24
Vellore	39.22	5.38	38.92	1.51	41.94	13.98	40.74	1.10	61.20	29.05	59.34	2.01
Thiruvannamalai	47.13	2.16	32.57	0.88	21.64	4.24	30.84	7.32	30.08	1.92	58.00	0.38
Salem	69.17	174.03	72.23	128.02	70.84	182.99	70.55	81.06	71.19	14.31	85.45	3.74
Namakkal	0.00	0.00	0.00	0.00	70.91	95.64	47.66	90.15	72.11	16.05	85.91	24.60
Dharmapuri	13.59	25.70	14.10	96.35	18.84	55.57	21.70	142.52	42.06	131.31	85.09	537.53
Krishnagiri	0.00	0.00	0.00	0.00	0.00	0.00	23.02	31.78	42.06	4.52	24.15	0.99
Coimbatore	105.44	1271.12	115.16	1326.66	112.96	1321.19	113.09	1167.28	111.32	1107.35	106.04	377.27
Thiruppur	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	42.47	594.03	109.60	842.74
Erode	107.30	9.61	106.54	5.73	102.91	5.36	117.55	46.53	94.51	3.07	18.37	0.07
Tiruchirapalli	90.21	10.44	93.99	18.66	92.22	32.80	91.35	31.68	92.08	23.80	87.10	6.61
Karur	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	36.86	3.60	8.15	9.22
Perambalur	0.00	0.00	0.00	0.00	88.58	3.10	154.16	31.50	147.15	3.65	49.23	4.81
Ariyalur	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pudukkottai	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	27.64	0.11	7.74	0.35
Thanjavur	38.16	10.21	0.00	0.00	0.00	0.00	0.00	0.00	49.15	1.98	0.00	0.00
Thiruvarur	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Nagapattinam	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Madurai	14.32	0.05	42.00	6.89	90.92	16.27	90.69	52.62	91.83	51.19	95.41	10.22
Theni	0.00	0.00	0.00	0.00	51.51	2.19	0.00	0.14	31.43	5.02	55.21	1.47
Dindigul	75.45	23.72	79.92	123.35	78.03	93.26	77.23	168.85	78.00	253.08	52.01	106.17
Ramanathapuram	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	80.62	1.36	65.38	1.05
Virudhunagar	75.00	49.81	76.03	69.98	74.92	61.61	76.24	81.40	76.92	97.74	88.39	9.41
Sivagangai	0.00	0.00	36.18	6.82	35.47	3.65	0.00	0.00	33.28	0.74	13.93	2.44
Tirunelveli	88.62	11.07	76.84	1.48	91.04	1.93	89.31	1.27	134.85	10.15	45.25	1.51
Thoothukudi	71.30	45.49	73.85	45.15	72.99	44.99	75.94	44.48	76.58	27.46	88.18	8.90
The Nilgiris	44.30	1.16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Kanniyakumari	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Table 6: Efficient cropping zones of horsegram in Tamil Nadu

Horsegram	RVI	RSI	RVI	RSI	RVI	RSI	RVI	RSI	RVI	RSI	RVI	RSI
	1985-90		1991-95		1996-00		2001-05		2006-10		2011-16	
Kancheepuram	91.95	8.50	100.04	9.50	99.97	1.13	105.36	1.26	100.00	2.18	78.84	0.16
Thiruvallur	0.00	0.00	0.00	0.00	107.15	4.03	100.00	5.43	100.00	2.39	101.64	1.02
Cuddalore	99.10	15.54	100.04	15.13	99.97	4.30	100.00	1.74	100.00	0.23	103.50	0.09
Villupuram	0.00	0.00	100.78	2.06	99.97	8.72	100.00	13.17	100.00	7.88	100.53	3.00
Vellore	103.74	106.06	93.79	101.91	74.86	98.00	89.43	189.18	93.65	229.03	111.34	194.88
Thiruvannamalai	67.24	20.29	82.79	80.69	91.73	56.38	88.42	109.39	99.92	91.29	122.98	55.32
Salem	80.24	177.50	95.55	152.03	114.52	215.48	113.58	123.70	119.99	93.18	112.25	86.00
Namakkal	0.00	0.00	0.00	0.00	126.77	76.43	106.90	92.80	140.38	32.91	99.77	27.69
Dharmapuri	103.35	584.01	108.64	655.69	101.82	691.10	103.86	684.07	143.13	586.52	124.70	408.89
Krishnagiri	0.00	0.00	0.00	0.00	0.00	0.00	80.14	273.97	96.70	983.43	91.40	544.77
Coimbatore	73.89	211.94	76.76	112.07	84.54	135.78	99.13	115.65	76.47	131.85	103.39	50.56
Thiruppur	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	43.27	140.74	38.93	167.74
Erode	125.54	128.98	64.84	119.45	61.30	154.77	80.25	193.48	77.40	168.28	101.03	21.68
Tiruchirapalli	90.35	33.63	101.03	32.42	101.18	36.58	100.00	34.58	100.73	40.98	104.07	15.61
Karur	0.00	0.00	0.00	0.00	110.23	47.51	100.00	78.45	98.62	129.43	104.00	228.63
Perambalur	0.00	0.00	0.00	0.00	110.23	0.36	100.00	0.48	100.00	0.29	104.34	0.12
Ariyalur	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	62.02	0.09
Pudukkottai	110.69	22.34	100.04	28.14	99.97	19.22	100.00	8.71	100.00	5.71	104.34	0.32
Thanjavur	70.72	4.97	20.14	0.01	17.34	0.02	0.00	0.00	0.00	0.00	15.53	0.00
Thiruvarur	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Nagapattinam	0.00	0.00	0.00	0.00	28.29	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Madurai	99.16	23.83	100.04	24.95	99.97	7.45	100.00	7.49	100.00	5.63	101.83	2.41
Theni	0.00	0.00	0.00	0.00	107.15	22.11	100.00	30.15	100.00	28.93	101.71	23.62

Dindigul	126.20	188.26	109.85	172.97	121.29	145.10	117.90	116.64	66.42	144.52	59.51	57.41
Ramanathapuram	93.29	7.60	100.05	9.62	99.97	1.93	100.00	0.48	100.00	0.24	98.06	0.12
Virudhunagar	93.99	8.70	100.04	3.77	99.97	4.34	100.00	5.82	100.00	5.25	99.16	2.26
Sivagangai	94.11	18.72	100.04	9.70	99.97	9.30	100.00	4.86	100.00	5.14	104.19	2.57
Tirunelveli	90.66	43.76	100.04	32.06	99.97	23.97	100.00	17.50	100.00	11.01	98.78	0.46
Thoothukudi	98.95	7.16	100.04	4.95	99.97	2.76	100.00	6.92	100.00	1.05	98.06	0.07
The Nilgiris	69.49	1.03	0.00	0.00	0.00	0.00	41.64	0.02	0.00	0.00	0.00	0.00
Kanniyakumari	90.40	7.05	100.04	6.67	45.62	0.07	73.08	0.54	80.11	0.48	0.00	0.00

Table 7: Crop wise categorization of efficient cropping zone for districts from thirty-year average

	Blackgram			Greengram			Redgram			Bengalgram			Horsegram		
	RYI	RSI		RYI	RSI		RYI	RSI		RYI	RSI		RYI	RSI	
Kancheepuram	111.4	23.1	ECZ	110.5	31.2	ECZ	94.0	7.3	NECZ	33.6	7.8	NECZ	96.0	3.8	NECZ
Thiruvallur	75.7	16.2	NECZ	96.0	114.7	NECZ	62.7	48.7	NECZ	34.5	1.6	NECZ	68.1	2.1	NECZ
Cuddalore	106.4	249.8	MECZ	108.0	58.1	ECZ	96.3	19.3	NECZ	25.4	3.8	NECZ	100.4	6.2	ECZ
Villupuram	102.7	61.4	ECZ	70.4	2.8	NECZ	91.0	13.9	NECZ	20.3	2.5	NECZ	83.5	5.8	NECZ
Vellore	102.6	31.0	ECZ	96.2	34.6	NECZ	92.3	519.3	NECZ	46.9	8.8	NECZ	94.5	153.2	NECZ
Thiruvannamalai	103.7	50.7	ECZ	98.2	33.0	NECZ	90.5	124.1	NECZ	36.7	2.8	NECZ	92.2	68.9	NECZ
Salem	139.5	76.0	ECZ	147.1	107.0	MECZ	108.4	160.9	MECZ	73.2	97.4	NECZ	106.0	141.3	MECZ
Namakkal	99.4	26.9	NECZ	101.9	68.9	ECZ	79.7	87.9	NECZ	46.1	37.7	NECZ	79.0	38.3	NECZ
Dharmapuri	114.3	25.7	ECZ	116.7	25.3	ECZ	110.4	202.3	MECZ	32.6	164.8	NECZ	114.2	601.7	MECZ
Krishnagiri	51.0	5.3	NECZ	52.1	6.1	NECZ	46.1	114.9	NECZ	14.9	6.2	NECZ	44.7	300.4	NECZ
Coimbatore	109.5	23.4	ECZ	95.4	70.6	NECZ	89.4	34.7	NECZ	110.7	1095.1	MECZ	85.7	126.3	NECZ
Thiruppur	34.7	4.2	NECZ	30.5	11.4	NECZ	25.1	2.8	NECZ	25.3	239.5	NECZ	13.7	51.4	NECZ
Erode	109.6	14.0	ECZ	93.5	61.4	NECZ	115.3	45.9	ECZ	91.2	11.7	NECZ	85.1	131.1	NECZ
Tiruchirappalli	127.2	44.2	ECZ	108.7	16.9	ECZ	76.4	115.9	NECZ	91.2	20.7	NECZ	99.6	32.3	NECZ
Karur	73.2	14.4	NECZ	68.7	4.2	NECZ	48.4	238.2	NECZ	7.5	2.1	NECZ	68.8	80.7	NECZ
Perambalur	72.9	6.4	NECZ	70.7	2.2	NECZ	60.6	40.9	NECZ	73.2	7.2	NECZ	69.1	0.2	NECZ
Ariyalur	36.0	6.7	NECZ	35.3	0.1	NECZ	35.7	4.7	NECZ	0.0	0.0	NECZ	10.3	0.0	NECZ
Pudukkottai	103.2	35.0	ECZ	99.6	11.3	NECZ	88.8	135.9	NECZ	5.9	0.1	NECZ	102.5	14.1	ECZ
Thanjavur	96.6	182.9	NECZ	83.6	162.7	NECZ	99.9	3.8	ECZ	14.6	2.0	NECZ	20.6	0.8	NECZ
Thiruvarur	52.4	204.5	NECZ	48.7	240.9	NECZ	31.8	0.2	NECZ	0.0	0.0	NECZ	0.0	0.0	NECZ
Nagapattinam	63.6	305.0	NECZ	64.2	277.2	NECZ	5.5	0.0	NECZ	0.0	0.0	NECZ	4.7	0.0	NECZ
Madurai	101.9	27.1	ECZ	89.4	130.8	NECZ	96.7	125.9	NECZ	70.9	22.9	NECZ	100.2	12.0	ECZ
Theni	72.7	5.7	NECZ	67.1	12.0	NECZ	101.7	164.6	MECZ	23.0	1.5	NECZ	68.1	17.5	NECZ
Dindigul	118.9	54.3	ECZ	126.1	68.6	ECZ	100.4	66.2	ECZ	73.4	128.1	NECZ	100.2	137.5	MECZ
Ramanathapuram	88.9	34.9	NECZ	96.2	8.9	NECZ	78.1	1.9	NECZ	24.3	0.4	NECZ	98.6	3.3	NECZ
Virudhunagar	108.4	95.0	ECZ	112.5	202.6	MECZ	89.8	53.5	NECZ	77.9	61.7	NECZ	98.9	5.0	NECZ
Sivagangai	101.9	10.9	ECZ	103.0	4.5	ECZ	99.8	25.2	NECZ	19.8	2.3	NECZ	99.7	8.4	NECZ
Tirunelveli	97.1	193.7	NECZ	108.0	113.3	MECZ	100.0	6.5	ECZ	87.7	4.6	NECZ	98.2	21.5	NECZ
Thoothukudi	91.2	237.7	NECZ	93.2	328.8	NECZ	97.0	6.7	NECZ	76.5	36.1	NECZ	99.5	3.8	NECZ
The Nilgiris	0.0	0.0	NECZ	13.4	0.0	NECZ	0.0	0.0	NECZ	7.4	0.2	NECZ	18.5	0.2	NECZ
Kanniyakumari	98.0	55.4	NECZ	78.3	1.6	NECZ	35.0	0.2	NECZ	0.0	0.0	NECZ	64.9	2.5	NECZ

Conclusion

Since, our farmers are practicing subsistence type of farming, the districts identified as MECZS, 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 these crops, 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 these crops in the NECZ, farmers are to be trained in innovative technologies to explore higher productivity, which can be done by strengthening the extension services.

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