Rainfall Interception by Palm Plant Canopy

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ABSTRACT

Oil palm is a commodity that provides excellent benefits and an abundance of oil-producing crops that were developed in various tropical countries including the one in Indonesia. Interception is considered an important factor in the hydrological cycle due to reduced rainfall that reaches the soil surface by a process of interception is quite large. This study was aimed to analyze the relationship between rainfall and interception, stem flow and through fall in a broad variety of oil palm plantation canopy closure. The study was conducted in February until May 2012 on oil palm plantations are that located in the Mendis village, Bayung Lincir district, Banyuasin regency, South Sumatra Province. This study consists of several stages of the main activity that are measurement of rainfall (Pg), through fall (Tf), and stem flow (Sf). Rainfall was positively correlated with the interception (Ic), through fall and stem flow. There is strong correlation between rainfall interception with through fall and stem flow of the greater rainfall interception is also getting bigger, the smaller Tf and Sf.

Key words : palm oil, interception, through fall, stem flow

INTRODUCTION

Many benefits were obtain from oil palm commodity that gives abundant profit, especially in Indonesia. Oil palm is a plant that requires large amounts of water. Rainfall required optimum plant oil palm on average of 2000 - 2500 mm / year with a uniform distribution throughout the year without the prolonged dry season and there is no water deficit of 250 mm (Fauzi *et al.*, 2002). Darmosarkoro (2001) stated that drought affects the physiological processes of plants, vegetative growth, production, populations of pests and diseases and weeds in oil palm land.

One of the important elements that affect the hydrology of the production is the interception of rain. Part rainwater retained on the surface of leaves and branches called water interception and water containment event is called event interception. The rest of the rain will fall on the soil surface through the flow stems (stem flow) and the outpouring of the canopy (through fall). Rain interception, stem flow and through fall is a component in the hydrologic process that is important in the management of water resources and in the context of climate change (Arnell, 2002).

Interception is considered an important factor in the hydrological cycle due to the reduction of rain water on the ground surface by the interception process is quite large. Precipitation that falls into oil palm land portion will be lost through interception, restrained while to then evaporated back into the atmosphere or absorbed by the oil palm plant itself (Gomez et al., 2000). Leaf area index (Leaf Area Index: LAI) also play a role in affecting rainfall interception. In the oil palm crop LAI values depending on the midrib and leaf area density planting (Noor and Aaron, 2004). The problem of uneven rainfall throughout the year will result in the use of water by plant roots as a condition of growth and development to generate maximum productivity can not be achieved. Study of the hydrologic function of the oil palms especially interception aspect becomes very important to know. For that it is necessary to review and analyze the interception of rainfall on plant oil palm immature (TBM) and mature (TM).

MATERIALS AND METHODS

The research was conducted in February and ending in May 2012 on oil palm plantations located in Bayung lincir District, Musi Banyuasin, South Sumatera Province at coordinates $103^0$45' 00" – $104^0$00'00" BT and $2^0$15'00" – $2^0$30'00" LS.

This research was conducted using a sample of three palm trees in the garden with age classes: 5, 10, 15, and 20 years. The tools used in this study consisted of : *tipping bucket* for the measurement of precipitation, Through fall, stem flow, data logger, battery, gutters, hose, wood, nails, tin plates, iron pole buffer, and ruler.

Preparation

In the early stages of research, field observation activities conducted for the determination of the location and the tree that will be used for research and a graduated assembly tools and collector tipping bucket type and proceed with the calibration tool.

Implementation

Stages of research begins with the placement of all equipment at predetermined locations begins at the location of the oil palm plantation age 5, 10, 20 years, and the last on the location of oil palm trees to the age of 15 years. Installation of equipment to measure the flow of tin trunks using zinc sheets are looped on the subject of palm oil that has been cleared of the remaining base of the frond, arranged with one end of the hose is placed lower for easier water flow, then plugged into a container tipping bucket. The next stages of the pipeline catcher drink water canopy using the gutter made at the midpoint between the three principal oil palm. Gutters with a diameter of 13 cm, is set to 10% slope gutters that spread the sixth direction and the tip of the sixth placed lower chamfer to facilitate water flow, then plugged into a container tipping bucket. Gutter placed 0.6 m above the ground to avoid the splash of water from the soil can potentially get into the gutters.

Measurement and Data Collection

The measurement data is done with the aid interception method *tipping bucket* were automatically recorded by the data logger during the period rainfall event intervals of 10 minutes. To calculate the interception values using the formula :

$$Ic = Pg – SF - TF$$

Notes :

1. Ic : Interception
2. Pg : Precipitation Gross
3. Tf : Throughfall
4. Sf : Stemflow

RESULTS AND DISCUSSION

Through Fall

Through fall positively correlated with precipitation (Pg), each of which is measured on a daily basis for all ages of oil palm trees with a fairly high correlation ($r2 > 0.90$). According Awal *et al.* (2008), occurs a strong correlation between age and LAI on oil palm trees, which at the age of 2 years have LAI range 0.57 to 0.79 and increased the age of 16 years with LAI values from 3.15 to 5.02. Value outpouring relatively larger crown at the age of oil palm trees are still young because the canopy is formed is still relatively rare. Marin (2000) stated that for some individual measurement value exceeds the value of the outpouring of canopy rainfall but the average is always lower than the precipitation.

As well as the outpouring of the canopy, the proportion of stem flow (Sf) of rainfall (Pg) tends to decrease with age up to 20 years of oil palm. However, the very small proportion (<2.5%) compared to through fall (> 58%) and stem flow rate is relatively very small (<2 mm/d) compared to through fall that can reach more than 100 mm/d. Stem flow of relatively small value possibly due to the texture of the bark on the trunks of palm-fiber and has a frond that precipitation will be hampered partly attached to the base of the frond.

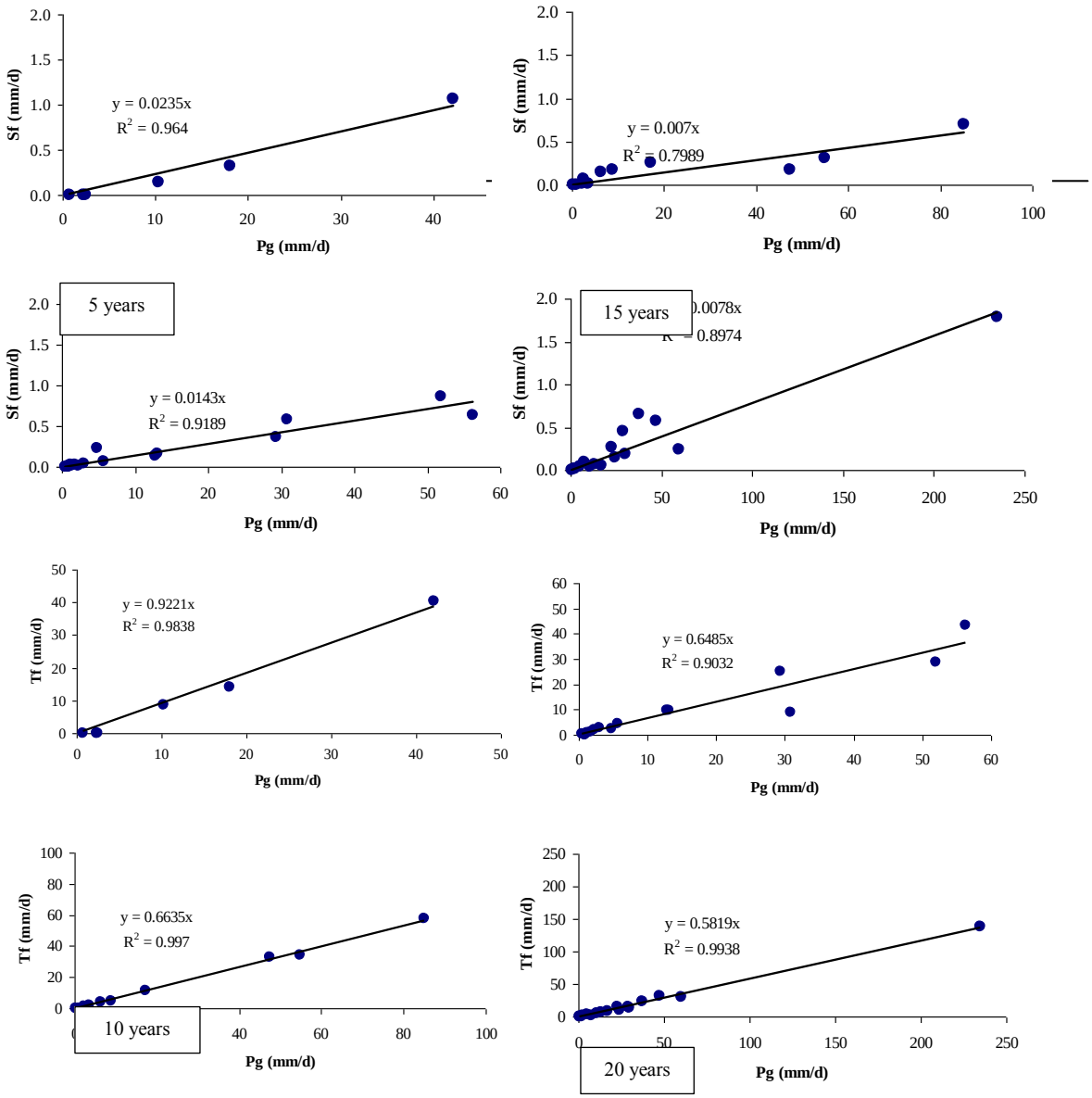

Figure 1. Relationship between rainfall in the upper canopy palm oil (Pg) with Sf.

Interception

The proportion of canopy interception of rainfall above the canopy were calculated from the difference between the amount of rainfall with through fall and stem flow are presented in Table 1. Interception strongly correlated with rainfall above the canopy. Interception increases with an increase in leaf area (LAI). The proportion of rainfall that fell on top of the canopy increases with canopy capacity. This is consistent with the statement of Siregar et al. (2006) which states that the interception capacity varied inversely with rainfall.

Table 1. Proportion through fall stem flow and canopy interception

Age (years)	LAI	Tf/Pg (%)	Sf/Pg (%)	Ic/Pg (%)
5	3,5	92,2	2,4	5,4
10	4,9	66,3	1,4	32,3
15	6,2	64,9	0,7	34,4
20	7,2	58,2	0,8	41,0

Source: Farmanta, 2012

CONCLUSION

Through fall, stem flow and interception positively correlated with rainfall (r 2> 90). The greater the rainfall, the greater the interception as well, as did the older the age of the plant that is characterized by the development of the LAI interception percentage will also increase.

The amount of interception of oil palm trees at the age of 5 years, 10 years, 15 years and 20 years respectively: 5.4%, 32.3%, 34.4% and 41.0% of the rainfall above the canopy.

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