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*Short Communication*

# Assessment of high rainfall events and drought over Kerala for planning agricultural operations


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India being an agricultural country, its growth purely depends on the weather and in particular the extreme weather events. Ajithkumar and Sreekala (2015) reported that mean annual rainfall for the state Kerala as whole is 2956.4 ± 392 mm with coefficient of variation of 13.3%. The occurrence of exceptionally heavy rainfall events and associated flash floods are frequent in Kerala for last few years. Indian agriculture depends on monsoon rainfall. Any unevenness in timing, duration and intensity of the monsoon rains has a significant impact on agriculture. Kerala is bounded by Arabian Sea to its west and the Western Ghat mountain range to its east. Around 44 rivers flow through Kerala and there are about 50 major dams distributed mostly across the Western Ghats (Ramasamy *et al.*, 2019), which provide water for agriculture. In India northeast received highest rainfall during monsoon season followed by Kerala. Any unevenness in rainfall causes flood and drought in different parts. Ninety percent of annual rainfall concentrated in the rainy season, leading to water logging and hampering the ongoing harvest of summer-autumn crop (Kyu *et al.,* 2019). A study conducted by Aswathi *et al.* (2019) on diurnal variation of rainfall over central zone of Kerala using self-recording raingauage reported that maximum amount of rainfall, is received after 8.00 PM, i.e., during the night/early morning hours in all the seasons except summer season.

The daily rainfall data from agrometeorological observatory installed at six different agricultural research stations viz., Ambalawayal, Pilicode, Pattambi, Vellanikkara, Kumarakom and Vellayani in Kerala for the period 1983 to 2018 were used to study the extreme weather events like high rainfall events, agricultural droughts and meteorological droughts. Pilicode represents northern zone, Ambalawayal comes under high range zone, Pattambi and Vellanikkara represents central zone and Kumarakom and Vellayani represents southern zone. Agricultural drought, meteorological drought and high rainfall events were assessed using Weathercock v 3.1, a software developed at Central Research Institute for Dry Land Agriculture (CRIDA), Hyderabad (Saikia *et al.,* 2017) was used to analyze climatic data for characterizing crop growing environments. Average rainfall of Kerala per day in all the years from 1983-2018 seldom exceeds 50 mm, so, rainfall above 50 mm per day was taken as high rainfall event. Agricultural drought and heavy rainfall events occurred were calculated from available rainfall data for all six stations. According to India Meteorological Department, meteorological droughts have been categorized two types based on rainfall deficit from normal value. Moderate drought means 26-50% deficit rainfall from normal rainfall. Severe drought occurs when rainfall deficit is 50% from normal value. Agricultural drought are two types, *kharif* drought means at least four consecutive weeks receiving less than half of the normal rainfall during *kharif* season and *rabi* drought means six consecutive weeks during *rabi* season receives less than half of the normal rainfall.

Meteorological drought occurs when there is a prolonged time with less than average rainfall. Meteorological drought was not experienced in Pilicode station. Total annual kharif and rabi drought weeks and total number of high rainfall events during kharif and rabi season is given in Table 1. Agricultural drought for rabi season were experienced fewer in Vellanikkara station and more in Kumarakom. Kharif season's droughts were experienced more in Vellayani and Kumarakom, under southern zone compared to other stations. Total number of high rainfall events during kharif season was more in Pilicode (628), which comes under northern zone, whereas, less in Vellayani (74) which comes under southern zone. Total number of high rainfall events during rabi season was more in Vellayani (87), which comes under southern zone, whereas, less in Ambalawayal (25) which comes under high range zone. Highest number of kharif drought weeks were experienced in the year 2012 followed by 2016. Whereas, rabi drought weeks were highest in the year 2016. In almost all the years as the high rainfall events increases, number


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**Table 1:** Total annual kharif and rabi drought weeks and total number of high rainfall events during kharif and rabi season from 1983-2018

| Station | Total number of *kharif* drought weeks | Total number of *rabi* drought weeks | Total number of high rainfall events (>50 mm per day) during *kharif* season | Total number of high rainfall events (>50 mm per day) during *rabi* season |
|---|---|---|---|---|
| Ambalawayal | 46 | 18 | 161 | 25 |
| Vellanikkara | 82 | 6 | 375 | 71 |
| Kumarakom | 109 | 165 | 269 | 65 |
| Pattambi | 69 | 69 | 280 | 38 |
| Pilicode | 45 | 41 | 628 | 53 |
| Vellayani | 118 | 48 | 74 | 87 |

of agricultural drought weeks also decreases. But in some situations, even in high rainfall event, drought weeks were experienced. This may be due to the occurrence of rainfall in short time span. Lee and Dang (2019) evaluated the variability of precipitation in the Mekong Delta of Vietnam using Mann-Kendall test and Sen slope estimate. In Kerala, northern region receives more amount of rainfall as compared to central and southern zone. Numbers of drought weeks experienced were fewer in northern zone compared to southern and central zone. The rainfall distribution in northern zone of Kerala is uni-modal type as the region receives rainfall mainly from south west monsoon and in southern region rainfall received is from both south west monsoon and north east monsoon (bimodal distribution). Even then the drought experienced is more in southern zone of Kerala. This may be due to the geography of Kerala. During south west monsoon season, the moisture laden wind hit the central zone and northern zone mainly compared to southern zone. The rain received from south west monsoon is more and the moisture laden wind is blocked by Western Ghats which results in orographic precipitation. Whereas in case of north east monsoon, the rainfall received will be more in southern zone compared to other regions, but the amount of rainfall received will be less as compared to south west monsoon. This may be the reason for high number of drought weeks in southern zone of Kerala (Vellayani). High rainfall areas have a series of wet and dry spells, rainfall can be harvested in either farm ponds or in village tanks and can be recycled as life saving irrigation during a prolonged dry spell. In southern part of Kerala, where there is more chances of occurrence of drought is there, construction of farm ponds and village tanks will be enhanced and more attention should be given regarding conservation of water compared to other regions. The remaining water can also be used to provide irrigation for a second crop with a lower water requirement. GunneLl (1997) observed that rainfall totals in stations located north of Kerala along the Arabian Sea margin show typical, unimodal monsoon rainfall regimes because monsoon retreat does not provoke a second October peak.

Strategies adopted to mitigate extreme weather events are not universal. All such strategies are location, time, crop, crop stage and to some extent socio-economic condition specific. In northern zone of Kerala, cleaning of canals before commencement of south west monsoon, taking precautionary measures to rescue livestock etc. may be undertaken as there may be high chances for water logging and flooding. Whereas, farming in southern zone of Kerala requires different moisture conservation practices viz., zero tillage, mulching, growing of drought resistant varieties etc. Developing such strategies for each specific location can help to make agriculture sustainable. Such study may help to establish secure water supplies in different parts of Kerala that will be available during drought and to take proper precautionary measures to mitigate the after effects of high rainfall events too.

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