



Analysis on Length of Growing Period use NDVI Value in Coimbatore Region

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Study has been conducted to analyses length of growing period use NDVI value. The LGP is normally analyses weather station data. In this study LGP analyses using NDVI data (1992-2015) from public domain AVHRR (Advanced Very High Resolution Radiometer) 1km resolution for Coimbatore regions. The duration of the growing period was calculated using the NDVI threshold value and compared to the NBSS&LUP normal length of growing period (1999). For J. Reddy technique validation, ground station data such as rainfall and PET analyzing LGP are used. According to the study, the maximum LGP was found in the Karamadai, Pollachi north, and Pollachi south regions, while the lowest LGP was found in the sulur region, and short-duration crops were recommended.

Keywords: LGP; NDVI; NDVI threshold value; start of season; end of season.

1. INTRODUCTION

The length of growing period refers to number of days in a year during which rainfall and moisture

stored in the soil exceeds half of potential evapotranspiration. The National Bureau of Soil Survey and Land Use Planning estimated LGP using the PET and rainfall [1],[2]. An alternative

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method to analyses to LGP is the direct use of multi-temporal remote sensing data. Time series of vegetation indices, derived from optical sensors on board satellites, provide information about the green-up and senescence of vegetation during the year. These include the Advanced Very High-Resolution Radiometer (AVHRR) and the Moderate Resolution Imaging Spectroradiometer (MODIS). Many authors have performed phenological analysis on vegetation index time series from these sensors [3],[4]. The most commonly used vegetation index is the normalized difference vegetation index (NDVI), which is calculated as the near infrared minus red reflection, divided by the sum of the two [5],[11]. Normalized difference vegetation index (NDVI) reflects growing status of green vegetation, so crop monitoring could be realized by using LGP [6]. The LGP can be estimate from NDVI Threshold value, including start- and end-of-season [7],[10]. LGP analyses at the multiple years of AVHRR NDVI data [8],[9].

rainfall and weekly PET using analyses Length of growing period (Jeevananda Reddy method).

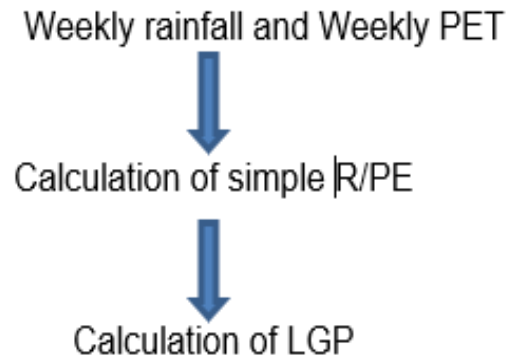


Image 1. LGP using ground station data

LGP using temporal NOAA-AVHRR (7-day, 1km) NDVI data composite. AVHRR-NDVI composite data were downloaded from respective website (<http://maps.elie.ucl.ac.be/CCI/viewer/profiles.php>) for 1992-2015. Crop information was extracted from NDVI composite using NDVI threshold values, identified for Coimbatore region. The NDVI value of the 7-day composite of the corresponding season was taken as Threshold NDVI Value for each Coimbatore regions.

2. MATERIALS AND METHODS

2.1 Study Area

Coimbatore district is situated in North Western part of the Tamil Nadu, the district covering an area of 4889 sq.km falls between 10°13'4" North to 11° 24'5" North latitude and 76° 39' 25" East to 77° 18' 26" East longitude with elevation 426.72 m above mean sea level. The mean annual rainfall is 657mm distributed in 47 rainy days. The mean maximum temperature is 31.5°C and minimum temperature is 21.4°C.

2.3 Methodology for Analyzing LGP using NDVI

To identify crop phenology stage, i.e., Start of Season, NDVI threshold value was identified Start / Onset of season (SOS) were considered when NDVI crosses the threshold value (TV) and continues in an upward trend. End of Season (EOS) is identified as the period when NDVI falls below the threshold value and continues a downward trend.

2.2 LGP using Ground Station Data

Ground station data for 24 years (1992-2015) (TNAU, ACRC, Coimbatore) such as weekly

Chart 1. LGP by Jeevananda Reddy method, 1983 [12]

LGP by Jeevananda Reddy method, 1983 [12]		
Climate Variable	14 weeks moving average R/PE	Simple weekly R/PE
G-Growing period.	≥ 0.75	≥ 0.50
S-Sowing Rain	-	≥ 0.50
Ps-Presowing	≥ 0.50	≥ 0.25
W-Wet spell	-	≥ 1.50
D-Dry spell	-	≤ 0.50

SGS: Simple R/PE value more than 0.75
 EGS: The simple R/PE value less than 0.75 (after start of growing season)

3. RESULTS AND DISCUSSION

3.1 Determination of LGP using NDVI Value

Different region of Coimbatore NDVI composite data indicates the trend in extent under various crop phenology. NDVI Threshold value analysis was performed to assess variability in various LGP classes. LGP 90-120 days, 120-150 days, 150-180 days and 180-210 days comparison between the LGP derived from NDVI and reported by NBSSS & LUP (1999) in different regions of Coimbatore. Satellite data is able to sense crop germination only after a sufficient time-lag of 2-3 weeks after date of sowing (DOS).

3.1.1 Determination of the length of growing period using weather station data for analyse J. Reddy method – Karamadai

The Fig.1 showed Karamadai region 24 years (1992-2015) length of growing period 175 days

and the start of season was 23 standard week and end of season 51 th standard week.

3.1.2 Determination of LGP using NDVI value- Karamadai

Satellite data is able to sense crop germination only after a sufficient time-lag of 2-3 weeks after date of sowing (DOS). The NDVI value is more than NDVI threshold value stat the season and less means end of season. Fig showed start of season 25 standard week and end of season 5 th satandard week.

3.2 Determination of the Length of Growing Period using Weather Station Data for Analyse J. Reddy method – Sulur

The Fig.3 showed Sulur region 24 years (1992-2015) length of growing period 84 days and the start of season was 36 th standard week and end of season 48 th standard week.

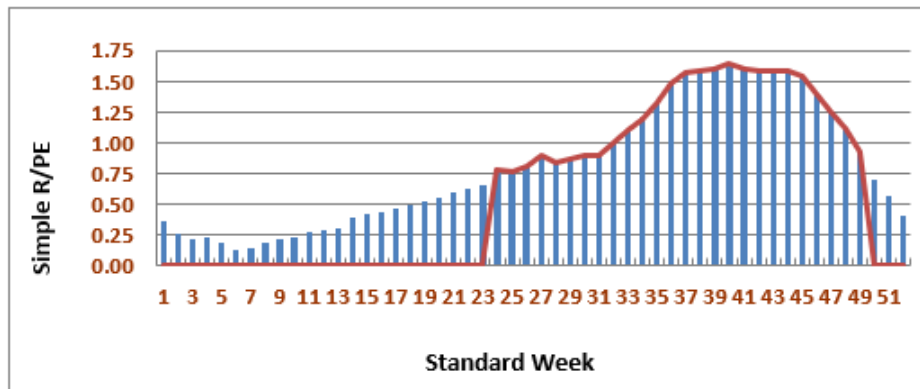


Fig. 1. Karamadai region R/PE 14 week moving average 24 years (1992-2015)

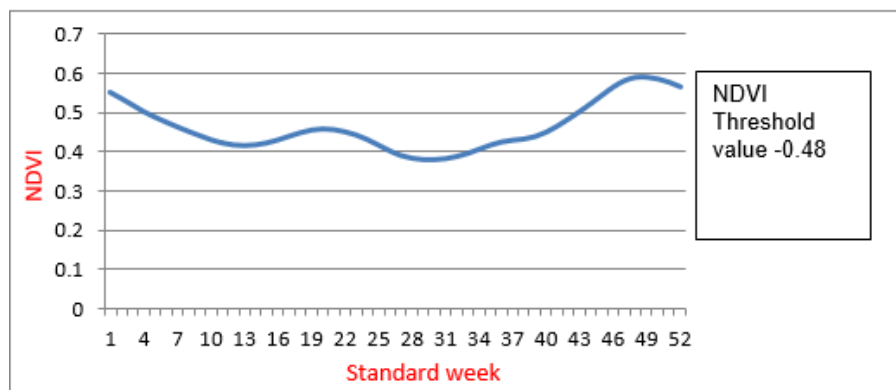


Fig. 2. Karamadai region NDVI for AVHRR (1992-2015) composite data

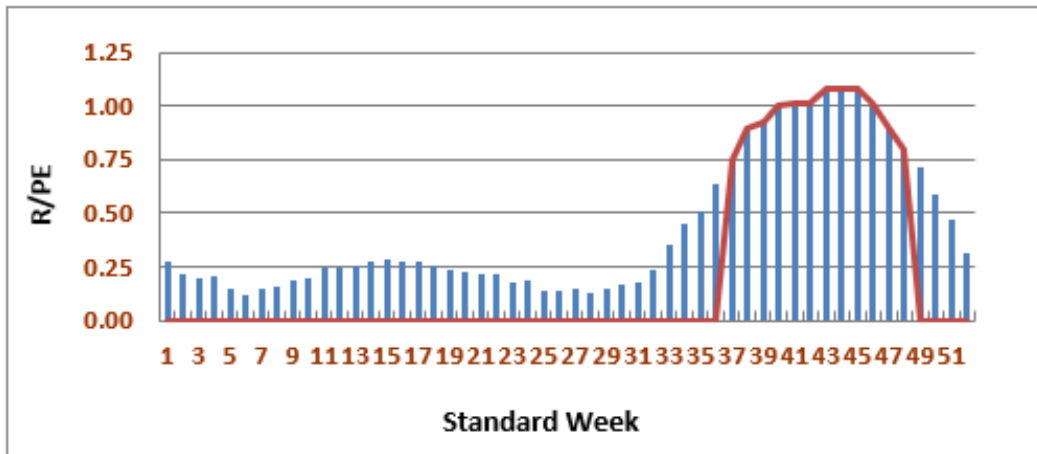


Fig. 3. Sular region R/PE 14 week moving average 24 years (1992-2015)

3.2.1 Determination of LGP using NDVI value – Sular

The NDVI value is more than NDVI threshold value start the season and less means end of season. Fig .4 showed sular region start of season 38 standard week and end of season 5 th satandard week.

3.3 Determination of the Length of Growing Period using Weather Station Data for analyse J. Reddy method – Sulthanpet

The Fig.5 showed Sulthanpet region 24 years (1992-2015) length of growing period 91 days and the start of season was 37 th standard week and end of season 48 th satandard week.

3.3.1 Determination of LGP using NDVI value- Sulthanpet

The NDVI value is more than NDVI threshold value start the season and less means end of season. Fig .6 showed Sulthanpet start of season 25 standard week and end of season 5 th standard week.

3.4 Determination of the length of growing period using weather station data for analyse J. Reddy method - Pollachi north

The Fig.7 Showed Pollachi north region 24 years (1992-2015) length of growing period 182 days and the start of season was 22nd standard week and end of season 48 th standard week.

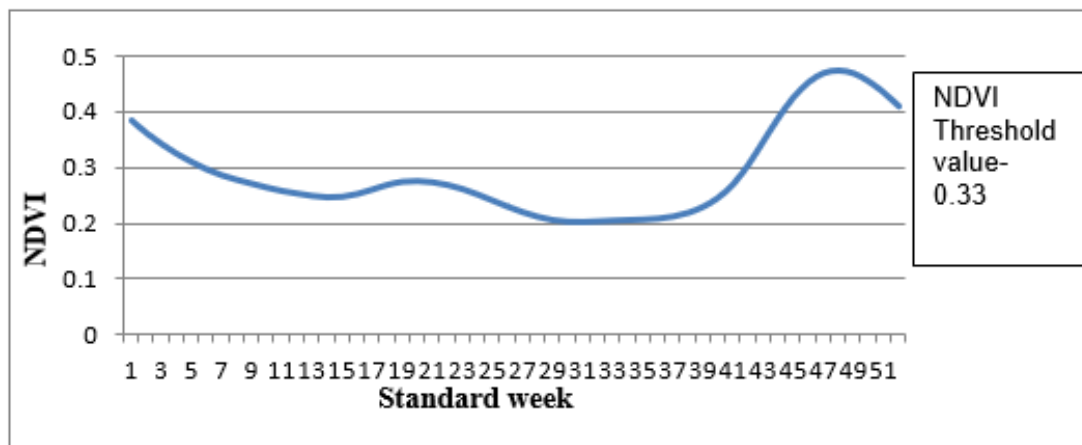


Fig. 4. Sular region NDVI for AVHRR (1992-2015) composite data

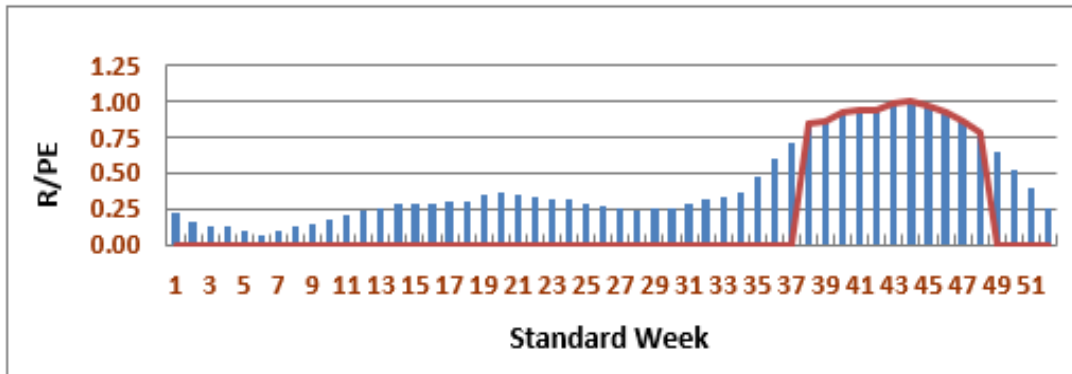


Fig. 5. Sulthanpet region R/PE 14 week moving average 24 years (1992-2015)

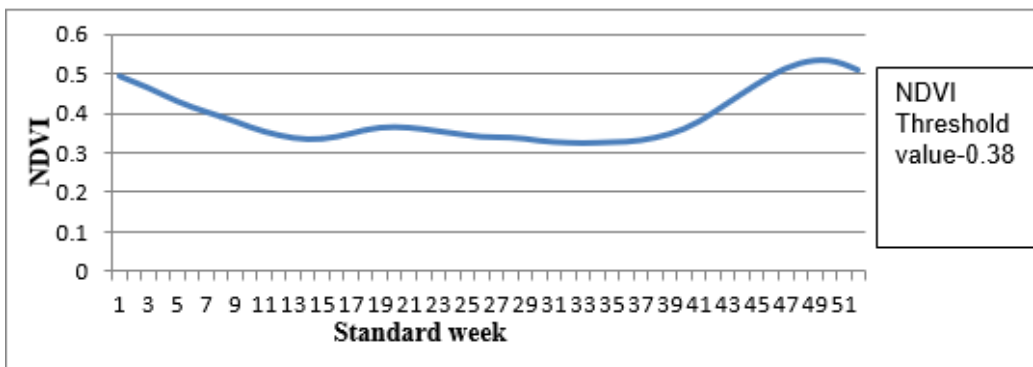


Fig. 6. Sulthanpet region NDVI for AVHRR (1992-2015) composite data

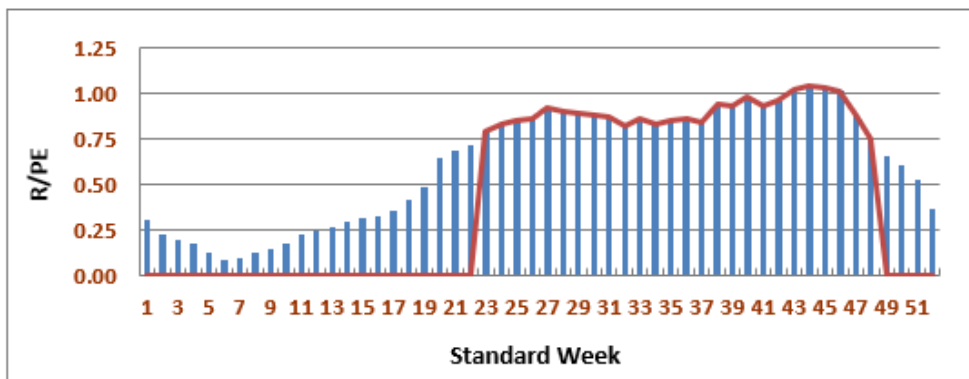


Fig. 7. Pollachi north region R/PE 14 week moving average 24 years (1992-2015)

3.4.1 Determination of LGP using NDVI value- Pollachi north

The NDVI value is more than NDVI threshold value start the season and less means end of season. Fig. 8 showed pollachi north start of season 26 standard week and end of season standard week 3.

3.5 Determination of the Length of Growing Period using Weather Station Data for Analyse J. Reddy Method - Pollachi south

The Fig. 9 Showed Pollachi south region 24 years (1992-2015) length of growing period 175 days and the start of season was 34 th standard week and end of season 48 th standard week.

3.5.1 Determination of LGP using NDVI value- Pollachi south

The NDVI value is more than NDVI threshold value start the season and less means end of season. Fig.10 showed pollachi south start of season 38 th standard week and end of season 6 the standard week.

3.6 Determination of the Length of Growing Period using Weather Station Data for Analyse J. Reddy Method - Periyanaicken palayam

The Fig.11 showed Periyanaicken palayam region 24 years (1992-2015) length of growing period 98 days and the start of season was 36 th

standard week and end of season 50 th standard week.

3.6.1 Determination of LGP using NDVI value- Periyanaicken Palayam

The NDVI value is more than NDVI threshold value start the season and less means end of season. Fig.12 showed Periyanaicken palayam start of season 39 th standard week and end of season standard week 3.

The simple linear regression NDVI threshold value and simple R/PE LGP was correlated different regions of Coimbatore. Fig .14, showed number of days length of growing period Coimbatore regions.

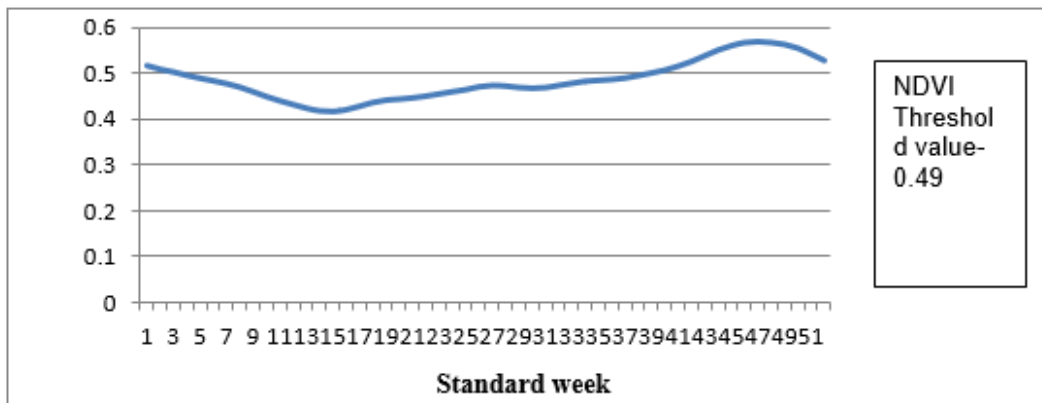


Fig. 8. Pollachi north region NDVI for AVHRR (1992-2015) composite data

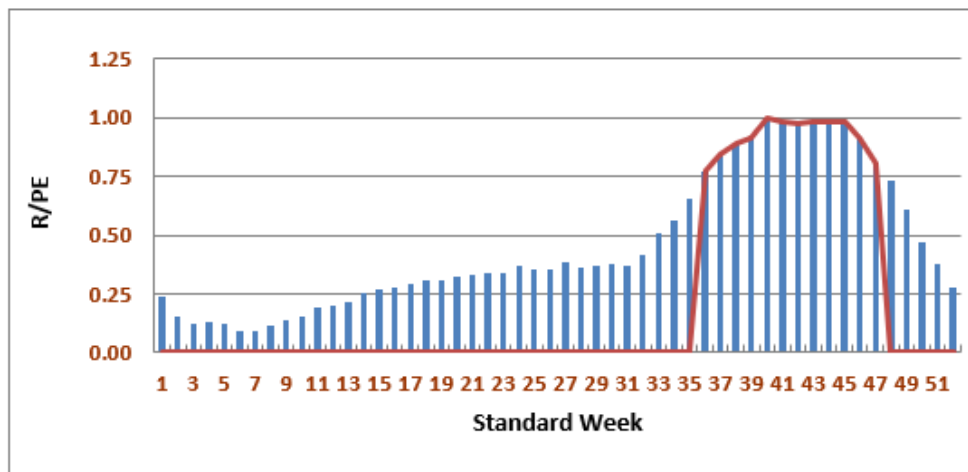


Fig. 9. Pollachi south region R/PE 14 week moving average 24 years (1992-2015)

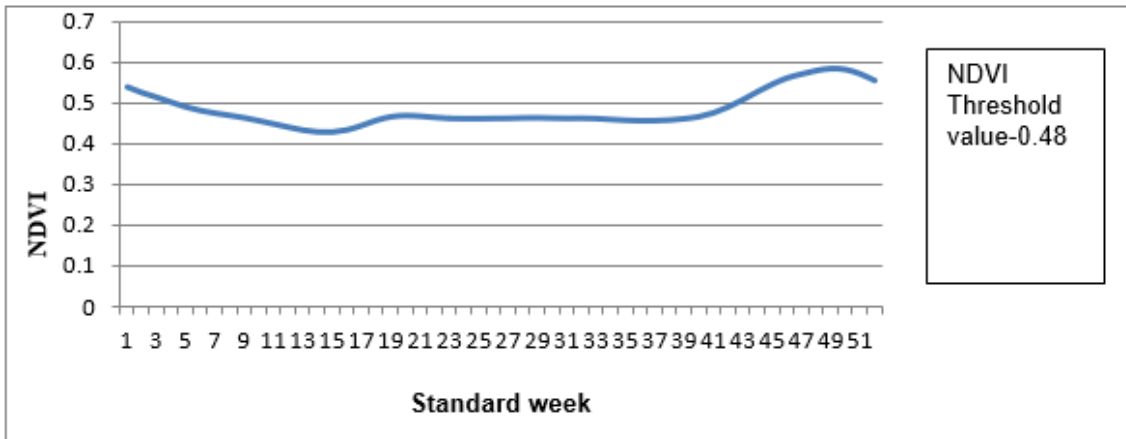


Fig. 10. Pollachi south region NDVI for AVHRR (1992-2015) composite data

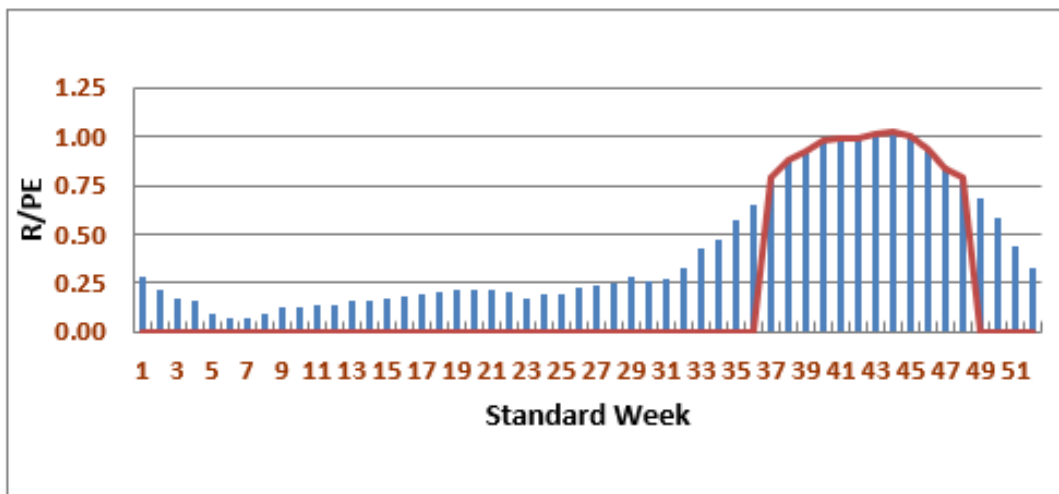


Fig. 11. Periyanaicken palayam region R/PE 14 week moving average 24 years (1992-2015)

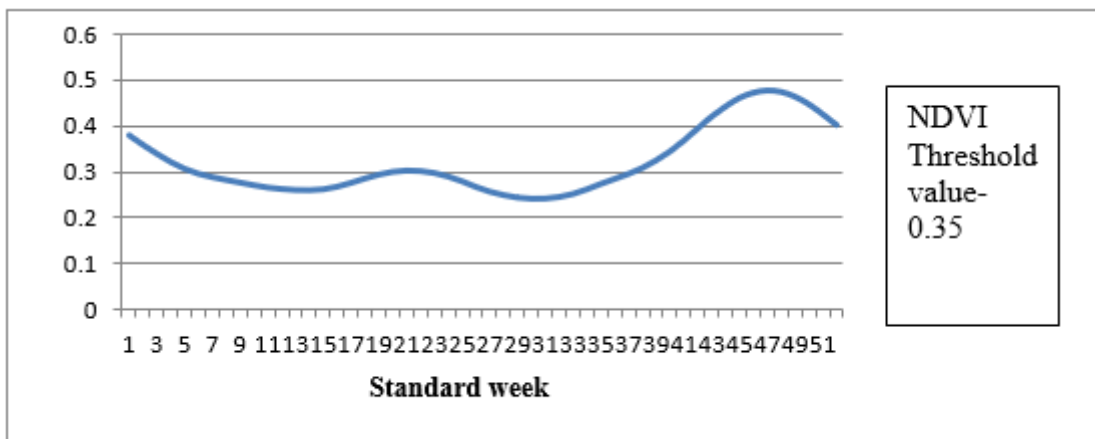


Fig. 12. Periyanaicken palayam region NDVI for AVHRR (1992-2015) composite data

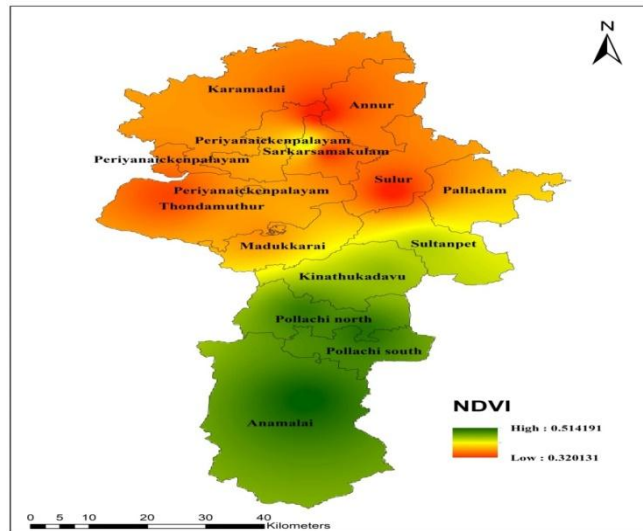


Fig. 13. NDVI for AVHRR (1992-2015) composite data

Table 1. Comparison of LGP for J. Reddy method and NDVI value

S.NO	Name of the Coimbatore regions	NDVI Threshold value	Normal LGP (NBSS&LUP 1999) days	Simple R/PE using LGP days
1	Karamada	0.48	150-180	175
2	Sulur	0.33	60-90	84
3	Sulthanpet	0.38	90-120	91
4	Pollachi North	0.49	150-180	182
5	Pollachi South	0.48	150-180	175
6	Periyanaicken palayam	0.35	90-120	98

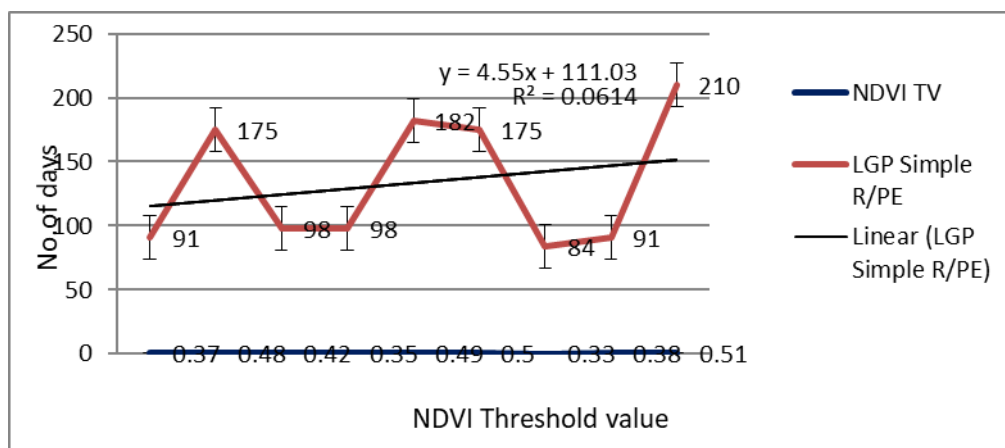


Fig. 14. LGP Variations in Coimbatore different regions

4. CONCLUSION

Start and end of the rainfed crop growing periods were delineated for all the Coimbatore region from which, the length of the growing periods

was estimated. The LGP is using selection of crop and variety for particular regions for crop planning. Results of this study may suggest the possibility of remote sensing in determining the length of growing period and mapping of suitable

crops. Future comparison of our results with station-based LGP estimates can assist in optimal utilization of the complementarity between climate- and NDVI-based LGP estimates.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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