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RESEARCH ARTICLE

A STUDY ON TEMPERATURE AND AGRICULTURAL PRODUCTION IN CAUVERY DELTA DISTRICTS OF TAMILNADU

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ABSTRACT

Temperature plays a key role in determining the climate of the region. Surface of the land is heated up quickly than the water bodies because a land surface doesn't allow penetration of heat deeply so the temperature of the land surface rises quickly. The effect of temperature is reduced by the sea breeze, land breeze and wind flows over various water bodies. In this study we tried to calculate the continentality by using Conrad's Coefficient of Continentality index for the period 1901 to 2000 and the attempted to compare the Continentality with agricultural production in the five districts of central Tamil Nadu region of Thanjavur, Thiruvarur, Nagapattinam, Pudukkottai and Trichy districts. This study will conclude that there is negative correlation between the Temperature and paddy yield. The analysis of the data during the period 1901-2000 indicated that low coefficient of continentality in the decade 1951-1960 and high coefficient of continentality in the decade 1981-1990.

INTRODUCTION

Surface of the land is heated up quickly than the water bodies because a land surface doesn't allow penetration of heat deeply so the temperature of the land surface rises quickly. The effect of temperature is reduced by the sea breeze, land breeze and wind flows over various water bodies. This increase in heat has led to the greenhouse effect, resulting in climate change. The main characteristics of climate change are increase in average global temperature (global warming); changes in cloud cover and precipitation particularly over land; melting of ice caps and glaciers and reduced snow cover; and increase in ocean temperatures and ocean acidity-due to seawater absorbing heat and carbon dioxide from the atmosphere. Over the last century, atmospheric concentrations of carbon dioxide increased from a pre-industrial value of 278 parts per million to 379 parts per million in 2005, and the average global temperature rose by 0.74^0C. This is the largest and fastest warming trend that they have been able to discern in the history of the earth (IPCC, 2007). Indices are diagnostic tools used to describe the state of a climate system and understand the various climate mechanisms. Therefore, spatial distribution of various climatic indices determines the climatic conditions of a region.

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Many recent studies are based on indices derived from temperature and precipitation data. The studies on climate indices have been proved very useful for the forecasting of agricultural production. The increase of the annual range of temperature inland is perhaps the most striking effect of the continental surface on climate (Conard 1950). Vulnerability of climate sensitive sectors such as agriculture acquires significant importance in the context of global climate change. Agriculture being a climate sensitive sector and a sector that provides livelihood for more than 60% of India's population, there have been a large number of studies over the past decade that tried to assess the impact due to the climate variability and climate change. Temperature and sub-tropical agricultural areas might bear substantial crop yield losses due to extreme temperature (Edmar *et al.,* 2013). The effects of all the climate variables have had significant contributions to yield and cropping area of major food crops with distinct variation among them (Ruhul *et al.,* 2015). The range of reduction in duration of rice ranged from 9 to 14 days at the end of the century (Ramaraj *et al.,* 2013).The rise in atmosphereic temperature causes detrimental effects on growth, yield and quality of the rice crop by affecting its phenology, physiology and yield components(Singh 2001) (Sheehy *et al.,* 2005) (Peng *et al.,* 2004). The sensitivity of rice to high temperature varies with growth phase, an increase in day/night temperature and genotype (Yoshida, 1981). Effects of the continentality on the crop yield can be analysed in the study.

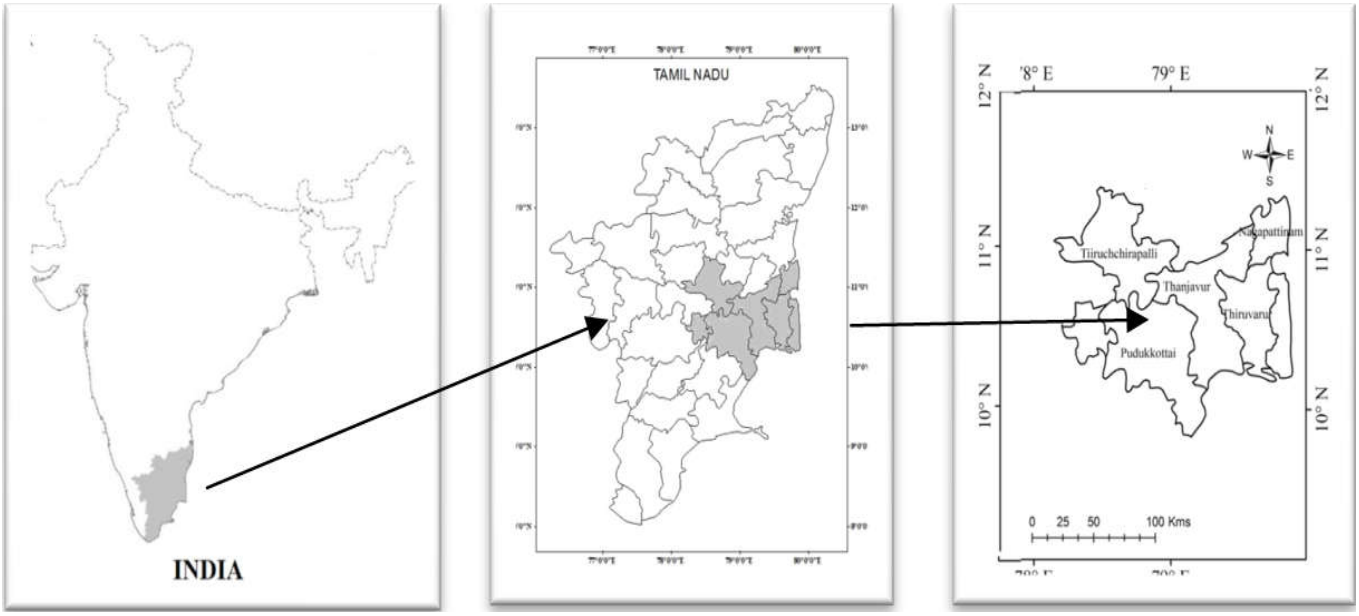

Fig 1. Location map of study area

Objectives

- To find the Index of coefficient of continentality for each district
- To find the temperature variability for the study region
- To find the variability of continentality for the study region
- To find the effects of climate change on paddy yield.

Data Base

Secondary data of temperature and crop yield were used for the study. This secondary data of maximum and minimum monthly temperature were taken from the www.indiawaterportal.org for the study region, this data available for the year 1991-2002 and crop yield data were taken from the government of Tamil Nadu for the period of 1985-2002.

Study Area

Tiruchy, Thiruvarur, Nagapattinam, Pudukkottai and Thanjavur districts were considered for the study. These districts are located in the middle of Tamil Nadu except Pudukkottai all other districts are landlocked locations. Map of the study area is shown in the Fig. No. 1

METHODOLOGY

For finding the continentality we used conard's Continentality index, it is given by the formula

$$K = \frac{1.7\,A}{\sin(\theta + 10)} - 14$$

Where,

K is the coefficient of Continentality
A is the Range of temperature
θ is the geographical latitude.

RESULTS AND DISCUSSION

We have taken the coefficient of continentality for one hundred years from 1901 to 2000 for the study area. Here Continentality coefficient is very less for the Pudukkottai because this is the only districts of the study area located nearer to the sea and Nagapattinam experience maximum coefficient of continentality because Nagapattinam is land locked and semi arid region. Even though the Thanjavur district located far away from coast it experiences low coefficient of continentality because this district boarded by Western Ghats it considerably reduces the effect of high range of temperature. Trichy experience second maximum of coefficient of continentality only after Nagapattinam because the effect of range temperature reduced by the presence of Cauvery river. District of Thiruvarur experiences Normal coefficient of continentality as we compare to other districts because Thiruvarur also boarded by Western Ghats showed in the Fig. No.2.

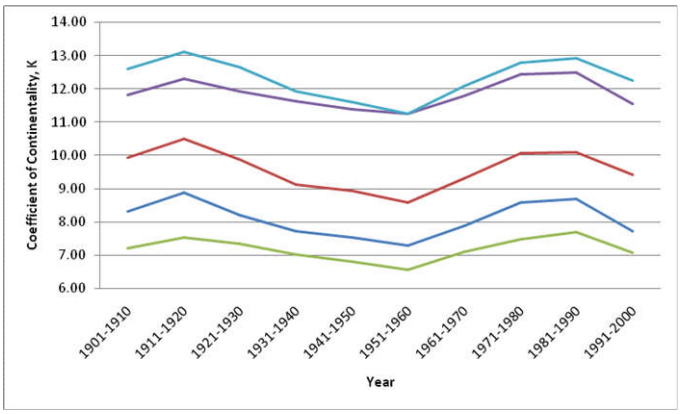

Fig. 2. Index of Coefficient of Continentality

And the lowest coefficient of continentality was recorded in Pudukkottai compare to other districts we discussed because of the influence of its location near the sea and the presence of rivers Amravati, Noyyal, Bhavani and Cauvery. Here we found the trend of continentality for the period of 100 years

from 1901 to 2000 for the study areas of Thanjavur, Thiruvarur, Pudukkottai, Tiruchy and Nagapattinam. Fig No. 2 shows that the graph lines are parallel to each other with increasing Phase of continentality from the decade 1901-1910 and attain maximum in the second decade of the 20th century then coefficient of continentality starts decreasing and attain minimum in the decade 1951-1960. From the decade 1961-1970 the coefficient of continentality increases and attain maximum in the decade 1981-1990 then it starts decreasing. Attempt has been made to find the relation with paddy yield and continentality from the Fig. No. 3 High paddy yield in the year 1987, 1990, 1993, 1998 and 2000 coincide with the high continentality in same year. The low paddy yield can be seen in the Nagapattinam district during the year 1985, 1988, 1991, 1995, 1999 and 2002.

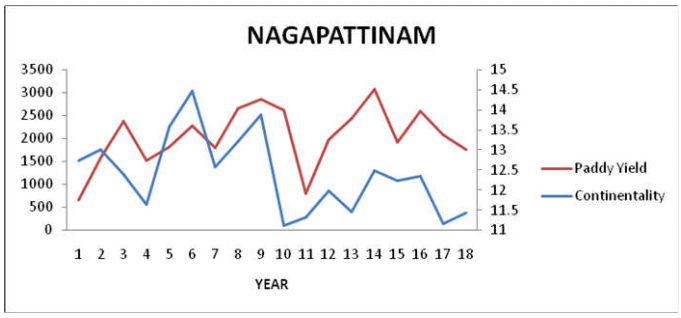

Fig. 3. Comparing Continentality with Paddy Yield

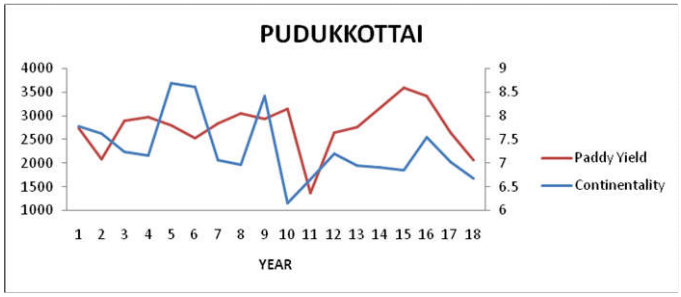

Fig. 4. Comparing Continentality with Paddy Yield

On the same years coefficient of continentality also low in the Nagapattinam district. From the Fig No. 4 we can see that Pudukkottai district has maximum of paddy yield and coefficient of continentality occurred in the year 1986, 1987, 1992, 1994 and 1999 and Minimum paddy yield and coefficient of continentality occurred in the year 1986, 1990, 1995 and 2002. In Thiruvarur district except in the year 1986, 1994 and 2001 where the coefficient of continentality is minimum and paddy yield is maximum. But remaining years shows normal trend of maximum of paddy yield and maximum of coefficient of continentality and minimum paddy yield in the years where minimum coefficient of continentality, Fig No. 5. Fig No. 6 shows the trends of continentality and paddy yield in Thanjavur district. Maximum paddy yield occurred in the year 1994, 1998 and 2001 on the same year the coefficient of continentality also high. In the year 1985, 1995, 1990 and 2002 the continentality is low and in the same year the paddy yield also reduced. According to the Fig. No. 7 Tiruchy district has a maximum of paddy yield and continentality during the year 1999, 2001, 1993 and 1996 and minimum of paddy yield and continentality during the year 1986, 1991, 1995 and 2002. Correlation coefficient reveals that Thanjavur has strong negative correlation between crop yield and continentality (r = -0.50037) followed by Thiruchy (r = -0.24914) and Thiruvarur which has low negative correlation (r = -0.05907). Pudukkottai and Nagapattinam have a positive correlation between crop yield and continentality the value of the coefficient of correlation are +0.01941 and +0.1941 respectively shown in the Table 1.

Table 1. Correlation coefficient of crop yield and Continentality

District	Coefficient of Correlation, r
Thanjavur	-0.50037
Thiruvarur	-0.05907
Pudukkottai	0.01941
Thiruchy	-0.24914
Nagapattinam	0.19414

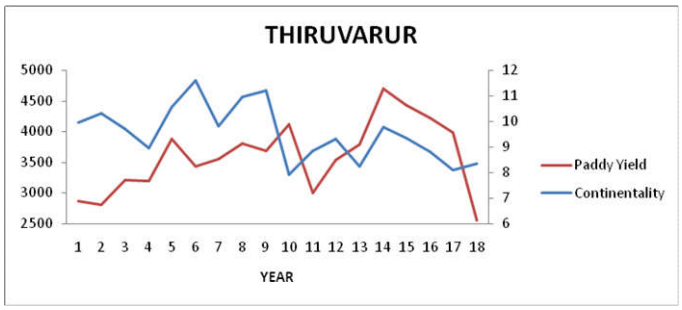

Fig. 5. Comparing Continentality with Paddy Yield

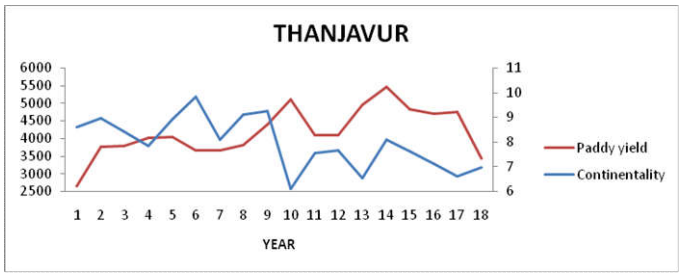

Fig 6. Comparing Continentality with Paddy Yield

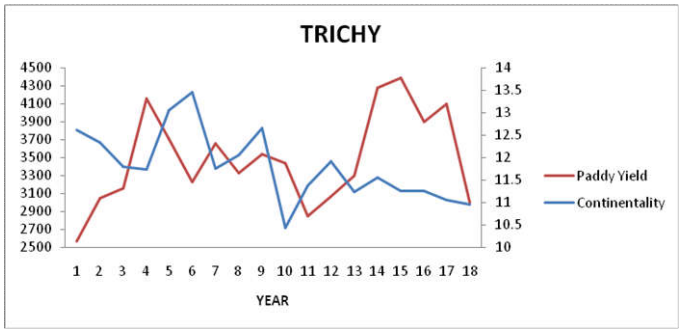

Fig. 7. Comparing Continentality with Paddy Yield

Conclusion

In the study of the temperature related to agricultural production we conclude that continentality increased in the initial part of the century attained maximum and then started to decrease up to mid of the 20th century. Then it starts to increase that attained maximum in the decade 1981-1990 and then started to decrease. The study also concludes that local geomorphology plays a major role in determining the temperature of the region. There is a negative correlation between continentality and agricultural production in the districts of Thanjavur, Thiruchy and Thiruvarur. There is a low

positive correlation between continentality and agricultural production in the districts Pudukottai and Nagapattinam. This paper concludes that there is less relation between the agricultural production and Temperature.

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