

# High Rainfall Intensity and Its Impact on Rice Crop Production in Batticaloa District in Sri Lanka

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## Abstract

Batticaloa is one of the district which located in the eastern province of Sri Lanka suffers the most due to natural disasters. The primary livelihood of the population in Batticaloa district is rice cultivation. Rainfall variability and the unexpected heavy monsoonal rainfall causes disastrous damage to rice production. Hence, it is failed to give maximum yield. Therefore, this study was carried out to study the economic losses on rice production due to high rainfall intensity in Batticaloa district. It has been notified that the heavy north east monsoonal rain commenced in December 2010 and prevailed till February 2011 which initiated the flooding. Consequently, it enhanced the threatening and affecting densely populated rice cultivated areas and livelihoods. It has been found that Batticaloa district has caused losses in rice production from 267,200 metric tons (2010) to 107,700 metric tons (2011) compared to past and recent years due to high rainfall intensity which recorded as 2602.5 mm in the peak period from December through to February. Further, the indirect losses were on human food security, food prices, employment and farmers income etc. This economic losses had been proved by record of yield reduction in 2011. According to that, High rainfall intensity and flood are concluded that it capable to impact the rice crop production in Batticaloa district. Even though, floods can be emitted by proper environmental management techniques, alteration and maintenance of urban infrastructures and drainage improvement projects, awareness program to communities in order to mitigate the flood effects to rice production in Batticaloa district etc.

*Keywords:* Flood, north-east monsoon, rain fall, rice production..

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## 1. Introduction

Rice cultivation receives the highest attention in the Sri Lankan economy as rice constitutes the staple food of the population which occupies nearly 34% (0.77 ha) of the total cultivated lands in the country (Department of Agriculture, 2010) and it is the predominant crop in terms of land use and dietary importance. Sri Lanka currently produces 2.7 million tons of rough rice annually (Department of Agriculture, 2010). Per capita consumption of rice is 114 kilograms per annum (Annual report, Central Bank of Sri Lanka, 2010). About 1.8 million household are engaged in paddy farming island wide. The total paddy production contributes about 13% share in agricultural Gross Domestic Production in Sri Lanka (Central Bank of Sri Lanka, 2011).

However, there are few major emerging problems in the paddy cultivation in our country. The continuous food production for increasing population is a must. In the meantime we have to face and address the problems occurred by climate change for food security and food self-sufficiency. The increasing cost of production, decrease the productivity in a land and low income generation for farmers and decrease of land availability for agriculture are a few of them. Because of the adverse effects of climate change, extreme weather events or natural disasters are becoming increasingly common (UNDP, 2016). While this affects the country at large, people, farmers and agricultural workers face the worst impacts of this variability. Rainfall is one of the life sources for every human-kind. Importance of rain water for a nation whose economy is basically agricultural immense. Rainfall is a key determinant of the growing seasons and the types of agriculture practiced. Rainfall plays an important role in agriculture as any shortages or excesses of rainfall gives way to a reduction in yields. For instance, rice is the main crop in Sri Lanka and is highly susceptible to rainfall variability (Yoshino, 1984).

Based on above phenomenon, Batticaloa is one of the district in eastern province of Sri Lanka which suffers the most due to natural disasters. At the same time main economy of this district is Agriculture, primarily in the form

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of paddy. There are about 61,321 hectares of paddy land in the district (District Secretariat, Batticaloa, 2015). Due to the annual variation of the seasonal rainfall paddy cultivation failed to give the maximum yield. Rainfall variability causes disastrous damage to rice production in the Batticaloa district. Two monsoons South-West monsoon (May-September), North-East monsoons (December-February) and two inter monsoons (March-April and October-November) prevail in this district (Science Navigators, 2017). Batticaloa district receives its seasonal rainfall during the inter monsoons season of October to November and the North-East monsoon season. It is the cropping season of this district and referred as 'Maha' season. Seasonal dryness prevails during the South-West monsoon season and the cultivation practiced tank irrigation referred as 'Yala' season. Random occurrences of seasonal rainfall play a vital role in determining the success of paddy cultivation. Failure of rain in due season not only affects the Maha season crop, but also severely limits the Yala due to lack of adequate supply of water (Elankumaran C. 2003). Further, excess rainfall while causing flood damage to cultivation. Therefore, in this context, mainly focusing a study of high rainfall intensity and rice crop production relationship. It will explain some useful facts, which will benefit agriculture planning.

High rainfall intensity which results severe flooding. Batticaloa is such a district receiving high rainfall intensity due to north east monsoonal season. Thereby, intensifying the risk to flood occurrence. The worst case of flooding occurred in January second week and in February first week of 2011 in the eastern province, with Batticaloa experienced it's third highest ever level of rainfall in a single day as 312.2 mm (Anon, 2011b). The total rainfall during January till 4<sup>th</sup> February 2011 at Batticaloa was 1777.5mm while 1651mm being the annual total average (WMO/ESCAP, 2011). The increased frequency of flood incidence in the last ten years has caused severe hardship to poor farmers. Therefore, most of the farmers in these flood prone areas lost their existed socio economy vulnerabilities by the way of rice production loss. Hence, this study was conducted to investigate the effect of rainfall intensity on rice production in the major rice producing divisional secretariat divisions in Batticaloa district.

## 2. Methodology

The study was carried out at batticaloa district. The annual rainfall varies from 864 mm to 3081 mm (50 years data) distribution of which has slight variation throughout the district (District Secretariat, Batticaloa, 2015). Most of the rain is being received during the months of October to January and is both inter monsoon and North East Monsoon types. The Temperature ranges from 25° C to 35.4° C. As study area batticaloa district consisted of Manmunai south eruvil pattu, Poraitivu pattu, Manmunai south west, Eravur pattu, Manmunai west, Manmunai pattu, Manmunai north and koralai pattu divisional secretariat divisions.

This study is entirely based on secondary data available from the Department of Meteorology, Planning unit (Kaccheri) batticaloa, Department of Agriculture, Agrarian department (Batticaloa), Department of census and statistics (Agriculture and Environment statistic division), magazines about Sri Lanka's Floods, previous researches, websites from various sources. Then the data were manipulated to express the correlation between rainfall and encounter of rice production affected areas of batticaloa district.

## 3. Results and Discussion

### 3.1 Annual total rainfall

Results appeared in the figure 01 revealed that the annual rainfall from the period of 2009 to 2014 in batticaloa district. According to the 39th session of WMO/ESCAP panel for Tropical cyclones in Bay of Bengal and Arabian Sea, there was no tropical cyclone affecting Sri Lanka in the year 2011. However, the north east monsoon rain was very heavy due to cyclonic activity prevailed in the vicinity of the island triggered. Due to this event, eastern, northern and north central provinces are at a risk of flooding. Hence, the highest rainfall recorded in the year of 2011. In 12 districts of Sri Lanka, the unparalleled monsoon rains that continued flooding most specifically the eastern region in the year 2011. Batticaloa is one of the three districts of the eastern province estimated with heavy rainfall as 3581.3 mm. Rainfall in Sri Lanka has multiple origins. Monsoonal, convectional and expressional rain accounts for a major share of the annual rainfall (Department of meteorology, 2016). The mean annual rainfall may vary from year to year. As a consequence, excess rainfall leads to stagnate the water in water bodies and overflow which results flooding. According to the records severe floods have occurred in the years 1913, 1940, 1957, 1967, 1978, 1989, 1992, 2003, 2007 and 2011 (Disaster Management Centre, 2011).

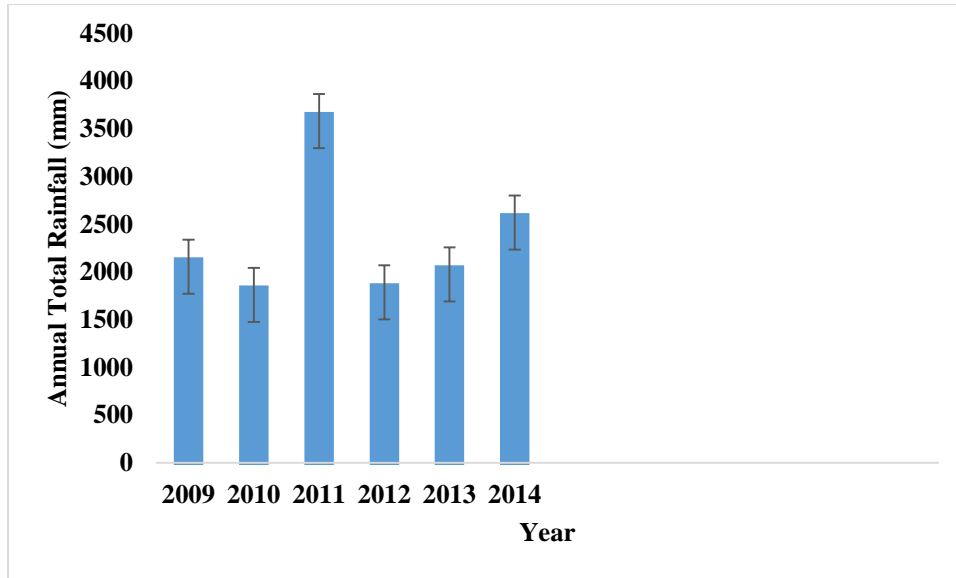


Fig. 1. Annual total rainfall 2009 to 2014

### 3.2 Monthly total rainfall in the year 2010

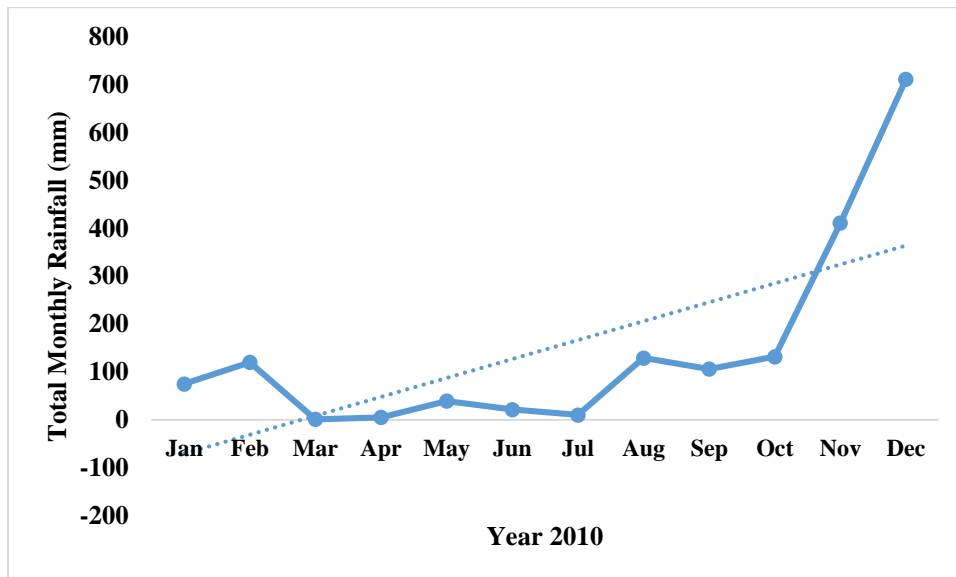


Fig. 2. Monthly total rainfall-2010

As shown in the figure 02, there was an increasing trend in monthly rainfall record throughout the year. At the beginning of the year 2010, less amount of rainfall received from January to November. The heavy rainfall started from end of the year 2010. The highest rainfall recorded in the month of December as 711.4 mm compared to other months. Generally, the two principal monsoon seasons are the Southwest Monsoon (SWM: May through to September) and the Northeast Monsoon (NEM: December through to February). During the north - east monsoon, the eastern half of the island receives from about 200 mm to over 1200 mm of rain (Department of census and statistics, 2015). This reveals that high rainfall intensity which received during the period of December 2010 due to the north east monsoonal rain.

### 3.3 Monthly total rainfall in the year 2011

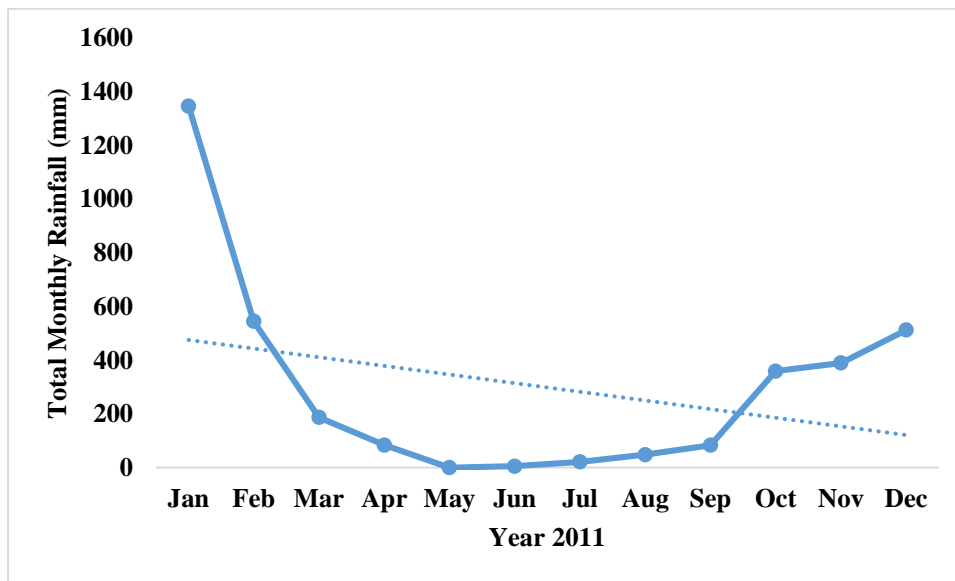


Fig. 3. Monthly total rainfall-2011

The rainy conditions with heavy at times in batticaloa district commenced in December 2010 and prevailed till February 2011. The results (Figure 03) indicated that the higher amount of rainfall received during the months of January and February in the year 2011. They were 1346.5 mm and 544.6 mm in January and February respectively. After the month of February 2011, rainfall intensity has decreased gradually. It ensures that the ending period of north-east monsoonal rain which is December through to February.

### 3.4 Total Paddy Production

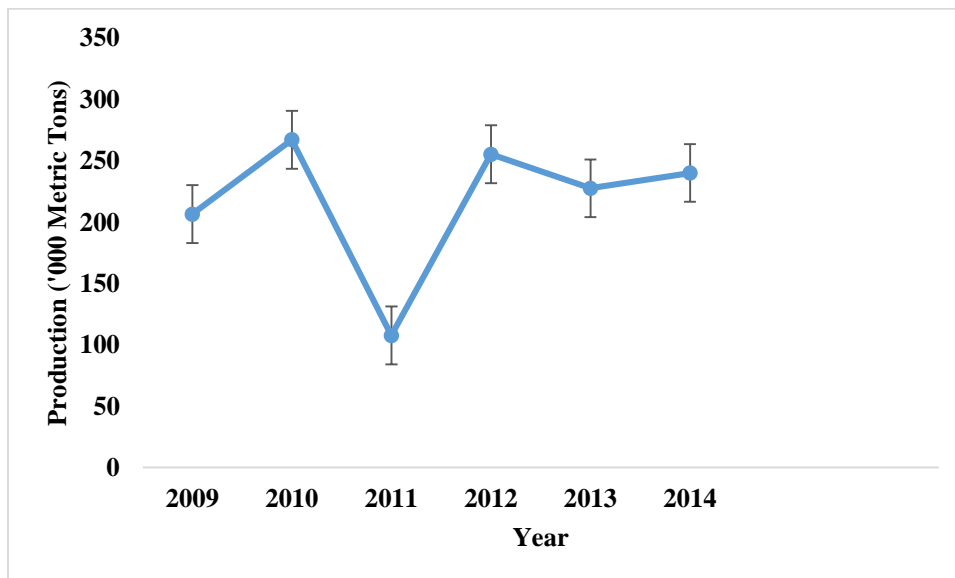


Fig. 4. Total paddy production

Considering the above variation there was no uniformity obtained in total paddy production irrespective of years in Batticaloa district. Paddy production has increased by 60,700 metric tons in 2010 than in 2009. After 2010, it has decreased to 107,700 metric tons. This reduction expressed that due to the worst case of flooding occurred in December 2010, January and February 2011. This occurrence support to aggregate loss of rice production in Batticaloa district. The data illustrated in this figure 04 that flooding significantly affect the rice production. In 2011, reduction of paddy production was notified comparatively lowest than the recent past and present years. Therefore, Sri Lanka floods 2011 was a greatest resource for loss of rice yield and production in Batticaloa district.

Meanwhile, the impact of floods on rice production have the potential to effect indirectly on human food security, food prices, income of farmers, loss of production as an input to some industries, input suppliers and markets, reduce availability of fertilizers for agricultural farmers and increase level of malnutrition due to reduced rice production etc. According to the Department of Agriculture (Batticaloa) 2011 report, 44,179 of paddy farmers are identified as highly affected due to flood 2011.

### 3.5 Damaged paddy extent due to rainfall-2011

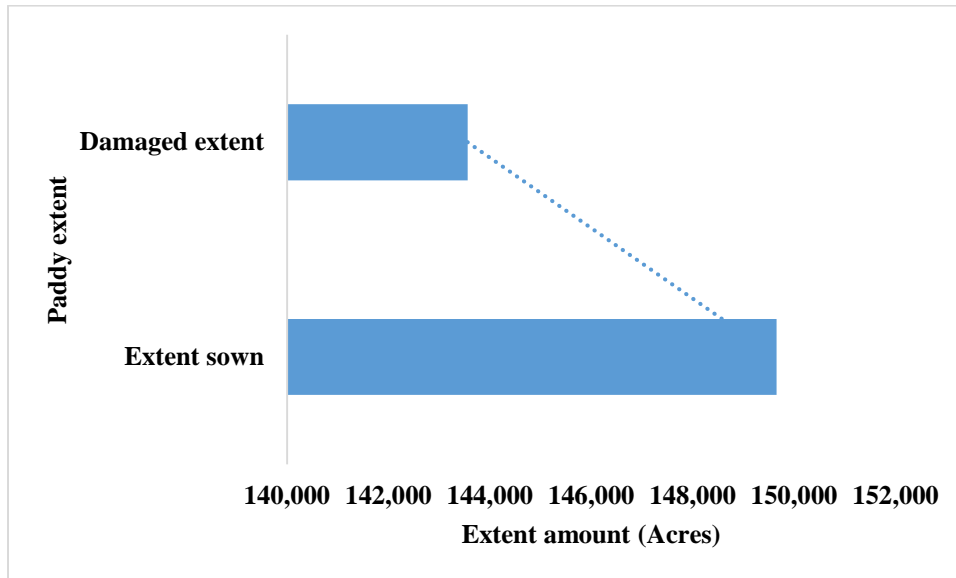


Figure 05: Paddy extent due to rainfall-2011

Damaged paddy extent due to rainfall 2011 are illustrated in figure 05 where the graphical trend line display that reduction in paddy extent compared to paddy sown extent. This crowning feature comply with the north east monsoon period of Sri Lanka, December to February and also 2011 floods worsened by north east monsoon huge rainy days. Here, clearly proven that 2011 Sri Lankan flood was the major reason to evolving the huge loss of paddy extent in Batticaloa district. It was estimated as nearly 95.9%.

### 3.6 Damaged paddy extent due to Maha and Yala season-2011

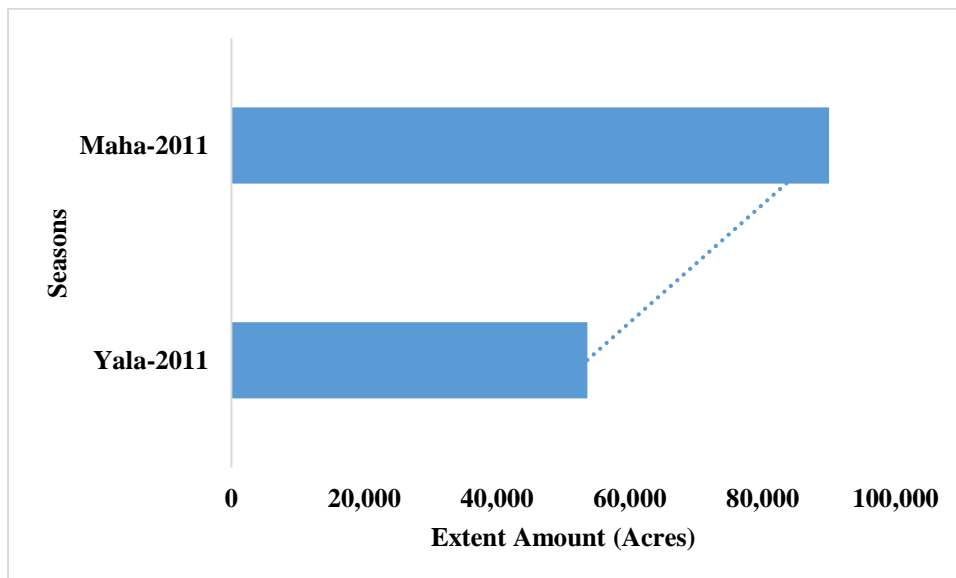


Fig. 6. Damaged paddy extent due to maha and yala season-2011

Loss of paddy lands during the seasons of yala and maha by flood in Batticaloa district in 2011 are explained in figure 06. The huge amount of lands damage occurred in a context of massive heavy rains and flooding and they distress Batticaloa. The most damage is recorded in maha season compared to yala season. This revealed that increase in average rainfall coupled with heavy monsoonal rainfall events during the period of January and February. Therefore, greater loss notified in maha season. The extent of paddy land has decreased and as a result it is offered impact on rice production. This may be due to the worsening of 2011 flood and circumstance of rainy season around eastern province.

#### 4. Conclusions

Batticaloa is one of the important rice producing district in Sri Lanka. It has seasonal variation within a year due to its geography and locality in the latitude of Sri Lanka. Due to the annual variation of the seasonal rainfall paddy cultivation failed to give the maximum yield. Foremost distinctive seasons are inter monsoon and northeast monsoon due to receiving massive rainfall to the eastern province. This seasons present greatest impact on Sri Lankans agriculture sector. Unfortunately, context of enormous rainfalls of these seasons offer negative impacts on rice production. Unexpected heavy rainfall causes floods. Batticaloa is one of the district frequently affected by flooding, recent worsened flood was notified in 2011. It could be stated that, the flood caused by unexpected climate changes had an impact on rice production in Batticaloa district and it was directly and indirectly affected the yield as well as the socio economic status of paddy farmers. According to the results, it has been found that 44,179 of paddy farmers are identified as highly affected due to flood 2011 in Batticaloa district and it has caused losses in rice production by 159,500 metric tons compared to 2010 due to high rainfall intensity which recorded as 2602.5 mm in the peak period from December through to February. The huge amounts of land damage occurred due massive heavy rains and flooding and they distress Batticaloa which distinctly highest during the maha season. Further, proper environmental management techniques, alteration and maintenance of urban infrastructures and drainage improvement projects, awareness program to communities in order to mitigate the flood effects to rice production etc should be developed among the farming communities in Batticaloa district for their betterment.

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