African Journal of Environmental Science and Technology Vol. 4(12), pp. 831-844, December 2010
Available online at http://www.academicjournals.org/AJEST
ISSN 1991-637X ©2010 Academic Journals

Full Length Research Paper

Variation of interception loss with different plant species at the University of Agriculture, Abeokuta, Nigeria

Ufoegbune, G. C.*, Ogunyemi, O., Eruola, A. O. and Awomeso, J. A.

Department of Water Resources Management and Agrometeorology, University of Agriculture, Abeokuta, Nigeria.

Accepted 7 November, 2010

Interception studies of six plants groups were carried out at the campus of University of Agriculture, Abeokuta in Nigeria, using three different sample sites. These sites were the Arborea plantation, cashew plantation and College of Environmental Resources Management premises of the University. The field work was carried out between 15th June and 28th September, 2009. Of the 22 rainfall events recorded for each plant species, at least 13 produced measurable through fall and stem flow and a maximum of 18 measurable records. Through fall showed a very strong linear correlation against daily rainfall for different plant species. The r^2 values varied between 0.841 (Teak) to 0.963 (Gmelina). This trend also followed for stem flow since without rainfall no stem flow. This was not the case for interception loss which showed only a moderate correlation against rainfall amount for each plant species with r^2 value ranging from 0.058 (Teak) to 0.716 (Neem). This implied an inverse relationship between interception rate and rainfall amount. Interception ratio for coniferous plants was more than deciduous plants, both having average values of 32.01 and 26.54% respectively when interception loss was considered per storm or event. But when considered at the end of observation, deciduous plants had more interception ratio than the coniferous plants with average interception values of 26.54 and 32.01% respectively. At the end of the observation, the interception loss for each plant, *Pinus leuceana* sp, cashew, Neem, Gmelina and Teak were 18.77, 21.04, 31.96, 26.16, 11.1 and 38.05% respectively. The values changed when considering average interception loss per storm and the values for the plants species as arranged above were 28.60, 30.18, 31.96, 37.26, 17.78 and 29.89% respectively. This showed that interception loss varied from one plant species to another. With these, one will know which can best be used for conservation purpose.

Key words: Through fall, stem flow, canopy.

INTRODUCTION

Not all precipitation which falls to a watershed reaches the soil surface to become available for plant growth, stem flow, or ground water recharge. The result of this interaction is dependent upon vegetable and precipitation characteristic (Kenneth, 1996).

Further more, several things can happen to precipitation as it falls on a range and watershed. It may impact directly on bare soil, intercepted by the canopy (trees, shrubs, forbs and grass as standing above ground) and may be detained there long enough to evaporate. It may also drip from the canopy, be collected in the canopy and run down the tree, shrub and forbs and grass stems. It may also pass directly through gaps in the canopy and finally, if it reaches the litter layer (mulch covering the soil surfaces) could be detained long enough to evaporate or pass through the litter and reach the soil surfaces. Once precipitation reaches the soil surfaces, the process of interception is complete and the process of infiltration begins (Kenneth, 1996).

Interception process which births the major bone of contention (interception loss) was first admirably described by Horton (1919) as the process by which

*Corresponding author. E-mail: gidufoes2000@yahoo.co.uk.

drops of water falling from precipitation are mostly retained by the leaf surfaces. This can also be defined as the segment of the gross precipitation input which wets and adhere to above ground object until it is retained to the atmosphere for evaporation.

Besides the above, there are certain factors which affect the rate at which precipitation is intercepted but major factors influencing interception are canopy storage capacity and wet canopy evaporation rate (Loustau et al., 1992). Other factors are vegetative factors like type of species, leaf area, seasonal characteristics and leaf surface. At watershed level, arrangement of vegetation across the watershed becomes significant. This is usually affected by canopy density and closure, species mix and the presence or absence of under story.

Also storm type plays role in determining interception loss. For instance a low intensity long duration frontal storm will generate different interception loss than a high intensity, short-duration convectional storm. In general, the precipitation and storm factors which affect interception loss are precipitation amount, storm frequency, and precipitation intensity storm duration, type of precipitation, wind during storm and wind during evaporation (Kenneth, 1996).

Additionally, Ayoade (1988) explained that, interception has three major components which are stem flow, through fall and interception loss. Out of these three components, only interception loss has its own water not getting to the ground before it is being evaporated back to the atmosphere. It is better defined as the part of the falling of the precipitation that is prevented from reaching the ground surface. This means that it does not take part in the land phase of the hydrological cycle. Therefore, it is regarded by hydrologist as a primary water loss like evapotranspiration.

In this research work, one will be able to see how interception loss varies from one plant species to another. For example Kenneth (1996) made an open declaration that there is significant variation between plants species considering their leaf shape. For instance, rain drops can run together forming large drops which fall from leaf as through fall but the needles of conifer do not allow this.

This is an experimental work that helps explain how interception loss varies across different plant species and the extent to which these plant species will affect the water balance of catchments. In Arid and semi arid regions where interception loss is of great significance compared to humid and sub humid region that receives more precipitation. The problem actually on ground is how interception loss variation is affecting water balance of the catchments where interception loss of significance which also affect plant growth and the soil improvement of such areas. This is because the water that should get to the ground surface evaporation back to the atmosphere.

The experimental sites are located in university of Agriculture Abeokuta, Ogun State this is situated in the Southwest part of Nigeria. The annual precipitation according to meteorological station in the school is between 713.8 and 1088.7 mm for records of 2004 and 2008. This is to establish the fact that the area is a derived savannah. Precipitation (rainfall) usually starts in May and ends in November with a break in August. The type of soil dominating the area is red soil but at the site especially cashew plantation and forest nursery are loamy soil with resemble thickness. The area in UNAAB where the sites were located are forest nursery plantation, cashew plantation and COLERM premises.

In this experimental work, certain materials were used to determine the variation of interception loss and these were: Funnels of sizes (147, 102, 133 mm in diameter), Metal gutters, Holes, Nails, Collecting buckets, Rubber, 1.5 L bottles, measuring tape, 250 ml measuring cylinder and ruler.

Moreso, the plants used are: Teak (*Tectoral grandis*), Gmelina (*Gmelina arborea*), Neem (*Azadirachta indica),* Cashew *(Anacardium occidentalis*), *Leuacena luecocephala* and *Pinus* (*Pinus carebeae*). The plants chosen or selected for this research work are of different leaf shape sizes. *Pinus* for example is broom like in shape; Teak has the largest leaf size. The experiment took about four months precisely starting from mid June to October.

The experimental design research design involved the collection of rainfall amount from open field, the collection of through fall different plants species within the experiment and will be measured through the use of measuring cylinder. Also, the width of each plants trunk was measured, their canopy cover and leaf area. Note that, the stem flow measurement was calculated in proportion to open field measurement and the canopy area. The interception loss calculated at the end of the experiment is the least interception loss to be expected from each plant species.

For trunk measurement, the width of the trunk has measured at 3 different points, at the centre the lower part and at the upper end. Then the average was calculated as the width of the trunk.

Calculating the depth of water fall for through fall and gross precipitation

Since automatic gauges were not used, bottles with funnels inserted into them were best used. The diameter of the funnels used was measured. Funnels of equal diameters were used except in cases of missing funnels where another size of funnel in diameter had to be used. In calculation, the depth of rainfall, known volumes of water have measured and recorded. This volume can be calculated mathematically as

$$\text{Vol.} = \Pi r^2 h$$

Where, r = radius of funnel which is half of a diameter; h = depth of rainfall which we are looking for from the formular $r = \Pi r^2 h$

Table 1. Interception rate per event/storm.

Coniferous		Deciduous	
Pinus	28.60	Gmelina	17.78
Leuceana	30.18	Cashew	31.96
Neem	37.26	Teak	29.89
Total	96.04	Total	79.63

Table 2. Summary of observation sites.

Sites	Aboreal plantation			Cashew plantation	Colerm premises	
Vegetation	**Gmelina**	**Neem**	**Teak**	**cashew**	***Leceana* sp**	***Pinus***
Observation period	June 15, 2009 October 28, 2009	June15,2009 October 28, 2009	June15, 2009 October28, 2009	June 15 2009 October 28 2009	June 15, 2009 October 28, 2009	June 15, 2009 October 28, 2009
Cross precipitation cluing observation period (mm)	328.98	328.98	328.98	352.94	346.22	346.22
Number of through fall collectors	10	10	5	7	5	5
Stem flow collectors	1	1	1	1	1	1
Numbers of samples of trees	1	1	1	1	1	1
Area of canopy coverage (mm^2)	43.86	50.07	18.33	76.52		14.68

Making h the subject of the formula,

$$h = \frac{V}{\Pi r^2}$$

Finally, volume which was recorded in ml was converted by multiplying it by 1000 mm to have the depth recorded in mm which is the standard unit rainfall amount. Regression statistics was used to express the relationship between through fall and rainfall amount while logarithmic model regression was used to express the relationship between interception loss rate and amount of rainfall. That is, it is explaining how rainfall amount will affect interception rate and through fall. Finally, analysis of variance was used to know if interception loss/rate varied from one plant specie to another.

RESULT

Out of 23 rainfall events recorded during the study period at least 13 events were recorded for each plant species from which interception loss can be accounted for. The plants used which were mention earlier on were *Pinus* (*P. carebeae*), Neem (*A. indica*), cashew (*A. occidentalis*), Teak (*T. grandis*), Gmelina (*G. arborea*) and leceana sp *(L. leucocephala*).

Table 1 revealed the summary of the observation sites. The sites used were arboreal plantation, cashew plantation and COLERM premises. The table showed the variation of rainfall from one place to another in a given area at a given period of time. These sites are in the same area with not up to 50 km apart and yet there is difference in the amount of rainfall revealed at each site. Although the amount of total rainfall at each site is quite close ranging from 328.98 to 352.84 mm. The area of canopy also varied, with cashew having the largest area (76.52 mm) and this influenced the number of through fall collectors used.

Through fall and stem flow at each site

Not all the rainfall events were recorded and also, not all that were recorded had their through fall values measurable. For example, *Pinus* has only 18 rainfall events recorded which could produce measurable through fall and stem flow. While Neem, cashew, leceana sp, Teak and Gmelina had 17, 16, 20, 18 and 13 rainfall events recorded. This is shown in Table 2 which gives the summary of rainfall events at the end of the observation. This agrees with Zulkifli et al. (2003), who produced 28 measurable events of through fall and stem flow out of 35 rainfall events recorded.

Table 2 shows the summary of rainfall events observation for *Pinus* tree. Out of 23 rainfall events recorded, only 18 events could produce measurable through fall, stem flow and interception loss readings. From Table 2,

Table 3. Summary of rainfall observation of interception loss measurement per storm for *Pinus*.

	Date	Net precipitation	Through fall	Stem flow	Interception loss	Percentage interception rate
1.	15/06	34.6	31.5	0.2031	2.8969	8.37
2.	22/06	17.6	16.02	0.1033	1.4767	8.39
3.	29/06	20.8	22.68	0.1221		
4.	6/07	3.4	2.41	0.0200	0.97	28.53
5.	7/07	7.66	7.21	0.045	0.405	5.29
6.		15.05	16.59	0.0883		
7.	10/07	34.43	34.18	0.2021	0.0479	0.139
8.	11/07	19.58	15.65	0.1149	3.8151	19.48
9.	13/07	4.05	3.25	0.0238	0.7762	19.17
10.	14/07	3.00	0.89	0.0176	2.0924	69.75
11.	16/07	7.64	7.42	0.0448	0.1752	2.29
12.	17/07	14.57	9.26	0.0855	5.2245	35.86
13.	18/07	2.75	1.36	0.0161	1.3739	49.96
14.	21/07	1.38	0.76	0.0081	0.6119	44.34
15.	10/08	4.94	0.976	0.0290	3.935	76.66
16.	17/08	10.63	6.21	0.0624	4.3576	40.99
17.	25/08	12.65	8.13	0.0743	4.4457	35.14
18.	15/09					
19.	14/09	29.02	22.92	0.0170	6.08	20.96
20.	18/09	10.28	6.68	0.0606	3.5394	34.43
21.	23/09					
22.	25/09	29.93	25.24	0.1757	4.5143	15.08
23.	28/09					

it would be noticed that whenever rainfall amount is high through fall readings for each storm tends to be low and vice versa.

Finally, one major factor that leads to the non-measurable events is rainfall duration. The longer the duration of rainfall the more reduced interception rate will be. This is supported by Toba and Ohta (2007) who explained that interception varied inversely with the duration of rainfall events. Longer rainfall events had smaller interception rates. When rainfall was short and light, interception rates were widely dispersed.

Table 3, represents the summary of rainfall observation for *Leuceana* spp. Only 20 events were recorded out of 23 rainfall events. The table showed how rainfall and through fall and stem flow affects interception loss. The higher the rainfall amount, the higher the through fall and stem flow.

Table 4 explained the summary of rainfall observation and out of 23 rainfall events only 18 events were measurable. The table also reveals the trends explained in *Pinus* and *Leucana* spp.

Also, from the table, there is a stricking rainfall event, which revealed the spatial distribution of rainfall. It showed that, rainfall normally varies from one place to another in a given area at a particular time. This can be seen in the record for day 9/07 where there is no record for Neem, Teak and Gmelina site (that is, Aboreal site) but there were rainfall records for the remaining two sites. At cashew plantation gross precipitation was 15.05 mm while for the other it was 15.05 mm while the last site did not have any record. Table 5 reveals that cashew had only 16 events that were measurable recorded for it. It also has the same trends with others explained as earlier on. A different characteristic revealed in it is the issue of leaf area. The highest interception rate in cashew was 51.03 while in *Pinus* for example has highest interception rate of 76.66%. This reveals the effect of leaf area on interception loss per event. Although, cashew had more canopy cover, it could still not intercept as much as those with less canopy.

Table 6, showed that only 13 measurable events were recorded for Gmelina. It had high values of through fall compared to the gross precipitation received at its site. Although it had broad leaf area and large canopy area, but the tree canopy was not dense. For Gmelina had the lowest interception rate compared to other plants but very high through fall rate as stated earlier on.

Similarly, Table 7 also expressed the summary of rainfall events observed for Teak. Teak did not have canopy area as large as Gmelina but had the largest leaf area compared to all other plants used. Its physical feature did not make it intercept more rainfall than other plant species rather it had high through fall values but not as high as Gmelina. Moreover, 18 measurable rainfall

Table 4. Summary of rainfall observation of interception loss measurement per storm for *Leuceana* Spp

	Date	Net precipitation	Through fall	Stem flow	Interception loss	Percentage interception rate
1.	15/06	34.6	-	0.8131		
2.	22/06	17.6	19.9	0.4136		
3.	29/06	20.8	19.50	0.4888	0.8112	3.9
4.	6/07	3.4	1.86	0.0799	1.4601	42.94
5.	7/07	7.66	12.54	0.1800		
6.	7/07	15.05	5.94	0.3537	8.7563	58.18
7.	10/07	34.43	28.54	0.8091	5.0809	14.76
8.	11/07	19.58	15.93	0.4601	3.1899	16.29
9.	13/07	4.05	3.05	0.0951	0.9049	22.34
10.	14/07	3.00	1.62	0.0705	2.7675	92.25
11.	15/07	7.64	5.91	0.1795	1.5505	20.29
12.	17/07	14.57	11.34	0.3424	2.8876	19.82
13.	18/07	2.75	1.06	0.0646	1.6254	59.11
14.	21/07	1.38	0.83	0.2973	0.2527	18.31
15.	10/08	4.94	0.989	0.1161	3.8349	77.63
16.	17/08	10.63	7.28	0.2498	3.1002	29.16
17.	25/08	12.65	11.02	0.2973	1.3327	10.54
18.	5/09	10.53	9.28	0.2475	1.0025	9.5
19.	14/09	29.02	26.12	0.6820	2.218	7.64
20.	18/09	10.28	8.49	0.2416	1.5484	15.06
21.	23/09	7.19	3.91	0.1690	3.111	43.27
22.	25/09	29.93	23.16	0.7034	6.0666	20.27
23.	28/09	44.54	33.58	1.047	9.913	22.26

Table 5. Summary of rainfall observation of interception loss measurement per storm for Neem.

	Date	Net precipitation	Through fall	Stem flow	Interception loss	Percentage interception rate
1.	15/06	34.6	25.9	0.6505	8.0495	23.26
2.	22/06	17.6	19.98	0.3309		
3.	29/06	18.4	19.80	0.3459		
4.	6/07	1.21	0.31	0.0227	0.9227	76.26
5.	7/07	11.25	10.81	0.2115	0.2285	2.03
6.		-	-	-	-	
7.	10/07	31.14	29.95	0.5854	0.6046	1.94
8.	11/07	22.76	19.37	0.4279	2.9621	13.01
9.	13/07	3.51	2.34	0.0660	1.104	31.45
10.	14/07	5.15	2.55	0.0968	2.5032	48.60
11.	15/07	8.00	6.19	0.1504	1.6596	20.75
12.	17/07	14.76	13.80	0.2775	0.6825	4.62
13.	18/07	1.69	0.33	0.0318	1.3282	78.59
14.			-	0.0310		98.12
15.	10/08	2.51	0.29	0.0472	2.1728	86.57
16.	17/08	5.55	1.91	0.1043	3.5357	63.70
17.	25/08	11.45	16.31	0.3281	0.8119	4.65
18.	5/09	11.72	10.79	0.2203	0.7097	6.06
19.	14/09	29.56	26.43	0.5557	2.5743	8.71
20.	18/09	8.65	2.85	0.1626	5.6374	65.17
21.	23/09	10.62	10.63	0.1997		
22.	25/09	29.61	29.78	0.5567		
23.	28/09	41.59	42.23	0.7819		

Table 6. Summary of rainfall observation of interception loss measurement per storm for cashew.

	Date	Net precipitation	Through fall	Stem flow	Interception loss	Percentage Interception loss
1.	15/06	34.6	29.75	0.4567	4.3933	12.70
2.	22/06	17.6	19.58	0.2323		
3.	29/06	20.8	19.40	0.2746	1.6746	8.05
4.	6/07	3.4	1.62	0.0449	1.7351	51.03
5.	7/07	7.66	8.08	0.1011		
6.		15.05	24.78	0.1987		
7.	10/07	34.43	39.95	0.4545		
8.	11/07	19.58	30.56	0.2585		
9.	13/07	3.26	2.31	0.0430	0.907	27.82
10.	14/07	3.75	3.09	0.0495	0.6105	16.28
11.	15/07	5.63	4.14	0.1008	1.3892	24.67
12.	17/07	15.25	14.68	0.1923	0.3777	2.48
13.	18/07	3.3	1.11	0.0363	1.1537	34.96
14.	21/07	0.85	0.51	0.0182	0.3218	37.86
15.	10/08	3.55	1.77	0.0652	1.7148	48.30
16.	17/08	10.63	8.65	0.1403	1.8397	17.31
17.	25/08	17.62	10.58	0.1670	6.873	39.01
18.	5/09	11.13	10.39	0.1390	0.601	5.40
19.	14/09	31.00	21.15	0.3831	9.4669	30.54
20.	18/09	8.93	5.96	0.1357	2.8343	31.74
21.						
22.	25/09	28.76	23.49	0.3951	4.8749	16.95
23.	28/09	44.66	48.73	0.5879		

Table 7. Summary of rainfall observation of interception loss measurement per storm for Gmelina.

	Date	Net precipitation	Through fall	Stem flow	Interception loss	Percentage interception rate
1.	15/06	34.6	24.18	0.7716	9.6484	27.89
2.	22/06	17.6	17.26	0.3925		
3.	29/06	18.4	18.20	0.4103		
4.	6/07	1.21	1.09	0.0270	0.013	7.69
5.	7/07	11.25	10.76	0.2509	0.2391	2.125
6.		-	-	-		
7.	10/07	31.14	31.41	0.6944		
8.	11/07	22.76	23.04	0.5075		
9.	13/07	3.51	3.05	0.0783	0.3817	10.87
10.	14/07	5.15	4.67	0.1148	0.3652	7.09
11.	15/07	8.00	7.76	0.1784	0.0616	0.77
12.	17/07	14.76	14.81	0.3291		
13.	18/07	1.69	1.85	0.0377		
14.	21/07	1.65	0.53	0.0368	1.0832	65.65
15.	10/08	2.51	2.44	0.056	0.014	0.56
16.	17/08	5.5	5.04	0.1238	0.3862	6.96
17.	25/08	17.45	17.63	0.3891		
18.	5/09	11.72	11.69	0.2614		
19.	14/09	29.56	31.52	0.6592		
20.	18/09	8.5	7.95	0.1929	0.5071	5.86
21.	23/09	10.62	9.89	0.2368	0.4932	4.64
22.	25/09	29.61	26.85	0.6603	2.0997	7.091
23.	28/09	41.59	38.11	0.9276	2.5524	6.1371

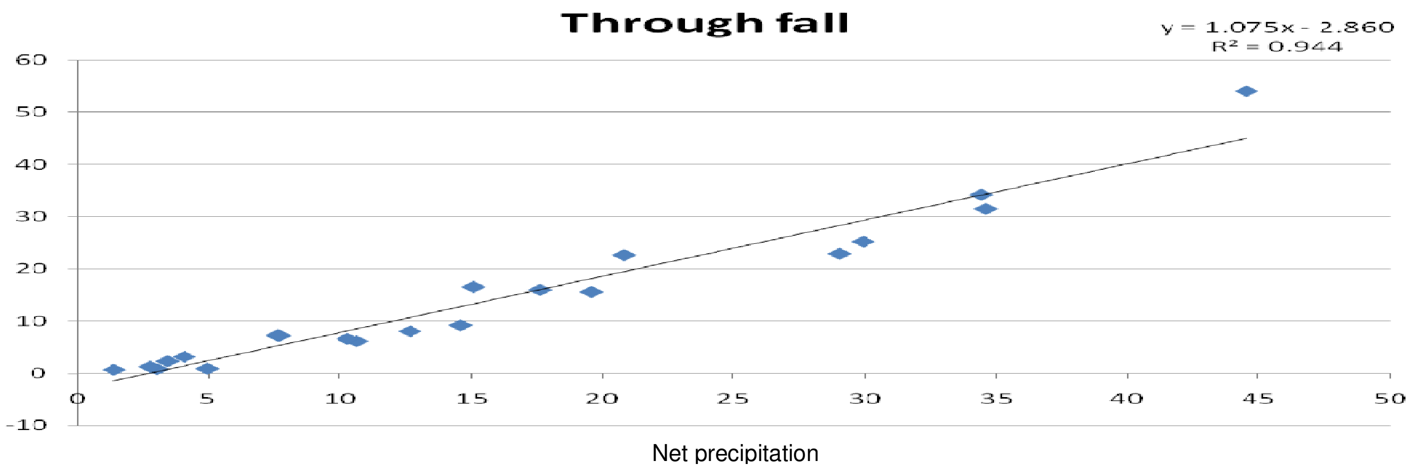

Figure 1. Regression of throughfall against rainfall (*Pinus*).

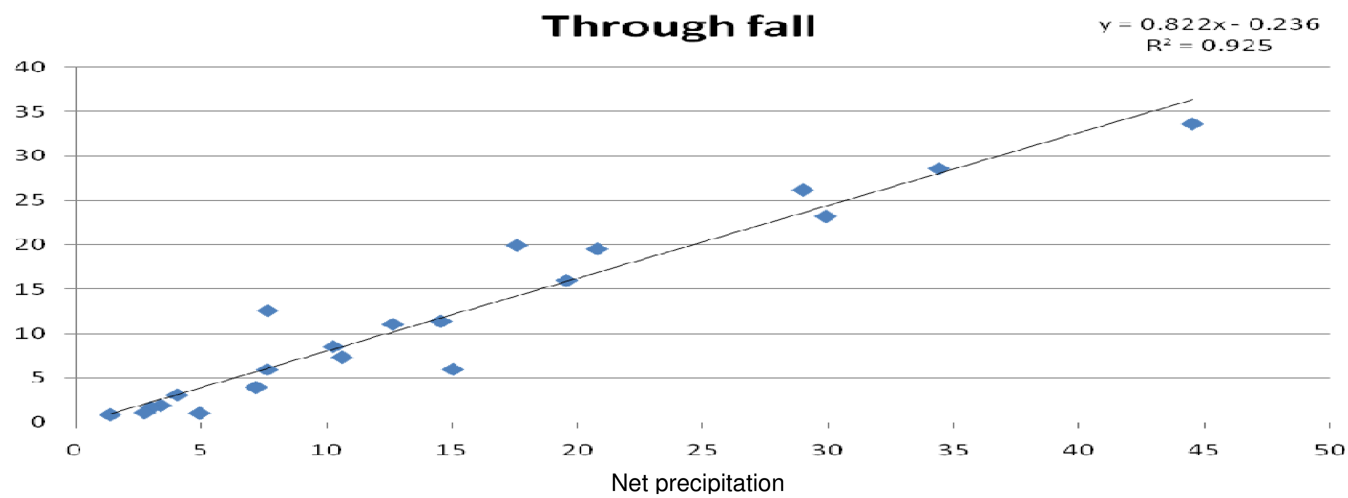

Figure 2. Regression of throughfall against rainfall (*Leuceana* spp).

events were recorded or used to evaluate the effect the plant on rainfall amount. Generally, for all the plant species, stem flow values are generally low and as rainfall amount is increasing, stem flow and through fall will also increases. Without rainfall neither of them will occur.

Regression of through fall against rainfall

Furthermore, Figures 1, 2, 3, 4, 5 and 6 shows the linear regression graph for each plant species. This graph reveals how through fall is strongly correlated against rainfall. The results also suggest that through fall can be comfortably predicted from rainfall data using the following equations for each plant. The above with the graphical representation for each plant species agrees with Zulkifli et al. (2003) and Toba and Ohta (2007).

Regression of interception loss against rainfall

Figures 7, 8, 9, 10, 11 and 12 showed the result of interception loss against rainfall. It showed direct or obvious relationship between interception rate and rainfall amount. There is only moderate correlation of interception loss with rainfall amount using the equation below for each plant species.

Teak

Figures 7, 8, 9, 10, 11 and 12 showed the obvious inverse relationship between interception rate and rainfall

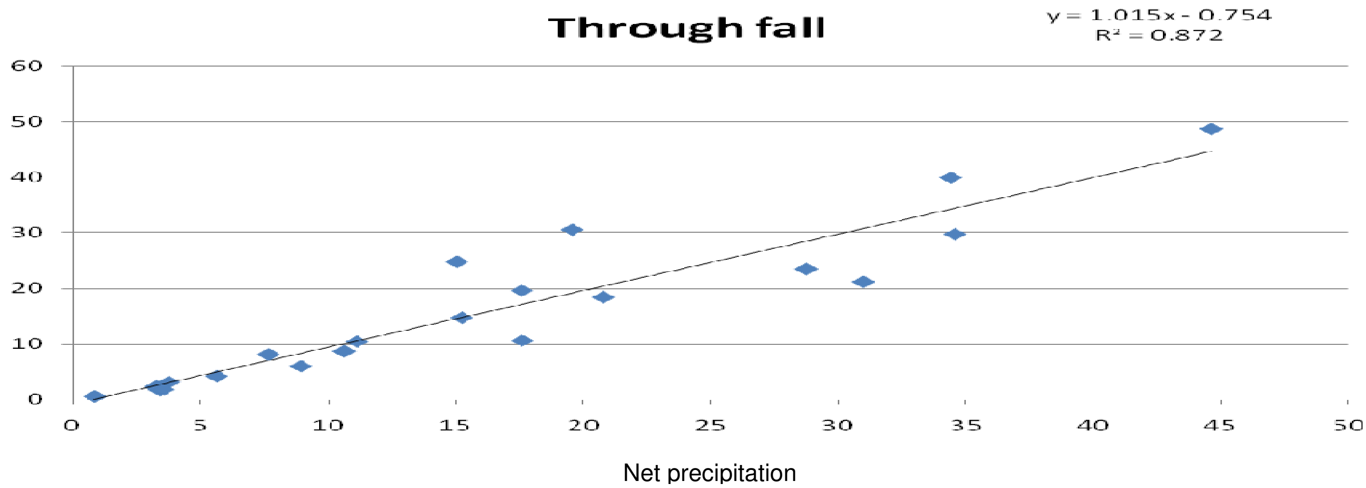

Figure 3. Regression of throughfall against rainfall (Cashew).

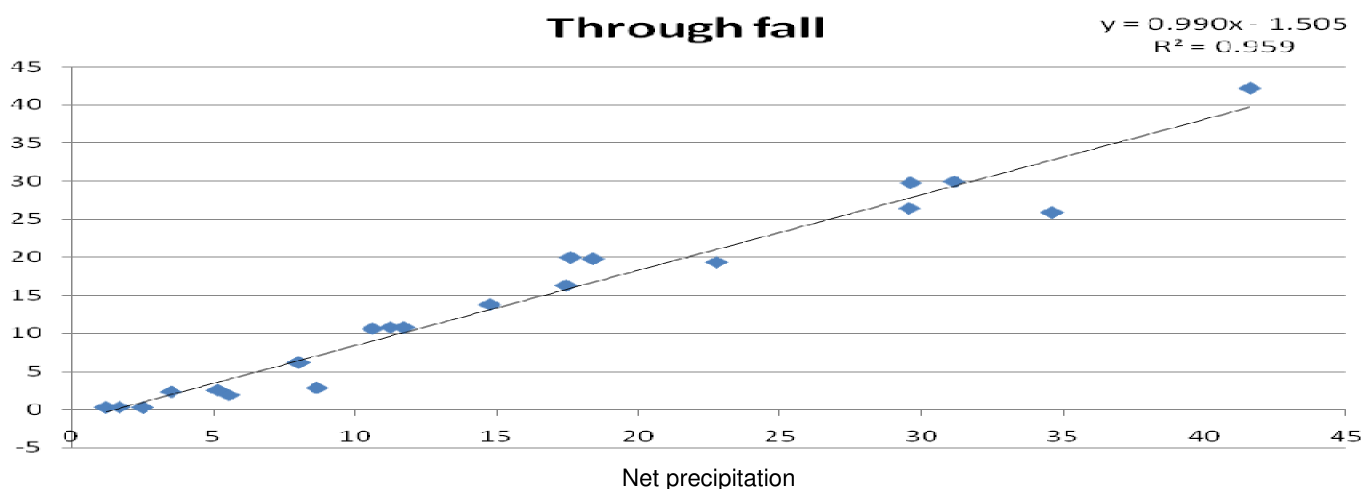

Figure 4. Regression of throughfall against rainfall (Neem).

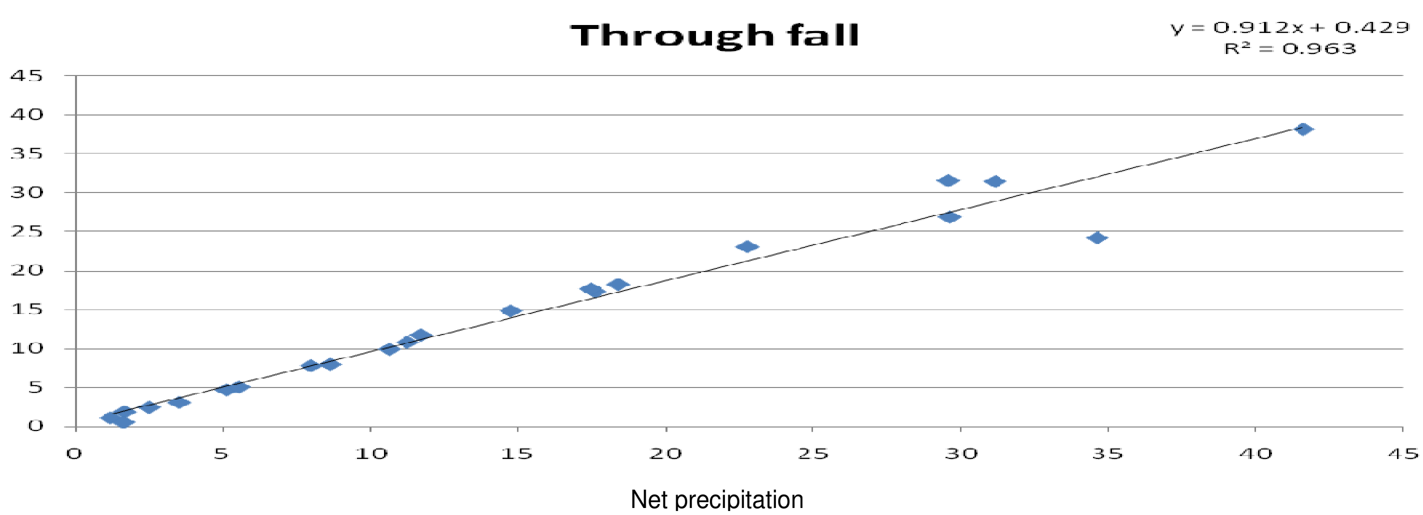

Figure 5. Regression of throughfall against rainfall (Gmelina)

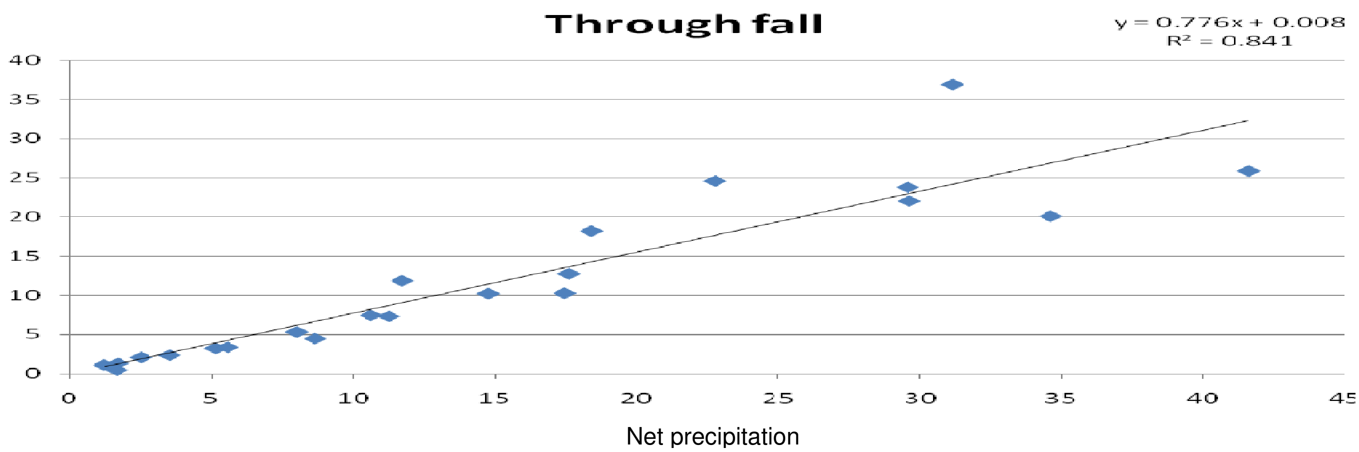

Figure 6. Regression of throughfall against rainfall (Teak).

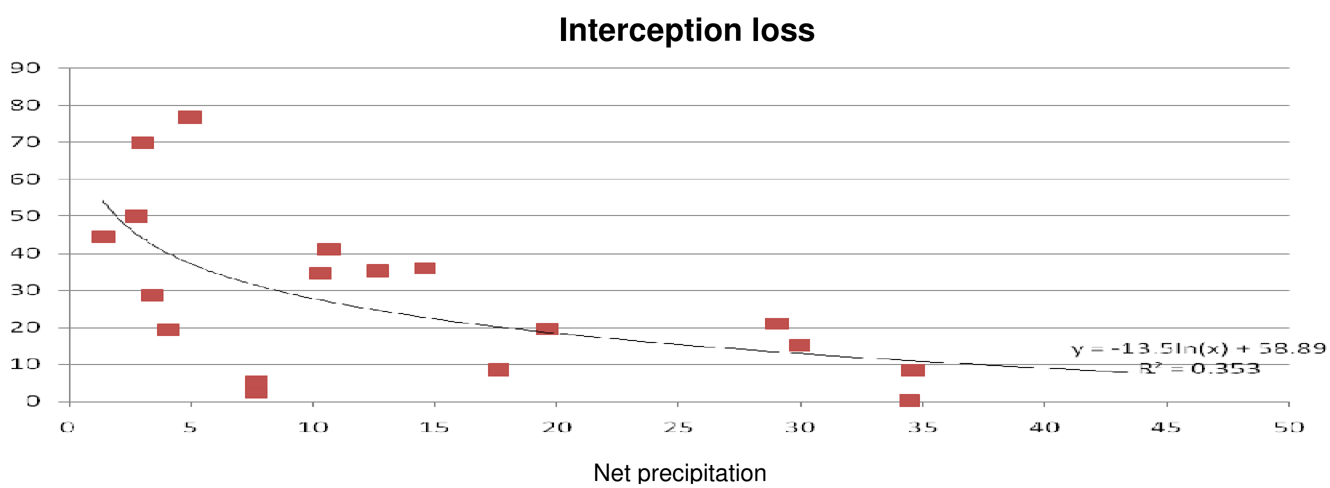

Figure 7. Regression of interception loss against rainfall (*Pinus*).

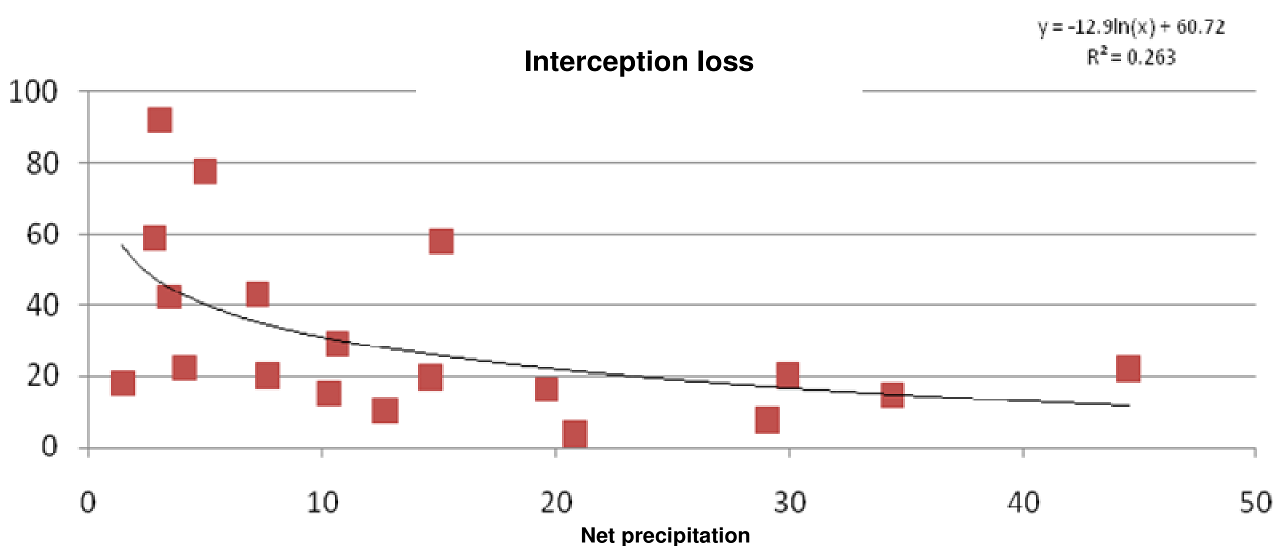

Figure 8. Regression of interception loss against rainfall (*Leuceana*).

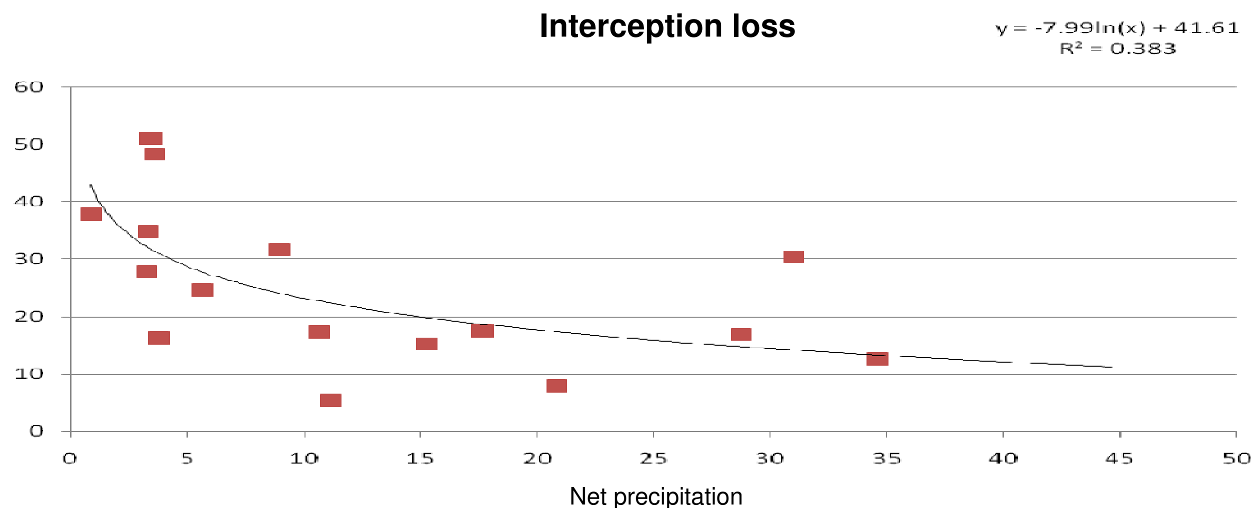

Figure 9. Regression of interception loss against rainfall (Cashew).

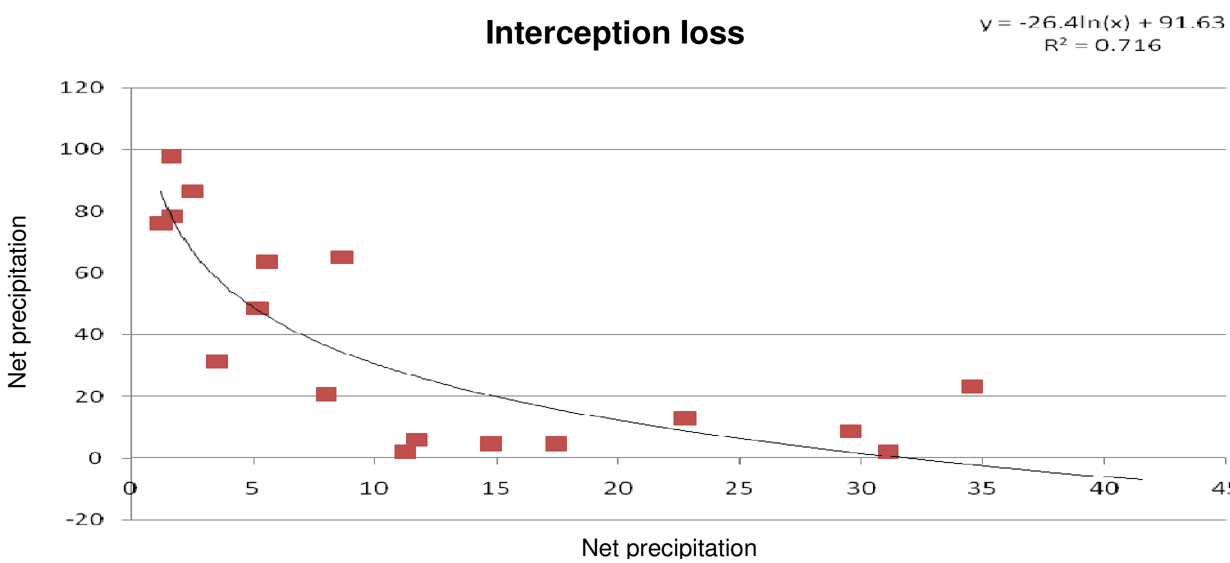

Figure 10. Regression of interception loss against rainfall (Neem).

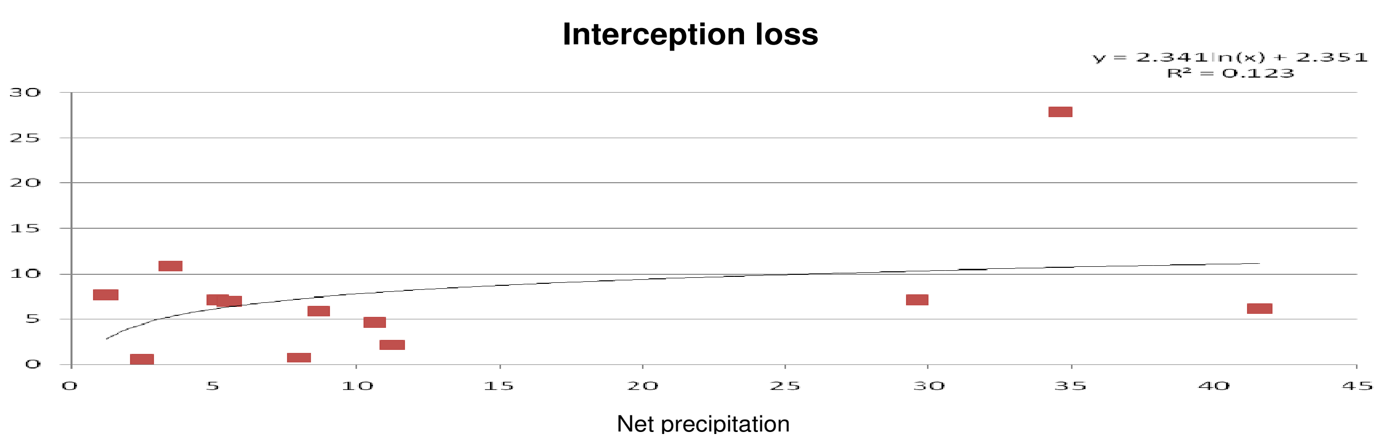

Figure 11. Regression of interception loss against rainfall (Gmelina).

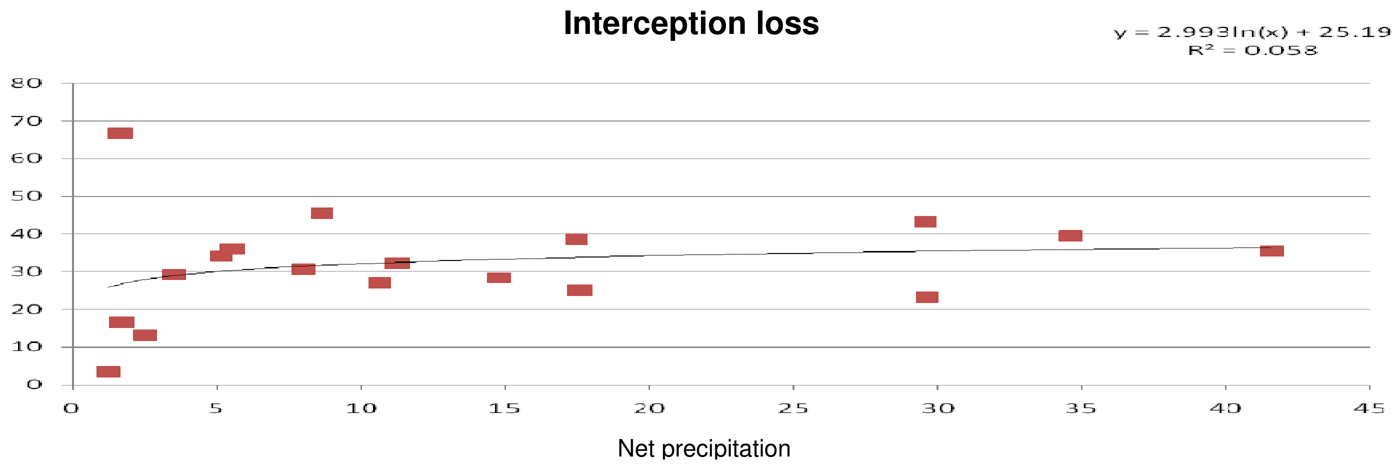

Figure 12. Regression of interception loss against rainfall (Teak).

amount and there is only moderate correlation of interception loss with rainfall amount.

The variation of interception rate with different plant species

Table 9 revealed how interception rate varies with difference plant types (deciduous and coniferous plants) at the end of observation and by viewing interception rate of each plant per storm or event. The interception rate at this point was calculated by adding all the measurable rainfall and subtracting the sum of all measurable through fall and stem flow. One can deduce the effect of leaf area on interception rate. Those with largest surface area in each group (Teak and Neem) intercepted more rainfall at a rate of 38.05 and 26.16% respectively. At the end of observation period, it was observed that deciduous plants tend to intercept more rainfall than coniferous plants as shown in Figure 13.

Table 1 showed the interception rate per storm, that is, at the end of each or daily rainfall events. From this table coniferous plant still revealed the same explanation as that for Table 9 but it was not so for deciduous plants. This may be as a result of the fact that cashew has more dense canopy. At this point, one was able to see or sense vividly the effect of plant canopy on interception rate. For a dense plant canopy tends to intercept more rainfall than a non dense one.

Moreover, for each daily rainfall events coniferous plants intercepted more rainfall than deciduous plants. Per events, deciduous plants had a total interception rate of 79.63% and coniferous plants had 96.04%. The reason for this was explained by Ayoade (1988) who said the nature of the leaves of conifers are very much numerous but small and such leaves will not only hinder the flow of raindops but represent many cavities in which water can be trapped. At the end of observation period, it was revealed that the conifers intercepted more rainfall than the decidious plants, as shown in Table 9.

Generally, a close attention must be given to interception rate per each or storm. This is because it will give one how much of rainfall each plant type or species will intercept for a given amount of rainfall. That is, how much of rainfall each plant will prevent from getting to the earth surface before going back to the atmosphere.

DISCUSSION

Through fall, stem flow and characteristics with rainfall amount

The results showed that as rainfall amount increases, through fall and stem flow also increases. This meant a linear relationship and trend was the same throughout each plant species. One will see this trend when comparing a day of heavy rainfall on a day of low rainfall amount. The above agrees with the findings of Zulkifli et al. (2003) who explained that for through fall and stem flow on occur, an amount of it is needed.

Interception rate characteristics

Interception rate varies inversely with gross rainfall amount. As rainfall amount increases, interception rate reduces or decreases in each plant species. This is best explained when the interception rate for each event is studied. For example, the rainfall event of 14/07/09 which has gross rainfall amount recorded as 5 mm had interception rate of 69.75% and comparing this with another event on 10/07/09 which had grass rainfall amount of 34.43 having interception rate of 0.139. Toba and Ohta (2007) also agreed with this, explaining that interception rate varied inversely with the duration of

Table 8. Summary of rainfall observation of interception loss measurement per storm for teak.

	Date	Net precipitation	Through fall	Stem flow	Interception loss	Percentage Interception rate
1.	15/06	34.6	20.1	0.8304	13.6676	39.51
2.	22/06	17.6	12.77	0.4224	4.4076	25.04
3.	29/06	18.4	18.20	0.4416		
4.	6/07	1.21	1.14	0.0290	0.041	3.39
5.	7/07	11.25	7.35	0.27	3.63	32.27
6.			-	-		
7.	10/07	31.14	36.85	0.7474		
8.	11/07	22.76	24.57	0.5462		
9.	13/07	3.51	2.4	0.0842	1.0258	29.23
10.	14/07	5.15	3.27	0.1236	1.7564	34.10
11.	15/07	8.00	5.35	0.192	2.458	30.73
12.	17/07	14.76	10.23	0.3542	4.1758	28.29
13.	18/07	1.69	1.37	0.04056	0.2794	16.53
14.	21/07	1.65	0.51	0.0396	1.1004	66.69
15.	10/08	2.51	2.12	0.0602	0.3298	13.14
16.	17/08	5.55	3.42	0.1332	1.9968	35.97
17.	25/08	17.45	10.29	0.4188	6.7412	38.63
18.	5/09	11.72	11.88	0.2813	-	
19.	14/09	29.56	23.78	0.7074	5.0726	43.28
20.	18/09	8.65	4.52	0.2076	3.9224	45.35
21.	23/09	10.62	7.49	0.2549	2.8751	27.07
22.	25/09	29.61	22.03	0.7106	6.8694	23.20
23.	28/09	41.59	25.85	0.9982	14.7418	35.44

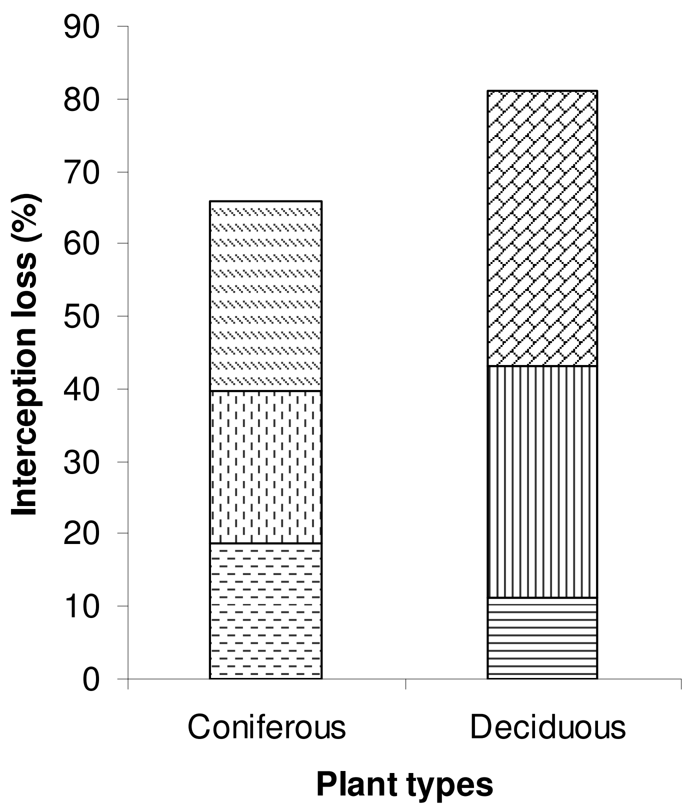

Figure 13. Chart showing interception at the end of observation.

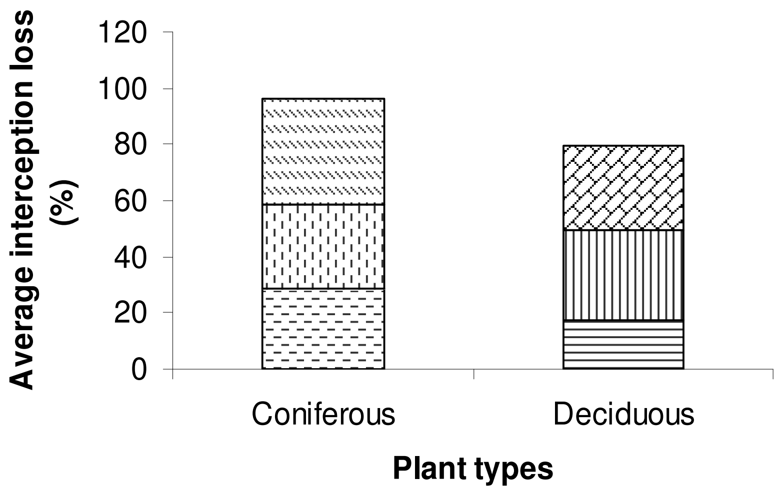

Figure 14. Interception rate per storm event at the end of the observation period.

rainfall events. That is, interception rate for each rainfall event decreases with the amount of increasing gross rainfall.

Characteristics of Interception rate with plant types

There are two major types of trees and these are coniferous tree and deciduous trees. According to this experimental work, the average interception rate prevent, is higher in coniferous trees than in deciduous trees. The reverse is the case when observing from the point of total interception loss at the end of observation.

The impact of each plant on interception can be best examined after each storm event. Therefore, boarding this down to leave shape effect on precipitation (rainfall), the tree type with the largest leaf surface area intercepts more of rainfall than others. This means that interception rate is also affected by the surface area of plant leaf. This is also discussed by Rakhmanov (1966) who explained that confers intercepts more rainfall than deciduous trees. What makes this two plant types different, is the surface area of their leaves.

Finally, at the end of event, for deciduous plants, had other least interception rate while for coniferous plants, *Pinus* had the least interception rate. Note that, for interception loss per event, cashew had the highest interception rate rather than teak and this reflects the effect of canopy cover in interception loss. Cashew had more cover than teak. But teak still showed a larger amount at the end of the observation while Neem had the largest amount for both per event and at the end of the whole observation. Discrepancy is explained by the nature of the leaves of conifers which are very numerous but small. Such leaves will not only hinder the flow of raindrops but present many cavities in which water can be trapped (Ayoade, 1988).

Implication of study

Wayne et al. (1972) explained that, it is reasonable to expect stream flow or groundwater supplies to be reduced in areas where the cover type conversion is from oak-history to loblolly pine. Interception differences alone might well account for an average reduction of 4 area inches (109 million of gallons) of water.

Also, in a bid to control siltation or soil erosion into river channels or dams it is necessary to study individual plant species selected to be used. Imagine Teak having average interception loss of 19.89% or Neem (37.26%) per storm event to be used for this purpose. It means in an area of land of 1,000 acre, the depth of water that will be lost back on the atmosphere will be million of gallons lost to the atmosphere per storm. This will surely affect ground water and discharge into the Dams. Moreover, in using trees to control soil erosion in semi Arid region where Dew is one of the sources of precipitation, one must choose carefully. Teak is out of it, but Gmelina will be the best to be used according to the results of this project.

Generally, no matter the type of plant to be used in controlling either siltation or land reclamation in semi and region, the impact of each plant on precipitation must be closely checked to prevent negative effect on stream flow or ground water supply (especially in semi Arid region).

REFERENCES

Kenneth WT (1996). Agronomy and range science. University of California, Davis, CA 95616- 8515.

Horton RE (1919). Rainfall interception, monthly weather review, 47: 603-623.

Loustau D, Berbigier P, Granier A (1992). Interception loss, through fall and stem flow in a maritime pine stand, II. An application of cash's analytical; model of interception. J. Hdrol., 138:469-485.
Ayoade JO (1988). Tropical hydrology and water resources. 125-138.
Zulkifli Y, Cham SY, Chang H (2003). Through fall, stem flow and interception loss of old rubber trees. J. Kejuruteraan Awam, 15(1):24-33.
Toba T, Ohta T (2007). An observational study of the factors that influence interception loss in bored and temperate forest.
Rackmanov VV (1966). Role of forests in water conservation, Moscow.
Wayne TS, Norbert BG, Junior OH (1972). Interception loss in lobilolly pine stands of the south Carolina, piedmont. J. Soil Water Conserv., 27:160-164.