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RESEARCH ARTICLE

# Block Level Analysis of Length of Growing Period in Virudhunagar District

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## ABSTRACT

Agriculture has been rightly termed as India's soul, the only sector holding a positive GDP even during the COVID 19 pandemic. Such an important sector is vulnerable to several factors, such as climate change, land use changes, market fluctuations, and other socio-economic factors. The climatic factors are major game changers in Agricultural production, especially with rainfall being the decider of crop selection and cropping pattern, whereas Potential Evapotranspiration is mandatory to gain knowledge on the crop performance. Thus, understanding rainfall and Potential Evapotranspiration owes us the benefit of determining the Length of the growing period (LGP), which could be used in crop selection. The LGP was analyzed from gridded APHRODITE data. The LGP analysis for three blocks in the Virudhunagar district of Tamilnadu showed that there had been 17-18 weeks of growing period differing within the blocks. Crop selection needs to be accommodated within this growing period, and the major rainfed blocks could opt for pulses and millets.

**Keywords:** *Length of growing period (LGP); Block level analysis; APHRODITE data; Virudhunagar district*

## INTRODUCTION

Rainfall is an atmospheric phenomenon involving hydrological components differing in spatial and temporal terms (Dar, 2011). Rainfall variability has major concerns for economies of an agrarian country like India (Yadav *et al.,* 2014). The variability in seasonal rainfall in a country can limit its growth and development. In India, the Gross Domestic Product (GDP) is influenced by monsoon rainfall rather (Kannaiyan *et al.,* 2001). Moreover, rainfall is the deciding factor in crop productivity, choice of crop, and the Length of its growing period.

The Length of Growing Period (LGP) is defined as the Length of rainy season, the duration between the onset and withdrawal of agriculturally significant rains (Ashok Raj, 1979). Information on the Length of growing season (number of days when plant growth takes place) for a particular region helps in the selection of cultivar (short / medium/ long duration) of a particular crop (IMD, 1991). Better agricultural operations are planned particularly, land preparation and sowing if the data on the onset date of rain is available and understandable. Many factors are deciding LGP for a specific region, which is dependent not only on the rainfall distribution but also on the type of soil, soil depth, water retention, release characteristics of the soil, air temperatures and daylight hours (Sivakumar *et al.,* 1993).

In Virudhunagar district, Paddy is the most predominant crop that is cultivated at 17420 hectares and one of the major Horticultural belts where crops such as Mango, Guava, Banana, Amla, Tomato, Brinjal, Bhendi, Onion, coriander, Chillies, flowers like jasmine, Arali, Tuberose *etc*., are grown extensively. The total area of around 13590 ha is covered by various Horticulture crops in the Virudhunagar district (Thiyagarajan *et al.,* 2020). Though Virudhunagar district is experiencing rainfall by the influence of both southwest (SW) and the northeast (NE) monsoons, a major amount is received by northeast monsoon (NEM) in the district. The cyclonic storms in the Bay of Bengal accelerated the precipitation, so the district enjoys torrential rainfall (CGWB, 2019). Virudhunagar is in a subtropical climate (period from April to June - hot and dry) (District profile). Usually, more humidity occurs in the morning than in the afternoons, and relative humidity of an average between 65 and 85% in the mornings is prevailing. Humidity in the afternoon is between 40 and 70%. The annual mean minimum and maximum temperatures are 23.78

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and 33.95°C, respectively. The daytime heat is oppressive, and the temperature is as high as 40.2° C. The lowest temperature recorded is of the order of 19.3°C (Tamil Nadu Rural Transformation Project - TNRTP, 2020).

To understand and manage crop production, it is vital to analyze the rainfall data to determine the cropping pattern and choice of crops. Hence, the block level length of growing period study was undertaken to critically analyze the historical rainfall data of the Virudhunagar district of Tamil Nadu, where rainfall is the major deciding factor for agriculture.

## MATERIAL AND METHODS

### *Study Area*

Virudhunagar district of Tamilnadu state is located between 09°12' and 09°47' North latitude and 77° 20' and 78° 26' East longitudes landlocked by Madurai and Sivagangai districts in the north, Tirunelveli and Tuticorin districts in the south (Fig. 1). Ramanathapuram district in the east, Theni district in the northwest, and Kerala state in the west. The district is a rainfed region receiving rain majorly in the Northeast Monsoon (NEM) months between October to December with an average rainfall of 829 mm. Three revenue blocks of the district - Kariappatti, Narikudi and Tiruchuli, were chosen for this study, being on the East side and completely influenced by the NEM (Fig. 2).


**Fig. 1. Virudhunagar district location on Tamilnadu state map**

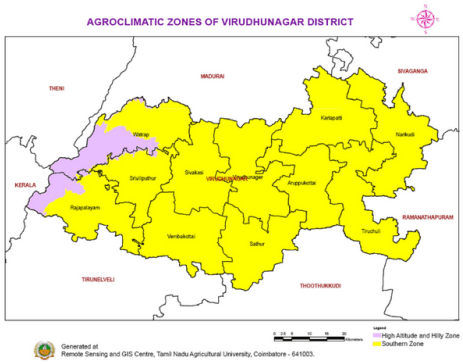


**Figure 2. Agroclimatic zones of Virudhunagar**

### *Data*

Weather and PET data obtained from APHRODITE website for the period between 1951-2020 was used for the analysis.

### *Jeevananda Reddy method (1983) – Length of growing period:*

| Condition | 14 weeks moving average (R/PE) | Simple R/PE ratio (Weekly) |
|---|---|---|
| G | ≥ 0.75 | ≥ 0.50 |
| S | - | ≥ 0.50 |
| Ps | ≥ 0.50 | ≥ 0.25 |
| W | - | ≥ 1.50 |
| D | - | ≤ 0.50 |

Where G is Effective rainy period.

S is Sowing rain

Ps is Pre-sowing cultivation.

W is Wet spell

D is Dry spell

***Available Effective Rainy Period (G)*** - The number of consecutive weeks in which the 14 weeks moving of R/PE ratio is ≥0.75 of this effective rainy period with a simple R/PE ratio of ≥0.5. This is otherwise known as a growing period.

***Sowing Rain (S)*** - The week before the beginning of an available effective rainy period is taken as the week of commencement of sowing rain. Here, the simple R/PE ratio should be ≥ 0.5.

***Pre-sowing Cultivation (Ps)*** - Pre sowing cultivation and seed bed preparation (Ps) get started when the 14 weeks moving average curve for R/PE ratio crosses 0.5 limits and when the particular week has simple R/PE ratio of ≥ 0.25.

***Wet spell (W)*** - Within G, if the simple R/PE ratio is ≥ 1.5, the week is called a wet spell.

***Dry spell (D)*** - Within the growing period if the simple R/PE ratio is < 0.5, the week is said to be called as dry spell.

***Crop failure (A)*** - If the 'G' period (in any year) is ≤ 5 weeks the possibility of growing any crop is limited.

## RESULTS AND DISCUSSION

The results on the Length of growing period analysis over three blocks of Virudhunagar district viz., Kariappatti, Narikudi and Tiruchuli are described as follows:

### *Length of growing period in Kariappatti block:*

Based on the 14-week moving period average as given in Figure 3b, 14 weeks between the 36th and 50th standard weeks (3rd Sep. to 16th Dec) have more rainfall than PET, which is average for a rainfed crop production. Adding two weeks for the soil moisture availability after rainy season and one week for pre monsoon, totally 17 weeks *i.e*., 119 days (27$^{th}$ Aug to 31$^{st}$ Dec) are available for crop production, considered as Length of Growing Period (LGP), which is average for a rainfed crop. The duration of the selected crop should be less than 110 days, so that crop may not suffer from terminal drought. There are only four weeks, 42$^{nd}$ to 46$^{th}$ weeks alone having excess rainfall during the LGP (Fig 3a). The excess rainfall received during that monsoon period must be harvested properly to ensure supplemental irrigation during winter. Hannen and James (1970) have quoted that the moving average method was better to smoothen a dataset and produce valuable results. A reliable amount of moisture meeting Evapo-transpiration does help in producing a bountiful crop than the excess moisture condition that could inundate the roots (Kanwar *et al.,* 1988) and suffocate the plants without oxygen transport which needs proper drainage of the flood waters after the rains (Ransom, 2013).

### *Length of growing period in Narikudi block:*

From Figure 4b, there is a period of 14 weeks between the 36$^{th}$ and 50$^{th}$ standard weeks (3$^{rd}$ Sep. to 16$^{th}$ Dec) having rainfall more than PET, which is average for a rainfed crop production. Adding two weeks for the soil moisture availability after the rainy season and one week for pre-monsoon, total of 17 weeks *i.e*., 119 days (27$^{th}$ Aug to 31$^{st}$ Dec) are available towards rainfed crop production. Like the Kariappatti block, the duration of the selected crop should be less than 110 days to surpass terminal drought. Distinctive from Kariappati block, there are only three weeks (43$^{rd}$ to 46$^{th}$ weeks) having excess rainfall intruding on the growing period (4a). Management of excess rainfall has proven to be vital in these three weeks. Crops like pulses and minor millets with less ET requirement could be accommodated to this available growing period of 12 weeks to harness maximum yield potential in a shorter time (Manikandan *et al.,* 2014). Similar suggestions were made by Kokilavani *et al.* (2016) when the growing period was 16 weeks but with a wide range of crops like groundnut, sesame, maize, varagu and soybean instead of cotton.

### *Length of growing period in Tiruchuli block:*

Owing to the 14-week moving period average as given in Figure 5b, the period of 15 weeks between the 36$^{th}$ and 51$^{st}$ standard weeks (3$^{rd}$ Sep. to 23$^{rd}$ Dec) has more rainfall than PET. With two weeks of post rainy season moisture availability and one week for pre monsoon showers, totally 18 weeks *i.e*., 126 days (27$^{th}$ Aug to 7$^{th}$ Jan) are available for crop production, considered as the Length of Growing Period (LGP), which is average for a rainfed crop. The duration of the selected crop should be less than 120 days, so that the crop gets accustomed within the growing period. The block experiences more wet weeks than the other two blocks, with five weeks, 41$^{st}$ to 46$^{th}$ weeks, having excess rainfall during the LGP (5a). Continuous wet weeks could pose the inundation problem and affect crop growth, which needs to be monitored properly. Tamil Nadu experiences the LGP between 91 and 126 days (13-18 weeks) (Vengateswari *et al.,* 2020). It is suggested that sorghum can be sown during 36th Std week against 16th Std week. Crop sown during 16th Std week; the crop may suffer from soil moisture stress (CPG, 2020).

## CONCLUSION

The length of growing period analysis for Kariapatti, Narikudi and Tiruchuli blocks of Virudhunagar district revealed that there had been around 100 to 120 days available for cropping in Kariappatti, Narikudi and Tiruchuli blocks. The Kariappatti and Narikudi blocks, have their growing period between the 36$^{th}$ week, extending until the 50$^{th}$ week (17 weeks), while the Thiruchuli block holds one week extra between 36$^{th}$ week to the 51$^{st}$ week. Comparing the wet weeks, Thiruchuli block has a greater number of wet weeks (5 weeks) compared to Kariappatti (4 weeks) and Narikudi (3 weeks). Short to medium duration crops like pulses and millets are fine with this growing period and especially the complete rainfed cultivation of the district.

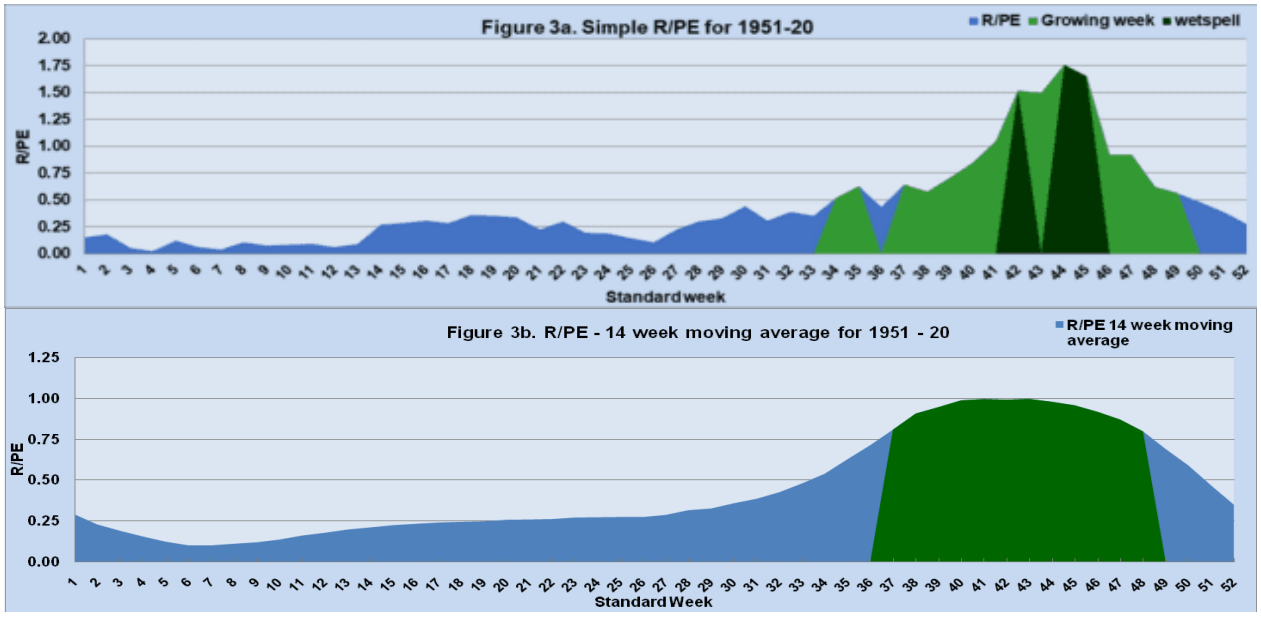


Figure 3. Length of Growing period analysis for Kariappatti block

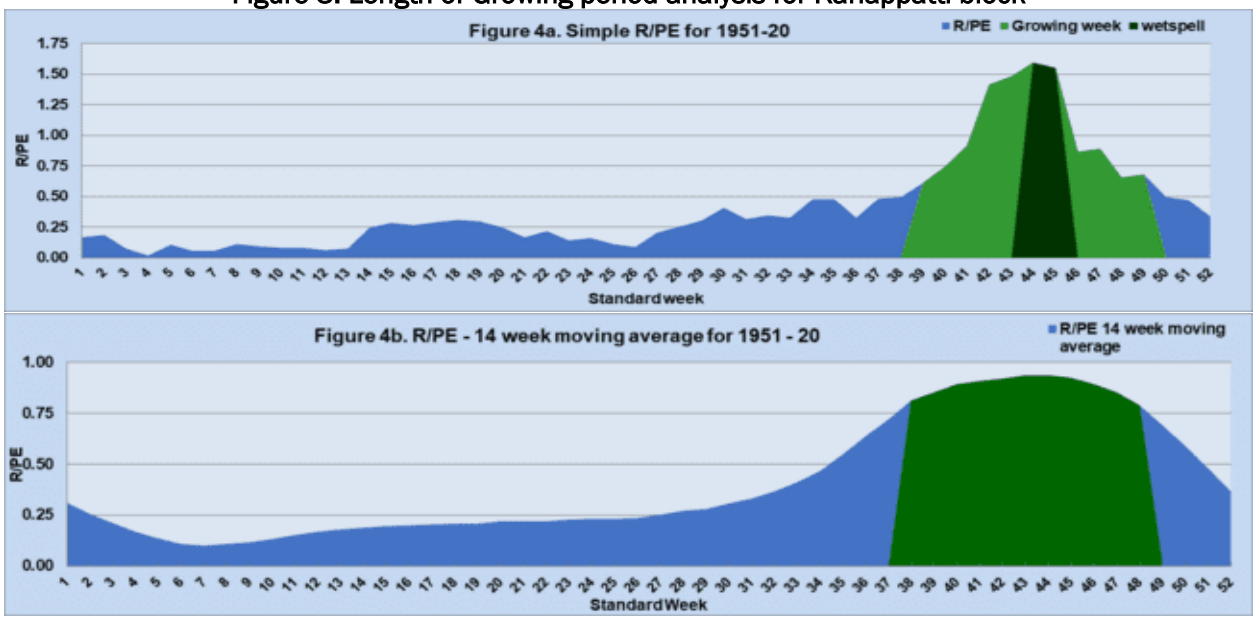


Figure 4. Length of Growing period analysis for Narikudi block

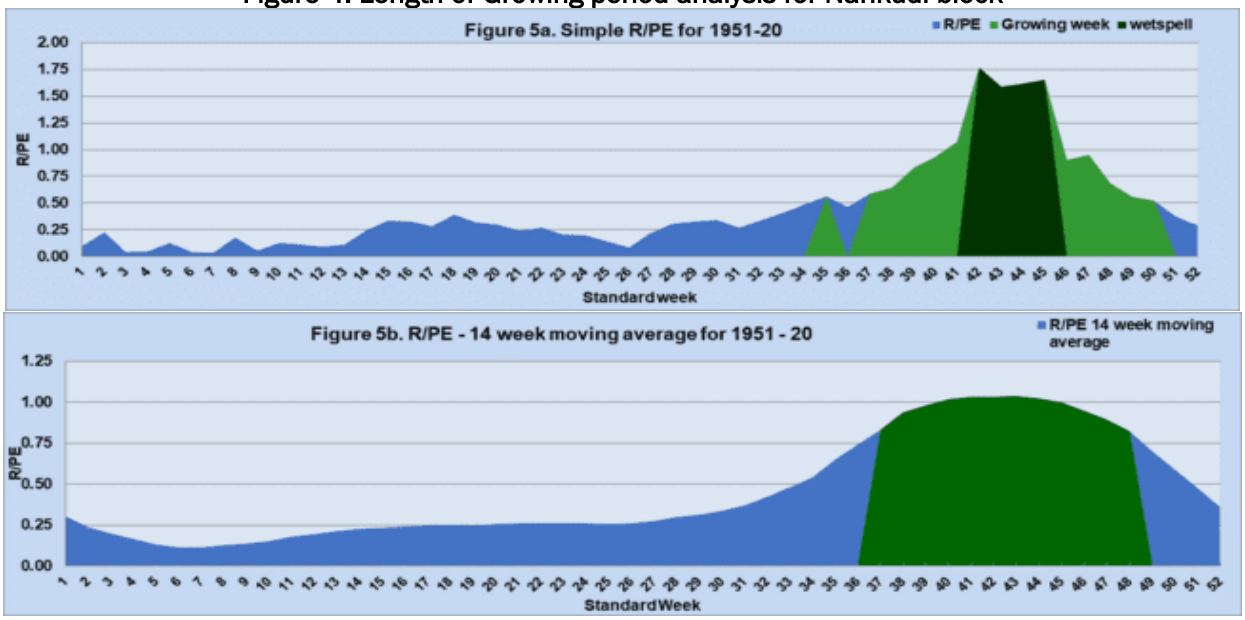


Figure 5. Length of Growing period analysis for Tiruchuli block

*Consent for publication*

All the authors agreed to publish the content.

*Competing interests*

There was no conflict of interest in the publication of this content

*Data availability*

All the data of this manuscript are included in the MS. No separate external data source is required.

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