possess a major problem in the cultivation of crop plants. Halophytes offer a possibility of alternative crop, an understanding of their physisology of salt tolerance offers a possible route to increase salt resitance in existing crop species.

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Trends in rice area, production and productivity in the different agro-climatic zones of Tamil Nadu

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Abstract : Rice grain production in Tamil Nadu had ranged from 3.33 million tonnes to 7.56 million tonnes during 1959-60 to 1996-97. The overall trend on rice production and productivity increased but the area under rice showed a decreasing trend. Rice area in the state was declining at an average rate of 22,900 ha yr^{-1} and the total rice grain production increased at an average of 84,600 t yr^{-1}. The North Eastern Zone, Cauvery Delta Zone and Southern Zone contributed to 87% of total rice production in the state with a standard deviation of 1.64%. The Western Zone, North Western Zone and High Rainfall Zone contributed to 12.8% Rice productivity (kg grain ha^{-1}) in Tamil Nadu had shown an increasing trend at an average of 82 kg ha^{-1} yr^{-1}. The overall mean of rice productivity was highest in the Western Zone (4.2 t ha^{-1}). *(Key Words : Rice, Agro-climatic zones, Yield trend).*

Rice is the staple food in Tamil Nadu and hence rice production has been given top priority. Average rice grain yields in Tamil Nadu have increased considerably with the introduction of high yielding varieties and improved crop management technologies. But, there is still quite a gap between the potential yields in the different agro-climatic regions of Tamil Nadu and the actual yields

Table 1. Agro-climatic zones of Tamil Nadu and the district covered in each zone.

Zone Numer	Numer of the Zone	Districts included for the study
I	North Eastern (NEZ)	Cuddalore, Kancheepuram, Thiruvallur, Thiruvannamalai, Vellore, Villupuram.
II	North Western (NWZ)	Dharmapuri, Namakkal, Salem
III	Western (WZ)	Coimbatore, Erode
IV	Cauvery Delta (CDZ)	Nagapattinam, Thanjavur, Tiruvarur, Tiruchirapalli
V	Southern (SZ)	Dindigul, Madurai, Pudukottai, Ramanathapuram, Sivagangai, Tirunelveli, Tuticorin, Virudunagar
VI	High Rainfall (HRX)	Kanyakumari
VII	High Altitude and Hilly (HA&HZ)	The Nilgiris

harvested by the majority of farmers. The states share in rice area and production towards the bulk of the country was 6.9% and 12.0% in 1974 and 5.5% and 9.0% in 1994 (Jha and Kumar, 1998). The present study was taken up to assess the scenario of rice area and production in the different agro-climatic zones of Tamil Nadu over the period from 1959-60 to 1995-96.

Materials and Methods

Historical data on area, production and productivity of rice in the seven agro-climatic zones were studied. The data for 37 years (1959-60 to 1995-96) available for each district of Tamil Nadu were collected from the Season and Crop Reports, published by the Department of Economics and Statistics, Govt. of Tamil Nadu. The data for the year including all the seasons in each district were used for this study. The available data on rice production and productivity were on milled-rice basis. To enable comparison with field experiments, the data were converted to grain yield (un-milled) by multiplying with a factor 1.5 assuming a milled rice:grain ratio of 2:3. Hence, yield data is for grain (brown rice) only. From the district data, zonal data were grouped. In this study, we have ignored those parts of some districts that fall in different agro-ecological zones as the data available were on district basis only. The details of the zones and the districts included in each zone are presented in Table 1.

Results and Discussion

Rice area

The total rice area in the state fluctuated from 1.86 m ha (1989-90) to 4.41 m ha (1962-63)

Fig. 1. Trends in total area, production and productivity of rice in Tamil Nadu

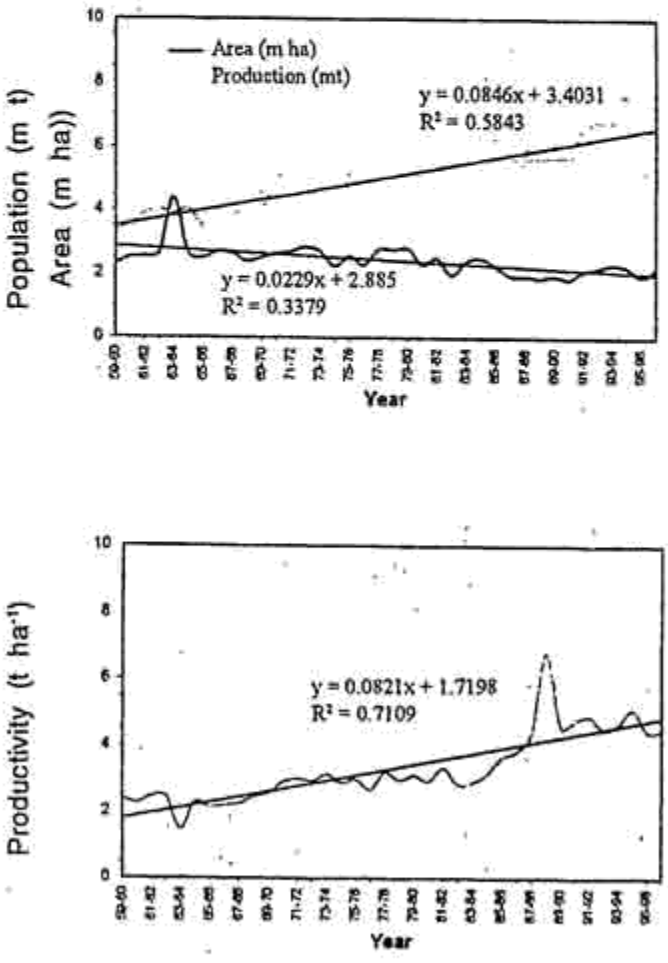


Table 2. Trends in rice area (million hectares) in the different agro-climatic zones of Tamil Nadu during 1958-59 to 1995-96.

Zone	Minimum	Maximum	Mean	Standard Deviation	Slope of the trent	R^2 of the trend
NEZ	0.500	1.495	0.811	0.190	-0.0106	0.390**
NEZ	0.060	0.185	0.111	0.025	-0.0050	0.049
WZ	0.050	0.164	0.099	0.023	-0.0008	0.50*
CDZ	0.545	1.480	0.752	0.161	-0.0100	0.480**
SZ	0.483	0.994	0.613	0.098	-4E-05	0.000
HRZ	0.031	0.089	0.050	0.011	-0.0008	0.700**
HA&HZ	0.002	0.004	0.003	0.001	-5E-05	0.560**

* Significant at 5% level ** Significant at 1% level

Table 3. Trends in rice production (million hectares) in the different agro-climatic zones of Tamil Nadu during 1958-59 to 1995-96.

Zone	Minimum	Maximum	Mean	Standard Deviation	Slope of the trent	R^2 of the trend
NEZ	1.269	4.054	2.525	0.657	0.0371	0.380**
NEZ	0.181	0.712	0.390	0.140	0.0086	0.470**
WZ	0.207	0.662	0.400	0.110	0.0071	0.510**
CDZ	1.605	4.288	2.332	0.553	0.0287	0.330**
SZ	0.793	3.363	1.756	0.663	0.0440	0.540**
HRZ	0.079	0.369	0.171	0.050	0.0015	0.110*
HA&HZ	0.003	0.013	0.007	0.002	-4E-06	0.000

* Significant at 5% level ** Significant at 1% level

Table 4. Trends in rice productivity (million hectares) in the different agro-climatic zones of Tamil Nadu during 1958-59 to 1995-96.

Zone	Minimum	Maximum	Mean	Standard Deviation	Slope of the trent	R^2 of the trend
NEZ	1.290	7.290	3.289	0.818	0.0914	0.690**
NEZ	1.560	7.485	3.576	0.801	0.0894	0.680**
WZ	1.575	7.185	4.193	0.889	0.1074	0.800**
CDZ	1.245	7.470	3.264	0.786	0.0805	0.580**
SZ	1.335	5.190	2.862	0.661	0.0716	0.640**
HRZ	1.755	8.235	3.600	0.932	0.0931	0.550**
HA&HZ	0.915	4.815	2.460	0.590	0.0413	0.270**

* Significant at 5% level ** Significant at 1% level

Figure 2. Share of agro climatic zones to total rice areas in Tamil Nadu.

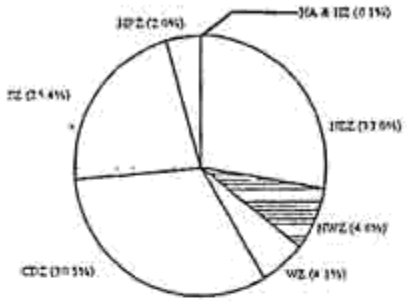
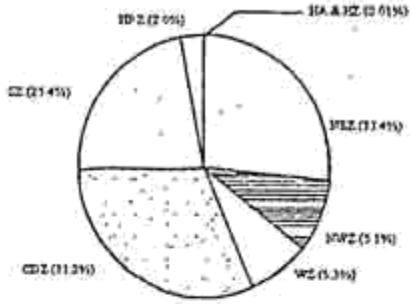


Figure 3. Share of agro-climatic zones to total rice production in Tamil Nadu.



with a standard deviation of 0.44 and the overall trend showed a decline at an average rate of 84,600 ha yr^{-1} (Figure 1). At this average rate of decline, rice area in the state would be 1.74 m ha in the year 2010, 1.51 m ha in the year 2020 and 0.82 m ha in the year 2050.

The historical data (mean from 1958-59 to 1995-96) showed that the major rice growing zone was NEZ (33.0%), followed by CDZ (30.8%) and SZ (25.4%) which together contributed to 89.2% of total rice area in the state (Figure 2). During the period under study, the annual fluctuations in rice area were higher in NEZ and CDZ followed by SZ (Table 2).

The declining trend was not significant in NWZ and SZ. The average rate of decline in rice area was highest in NEZ (10,600 ha yr^{-1}) followed by CDZ (10,000 ha yr^{-1}). Rice area in SZ had been almost stable over the years.

Rice production

Rice grain production in Tamil Nadu had varied from 3.33 m t (1958-59) to 8.51 m t (1993-94) with a standard deviation of 1.23 m t and there had been an increasing trend in the production with an average rate of increase of 37,000 t yr-1 (Figure 1). At the average rate of increase the rice production in the state would be 7.63 m t in the year 2010, 8.48 m t in the year 2020 and 11.02 m t in the year 2050.

The average values for the study period showed that NEZ contributed to 33.4% of total rice production (Figure 3) in the state followed by CDZ (31.2%) and SZ (22.6%). Fluctuations in production was higher in SZ and NEZ followed by CDZ (Table 3). The increasing trend in production was at a higher rate in SZ, followed by NEZ and SZ compared to other zones. Declining trend was noticed in HA&HZ.

Rice productivity

Rice productivity (kg grain ha^{-1}) in Tamil Nadu had shown an increasing trend at an average rate of 82 kg ha^{-1}. The productivity had ranged from 1.47 t ha^{-1} (1962-63) to 6.81 t ha^{-1} (1987-88) with a standard deviation of 1.08. At the computed average rate of increase in the productivity, the productivity in the state would reach 5.82 t ha^{-1} in the year 2010, 6.65 t ha^{-1} in the year 2020 and 9.11 t ha^{-1} in the year 2050. But, if the productivity is computed from the estimated area and production (as shown earlier), the productivity would be 4.39 t ha^{-1} in the year 2010, 5.61 t ha^{-1} in the year 2020 and 13.37 t ha^{-1} in the year 2050. Doberman and White (1999) have emphasized that it may become necessary to breed varieties with and yield potential of 13 t ha^{-1} to meet the demand. The overall mean of rice productivity was highest in the Western Zone (4.2t ha^{-1}) (Tabel 4). In some years, the productivity reached more than 7 t ha^{-1} in NEZ, WZ, CDZ and HRZ and it did not go beyond 5.2 t ha^{-1} in SZ.

Conclusions

Since the area under rice is declining, it may be extremely difficult to meet the increasing demand unless steps are taken to increase the productivity. There is scope for increasing the productivity in all the zones especially in the Southern Zone.

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