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The Potential of Sagu Baruk Palm (*Arenga microcarpha*) as Conservation Plant

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ABSTRACT

Sagu Baruk palms (*Arenga microcarpha*) was an endemic plant which producing carbohydrates that used as primary food from generation to generation of Sangihe distric island people. Sagu Baruk palm was also locally known as a very useful plant to protect soil and water availability surrounding plants. It could be seen that they remained green even in the long dry season. In a depth research on Sagu Baruk palm both ecological aspects and its benefits as conservation plant as well as food providers for communities in the Sangihe distric island, had never been implemented. The aim of this study was to analyze the physical environmental condition around Sagu Baruk palm and to get the infiltration capacity equation model (Horton model) around the Sagu Baruk palm. The research was conducted from October 2010 to June 2011 at Gunung Village, Middle Tabukan, Sangihe distric island. The village spreads from coast up to the top of hill with an altitude of ± 600 meters above sea level. The form of topography was mountainous with 20-40% of slope and the land use is mixed of farms, coconut, cloves, nutmeg, and sagu plant. Tools or materials used in this study were double ring infiltrometer, soil tester, termohygrometer, GPS, klinometer and stopwatch. The methodology consists of descriptive analysis, t test, and ANOVA. Results show that there is a significant difference between depth of 0-20 cm and 100-250 cm in physical condition of soil and characterized by the existence of higher percentage of sand in a depth of 0-20 cm, and a higher percentage of clay in a depth of 100-250 cm, then the permeability level, bulk, and the porosity in a depth of 00-20 cm higher than the depth of 100-250 cm. In microclimate comparison, it presents any difference in air humidity, air temperature, soil moisture, and wind velocity in both for dry and rainy season. In the comparison of soil chemical analysis of N soil, P_2O_5, K_2O. and C organic, the four variables showed that there are no significant difference among the three types of altitude. The result of this research is suitable to the equation model for infiltration capacity and infiltration constanta around Sagu Baruk palm. Infiltration capacity at a position nearing cluster is higher than outside one in dry as well as rainy season. From the comparison of infiltration constatnta and infiltration rate between the seasons, it shows that in the dry season these values are higher than the rainy season, but infiltration constanta in the rainy season is higher than the dry season
Keywords: infiltration, conservation, Sagu Baruk palm.

INTRODUCTION

Humans in fulfilling their daily needs (food, clothing, and shelter) are processing and exploiting natural resources, either directly or indirectly. The use of natural resources for more or in a little will disruptive environment. However, fortunately the environment has certain resilienced the ability to recover damage due to a disruption. Indonesia as an agricultural country, most of the livelihoods of its inhabitants are farming (as farmers). Therefore the use of natural resources which includes soil, water, and forests are always increasing as a result of population growth [1]. In that understanding, these relationships are known as carrying capacity of land, namely the ability of a unit of natural resources in fulfilling human needs for an optimal number of populations.

Public awareness about the importance role of environment in people's lives continues to be cultivated through the information and education in and out the schools, providing stimulus, law enforcement, gets along with the encouragement of the active role of the community to preserve the environment in every economic and social activities. According to Suryanegara [2], the onset of natural resource damages a result of the use by humans, and then the man also makes effort to fix and regulate the use of those resources, so there are mutual relations and mutually interact among the human and natural resources.

If the capability of environment is carrying capacity, it has been exceeded due to the fulfilling of human needs is in increasing, one of the damages that can occur in the deterioration of natural resources is related to the physical and chemical character of soil. Sign of decline in the form of losses nutrients and organic material so that plant growth inhibited. The reduced infiltration capacity and the ability of soil to hold

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water, which eventually resulted in reduced productivity of land and this, will reduce the ability of environmental sustainability. For that control efforts need to be carried out in a proper way so that the expected sustainability of land capability can be maintained.

MATERIALS AND METHODS

Infiltration is the process of entering water into the soil through the soil surface and vertically downwards. According to the Seyhan [3], infiltration is water that seeped into the earth's surface (if the surface is permeable) because of the influence of gravity and capillary forces. Water that infiltrated into the permeable layer is then collected in the cavities that exist in the soil to form soil water [4]. The process also includes the replacement of water infiltration into the empty spaces in the soil and ground water movement in soil that is not saturated. Water infiltration is then used by plants, evaporates from the soil, appears as sub surface run off and the base flow continues joining into the ground water.

The rate of infiltration is the amount of water per unit time that enters through the soil surface. The maximum rate of water can get into the ground at one point called the infiltration capacity. Soil infiltration capacity at the beginning of the rains is the largest, and then decreases with increasing duration of rainfall occur to achieve a constant minimum value. Infiltration rate of a soil associated with soil texture and soil canopy cover can be seen in the following table [5]:

Table 1 : The capacity of some types of soil infiltration associated with the canopy (ground cover)

Texture	Infiltration Capacity (mm/hour)	
	Bare Ground	Vegetated
Clay	0 – 5	5 - 10
Clay Loam	5 – 10	10 – 20
Loam	10 – 15	20 - 30
Sandy Loam	15 – 20	30 - 40
Sand	20 – 25	40 - 50

Soil infiltration capacity depends on the influence of a combination of many factors, such capacity is highly variable among locations and showed periodic fluctuations seasonally and not at a specific location, because of these things so that value range infiltration capacity showing in the following table [6]:

Table 2: Infiltration Classification and Percolation rate

Description	Infiltration (mm/hour)	Percolation (mm/hour)
Very Slow	< 1	< 1
Slow	1 – 5	1 – 5
Medium Slow	5 – 20	5 – 16
Moderate	20 – 65	16 – 50
Medium Fast	65 – 125	50 – 160
Fast	125 – 250	>160
Very Fast	> 250	-

Infiltration capacity correlated with soil physical character, positively correlated to the porosity of the soil and organic matter content, while the content of clay and weight content of the soil negatively correlated [7]. Rainfall and water content affect infiltration capacity. Blow raindrops tend to damage the structure of the soil surface, the fine materials from the surface can be washed into the cavities of the soil, clogging pores, thereby reducing the rate of infiltration. Vegetated lands generally absorb more water due to organic matter and micro-organisms and plant roots tend to increase soil porosity and stabilize soil structure [8].

Efforts to cultivate the land certainly have a double value to enhance the infiltration of rainwater into the ground to produce a ground water reserves while reducing the negative impact of direct runoff occurs during the rainy season (flood, erosion, etc.). In this course should be pursued type of plant roots that have a high porosity, and have a product value as well as planting and maintenance, then it does not require high cost. According to Andrew [9], the vegetation brings contribution to the preservation of soil and water. Vegetated area is expected to have better function in manage water as compared with not vegetated area, with the reason as follow:

a. Vegetated area theoretically have better physical land character so it has a greater infiltration capacity
b. The character of woody rooting vegetation will be more tightly and deeply penetrate soil horizon that allows for greater water retention.
c. A tighter canopy system consists of several layers so that the mechanical effect rain water blow does not directly upon the soil surface.

d. Litter in vegetated areas caused the water on the soil surface has more chance to infiltrate, as presented in Table 3 below.

Table 3: Infiltration capacity at the initial state (fo) and the final state (fc) under various vegetation

Vegetation Species	Beginning Infiltration Capacity (cm/hour)	End infiltration capacity (cm/hour)
Pine merkusi 27 years old	255,24	29,88
Eminii Maesopsis 3,5 years old	258,84	26,28
Eucalyptus sp.	262,08	29,88

As shown in the table above that the infiltration of various vegetation characteristics varies in kind, it is caused by the root system of vegetation is different so that the porosity is formed different too.

Potential of Sagu Baruk Palm for Soil and Water Conservation

Sagu Baruk palm is a species of Sago palm that grows on a dry land and was found in the Sangihe Island. Sago can be grown at an altitude of 0-500m asl, has a stem diameter between 20-25 cm and plant height (mature) between 6-16 m [10]. Sagu Baruk Name is the name that has been known in Kepulauan Sangihe from generation to generation. Denium [11] said that these plants, including cluster and genus of Metroxylon Palma, because it contains starch in the stem but the difference with a true Metroxylon is Sagu Baruk palm can grow well in dry land and forming a cluster. Because the structure of Sagu Baruk palm flowers similar with palm plants, Sagu Baruk palm classified in the Arenga genus [12]. Sagu Baruk palm are the type of tree that grows to form a cluster with roots that has high enough porosity. Sagu Baruk palm roots systems can be gripped so that the soil layer washout can be suppressed and the runoff can be decrease. Sagu Baruk palm are only found on the Sangihe Island (endemic plants) that needs to be maintained it existences or conserved. In government regulation No. 32 of 2009 Chapter 1 Article 18 explained that the conservation of natural resources is the management of natural resources wisely to ensure their utilization as well as sustainable availability while maintaining and improving the quality and diversity.Some facts show that Sagu Baruk palm if developed as a crop soil and water conservation are: (1)economic value, (2)the ability to hold and distribute the rain water through the roots, (3)utilization of intercropping plant, (4) the low cost of planting and plant care.

a. Economic Value

Sagu Baruk palm is the primary food source of 88.33% population of the Sangihe Island [13]. According to Noli et al [14] production of Sagu Baruk palm 20-30 kg per stem. Utilization of Sago flour in addition to direct food ingredient, is also an ingredient for the manufacture of various types of cakes, noodles, etc. [15], in addition Sago flour potential to be used as raw material for the manufacture of plastic that easily decomposes known as biodegradable plastic and can be processed into sago flour ethanol [16]. Sago stem that is hard enough used by people as a construction material (reinforced concrete for the walls) and the potential to be develop as furniture. Sago waste residue can be used as fodder and potentially for cultivating mushrooms. When the Sagu Baruk palm pulp turned into the soil it is used as fertilizer.

b. The ability to hold and distribute the rain water through the roots

The ability of Sago plant roots to distribute rain water among others and it can be seen from the spring that appears in the vicinity of Sago plants and can survive in the dry season; low surface erosion around the land that over grown with sago plant. Sagu Baruk palm can be used as a source of carbohydrates for food and it can also be used as a reforestation plant [17]. This is supported by the ability of these plants reproduced themselves quite quickly which is every month seedling can grow an average of 5-6 seedlings per hill [18]. Thus, Sagu Baruk palm has the ability to cover ground fast enough to reduce the danger of erosion.

c. Utilization of intercropping plant

In fact, land that over grown by Sagu Baruk palm is very well planted with seasonal crops (peppers, tomatoes, rice, corn, potatoes, etc.). In the dry season, crop plants that are planted around sago plants are more resistant than those grown on vacant land (observations and interviews, 2009).

d. The low cost of planting and plant care.

A sago plant is a plant that is highly resistant to weather changes. In the long dry season which is difficult to grow compared with the other plants, sago palms can still grow and produce. Sagu Baruk palm can grow naturally to form seedlings between 4 to 6 pups / month (personal communication with sago farmers, 2009). In practice, farmers do not work special treatment and just clean it while cutting down sago trees of the grove. The advantages of Sagu Baruk palm such as economic value, its ability to hold and deliver water into the soil as well as the ability to grow on dry land though steep, is highly reliable potential for utilization of sago plants as a crop soil and water conservation. For that purpose, ir needs more specific studies about the physical condition of the environment, including infiltration capacity around the Sagu Baruk palm.

RESULTS AND DISCUSSION

Physical Environmental around Sagu Baruk palm

The physical condition of the environment around Sagu Baruk palm is observed with soil sample data and micro climate data. In the soil sample data, it is divided into two depths of 0-20 cm depth and the depth of 100-250 cm. There are six variables that were observed in soil physical condition data which are as the percentage of sand, dust percentage, clay percentage, permeability, bulk, and porosity. The comparison value for each type of depth variable was presented as in Table 4 below:

Table 4 Comparison of inter-Depth Soil Samples

Variable	Depth 0-20 cm	Depth 100-250 cm	Sig t	Explanation
Sand Percent	41.40	4.54	0.001	Significant
Dust Percent	39.02	36.17	0.001	Significant
Clay Percent	19.73	59.30	0.001	Significant
Permeability	57.57	15.69	0.001	Significant
Bulk Density	1.18	1.29	0.001	Significant
Porosity	55.32	50.25	0.001	Significant

From the table as above, the results were:

a. For a percentage variable of sand: the percentage average of sand at a depth of 0-20 cm was 41.40%, and the percentage average of sand at a depth of 100-250 cm is 4:54%. Based on the results of different test using a t-test Sig t, it is obtained for 0,001. Because the Sig value of t <0.05 indicates a significant difference in the percentage of sand at a depth of two types. As shown on the percentage average of sand at a depth of 0-20 cm is higher than the depth of 100-250 cm.

b. For a percentage variable of dust: the percentage average of dust at a depth of 0-20 cm is 39.02%, and the percentage average of dust at a depth of 100-250 cm is 36.17%. Based on the results of different test using a t-test Sig, it is obtained for 0,001, because the Sig value of t <0.05 indicates a significant difference in the percentage of dust on both the type of depth. As shown on the percentage average of dust at a depth of 0-20 cm, it is higher than the depth of 100-250 cm.

c. For a variable percentage of clay: the percentage average of clay at a depth of 0-20 cm is 19.73%, and the percentage average of clay at a depth of 100-250 cm is 59.30%. Based on the results of different test using a t-test Sig t, it is obtained for 0,001, because the Sig value of t <0.05 indicates a significant difference in the percentage of clay in both types of depth. As shown on the average percentage of clay at a depth of 100-250 cm is higher than the depth of 0-20 cm.

d. For variable permeability: the average of permeability at depth of 0-20 cm was 57.57 cm / hour, and permeability average at a depth of 100-250 cm is 15.69 cm /day. Based on the results of different test using a t-test Sig t, it is obtained for 0,001, because the Sig value of t <0.05 indicates a significant difference in permeability in both types of depth. As shown on the value average of permeability at a depth of 0-20 cm is higher than the depth of 100-250 cm.

e. For the weight of the contents of variables,: the weight average of the contents at a depth of 0-20 cm is 1:18 gram/cm3, and the weight average of the contents at a depth of 100-250 cm is 1:29 gram/cm3. Based on the results of different test using a t-test Sig t, it is obtained for 0,001. because the Sig value of t <0.05 indicates a significant difference in contents weight of the second type of depth. As shown on the weight average of the contents at a depth of 100-250 cm is higher than the depth of 0-20 cm.

f. For the porosity variable: the porosity average at a depth of 0-20 cm was 55.32%, and porosity average at a depth of 100-250 cm is 50.25%. Based on the results of different test using a t-test Sig t, it is obtained for 0,001, because the Sig value of t <0.05 indicates a significant difference in porosity in both types of depth. It seemed that the value average of porosity at a depth of 0-20 cm is higher than the depth of 100-250 cm.

Based on the results as above, it can be seen any significant difference between the sixth variable depth of 0-20 cm and 100-250 cm depth. Depth of 0-20 cm is characterized by high permeability, high content weight, and high porosity. But the depth of 100-250 cm is characterized by low permeability, high content weight, and low porosity.

At the micro-climate data, it is divided into two season's namely rainy and dry seasons. There are ten variables observed on the micro-climatic data of air humidity near the cluster, cluster outside air humidity, air temperature near the cluster, cluster outside air temperature, soil moisture near the cluster, cluster out of the soil moisture, soil temperature near the cluster, cluster out of the ground temperature, wind velocity, and intensity of radiation. The comparison variable value for each season is presented as in Table 5 below.

Table 5 Micro Climate Comparison between season

Variable	Rain Season	Dry Season	Sig t	Conclusion
AH near the cluster	84.13	84.58	0.741	No significant
AH outside the cluster	81.20	76.50	0.001	Significant
AT near the cluster	26.05	26.03	0.947	No significant
AT outside the cluster	26.01	26.91	0.010	Significant
SH near the cluster	68.14	68.01	0.936	No significant
SH outside the cluster	52.33	48.18	0.017	Significant
ST near the cluster	25.47	25.47	1.000	No significant
ST outside the cluster	25.26	25.37	0.211	No significant
Wind velocity	0.55	1.36	0.000	Significant
Radiation intensity	3408	3575	0.647	No significant

Remark: AH: Air Humidity, AT: Air Temperature, SH: Soil Humidity, ST: Soil Temperature

From the table as above, the results were:

a. For air humidity variable near cluster: the air humidity average near cluster in the rainy season is 84.13% and 84.58% in the dry season. Based on the results of different test using a t-test Sig t, it is obtained for 0741, because the Sig value of t> 0.05 indicates no visible difference in air humidity near the grove on the second season. That is mean in the rainy season or dry season; air humidity near the cluster is same.

b. For air humidity variable outside the cluster: the average outside air humidity cluster in the rainy season is 81.20% and 76.50% in the dry season. Based on the results of different test using a t-test Sig t, it is obtained for 0,001, because the Sig value of t <0.05 indicates a difference in air humidity outside the cluster are significant in both seasons. Seen from the average value of the outside air humidity during rainy season is higher than dry season.

c. For air temperature variable near the cluster: the average air temperature near the grove in the rainy season is 26.05C and 26.03C in the dry season. Based on the results of different test using a t-test Sig t, it is obtained for 0947, because the Sig value of t> 0.05 indicates no visible difference in air temperature near the cluster in both season. That is mean in the rainy season or dry season; air temperature near the cluster is the same.

d. For air temperature variable outside the cluster: the average air temperature outside the cluster in the rainy season is 26.01C and 26.91C in the dry season. Based on the results of different test using a t-test Sig t, it is obtained for 0010, because the Sig value of t <0.05 indicates a difference in air temperature outside the clumps are significant in both seasons. It seemed that the average air temperature outside the cluster in the dry season is higher than the rainy season.

e. For soil moisture variable near the cluster: the average soil moisture near the cluster in the rainy season is 68.14% and 68.01% in the dry season. Based on the results of different test using a t-test Sig t, it is obtained for 0936, because the Sig value of t> 0.05 indicates no visible differences in soil moisture near the cluster in both season. That is meaned that either in rainy season or dry season; soil moisture near the cluster is the same.

f. For soil moisture variable outside the cluster: average out cluster of soil moisture during the rainy season is 52.33% and 48.18% in the dry season. Based on the results of different test using a t-test Sig t, it is obtained for 0017, because the Sig value of t <0.05 indicate differences in soil moisture outside the cluster is significant in both seasons. It seemed that the average value outside the cluster of soil moisture during the rainy season is higher than the dry season.

g. For soil temperature variable near the cluster: the average temperature of the soil near the cluster in the rainy season is 25.47C and 25.47C in the dry season. From the results of different test using a t-test t, it is obtained Sig of 1,000, because the Sig value of t> 0.05 indicates no visible differences in soil temperature near the cluster in both season. That is meaned that either in rainy season or dry season; soil temperature near the cluster is the same.

h. For soil temperatures variable outside the cluster: the average temperature of the soil outside cluster in rainy season is 25.26C and 25.37C in dry season. Based on the results of different test using a t-test Sig t, it is obtained for 0211, because the Sig value of t> 0.05 indicates no visible differences of soil temperature outside the cluster in both seasons. That is meaned that either in rainy season or dry season; soil temperature near the cluster is the same.

i. For wind velocity variable: average wind velocity during rainy season is 0:55 m /s, and 1:36 m / s in dry season. Based on the results of different test using a t-test Sig t, it is obtained for 0,001, because the Sig value of t <0.05 indicates a significant difference in wind velocity in both season. It is seemed that the average wind velocity is higher during the dry season than rainy season.

j. For radiation intensity variable: the average of radiation intensity during the rainy season is 3408 lux and 3575 lux in dry season. Based on the results of different test using a t-test Sig t, it is obtained for 0647, because the Sig value of t> 0.05 indicates no visible difference in the radiation intensity in both seasons. That is meaned that either in rainy season or dry season; radiation intensity is the same.

From the results as above, it can be seen that any difference in air humidity outside the cluster, air temperature outside cluster, soil moisture outside cluster, and wind velocity significantly between rainy and dry season. The rainy season is characterized as higher air humidity outside cluster, lower air temperature outside cluster, higher soil moisture outside cluster, and lower wind velocity.

There are four variables that were observed in soil chemistry data, that is variable N soil (measured using Kjedahl Method), available P_2O_5 soil variables (measured with extraction Bray I), available soil K_2O variables (measured with extraction Bray I), and C-organic (measured with the methods of Walky and Black). The comparison value of each position variable was described as in Table 6 below.

Table 6 Comparison of Soil Chemical Analysis

Variable	Position			ANOVA result	
	Upper	Middle	Bottom	Sig F	Explanation
N Soil	0.1173	0.1173	0.1165	0.995	Not Significant
P2O5	15.2650	17.3650	17.3000	0.552	Not Significant
K2O	32.3775	31.2225	30.9350	0.975	Not Significant
C Organic	5.2425	6.1350	6.4675	0.695	Not Significant

From the table above, it is obtained the following result as follow:

a. For N soil levels in average, upper and middle position has the highest N soil levels, on the other side of the bottom position having lower N soil levels, but the three averages are not far adrift. From the results of ANOVA, it shows that Sig F for 0995> 0.05, so it can be concluded there were no differences in N soil levels at all three positions. This indicates that N soil levels at any position tend to have same value.

b. For P_2O_5 levels in average and middle position has the highest levels of P_2O_5, on the other side of the top positions has lower levels of P_2O_5, but the three averages are not far adrift. From the results of ANOVA, it shows that Sig F for 0.552> 0.05, so it can be concluded there are no differences in levels of P_2O_5 in the third position. This indicates that the levels of P_2O_5 in any position tend to have the same value.

c. For K_2O levels in average, the upper position has the highest levels of K_2O, on the other side the bottom position has the lower K_2O level, but on average a third are not far adrift. From the results of ANOVA, it shows that Sig F for 0975> 0.05, so it can be concluded there were no differences in levels of K_2O in the third position. This indicates that the levels of K_2O in any position tend to have same value.

d. For N soil levels in average, bottom position has the highest N soil levels, on the other side upper position has lower N soil levels, but on average a third are not far adrift. From the results of ANOVA, it shows that Sig F for 0695> 0.05, so it can be concluded there were no differences in N soil levels at all three positions. This indicates that N soil levels at any position tend to have same value.

Based on the analysis as above, it can be concluded that the four soil chemical character in the three positions like upper (508 asl), middle (330 asl), and bottom (44 m asl) the N soil levels, P_2O_5, K_2O, and C organic did not show significant differences between the three positions.

Equation Model of Infiltration Capacity and Constanta Infiltration around Sagu Baruk Palm

Equation model of infiltration capacity and Constanta infiltration around Sagu Baruk palm (Horton formula) in various land conditions are obtained from the measurement data and calculation of the rate of infiltration. For the next, it is presented the comparison of the beginning infiltration rate, the ending infiltration rate, average infiltration rate, and constant infiltration in both seasons (dry and rainy), and third height position (upper, 508 meters above sea level, the middle, 330 meters above sea level, and bottom 44meters above sea level), on the conditions near and outer cluster.

In the results of data measurement and calculation of infiltration rate, infiltration capacity and Constanta divided into two seasons such as dry and rainy season. There are four variables that were observed as the measurement data and calculation of beginning infiltration rate (fo), ending infiltration rate (fc), the average infiltration rate (f), and the constant infiltration (k) on both conditions (near the cluster <0.5 m, and outside the cluster 2.5m. The comparison variable value of each season is described as in Table 7 below.

Table 7 Comparison of Infiltration rate between seasons

Variable	Dry Season	Rainy Season	Sig t	Explanation
fo near cluster	130.68	6.21	0.001	Significant
fo outside cluster	12.30	1.73	0.001	Significant
fc near cluster	2.23	0.01	0.001	Significant
fc outside cluster	1.24	0.01	0.001	Significant
f near cluster	102.90	51.19	0.001	Significant
f outside cluster	11.97	6.44	0.001	Significant
K near cluster	0.251	0.463	0.002	Significant
K outside cluster	0.166	0.197	0.001	Significant

From table above, it can be said that infiltration equation for near cluster position and outside cluster position of Sagu Baruk palm in dry season and in rainy season is as follow:

Infiltration equations near cluster of the rainy season: Ft = 0.01 + 6.20 e-0, 463 t

Infiltration equation outside cluster of rainy season: Ft = 0.01 + 1.72 e -0.197 t

Infiltration equations near cluster of dry season: Ft = 2.23 +128.45 e-0, 251 t

Infiltration equation outside cluster of dry season: Ft = 1.24 + 11.06 e - 11.06 t

From table 7, it can be described the results as follow:

a. For the beginning infiltration rate (near cluster), the average in dry season was 130.68 mm/minute and the average during the rainy season is 6.21 mm/minute. Based on the results of different test using a t-test Sig t, it is obtained for 0,001, because the Sig value of t <0.05 indicates a difference in the beginning infiltration rate (near cluster) are significant in each season. Seen from the beginning infiltration rate (near cluster) in dry season is higher than the rainy season.
b. For the beginning infiltration rate (outside cluster), the average in dry season was 12.30 mm/ minute and the average during the rainy season was 1.73 mm/minute. Based on the results of different test using a t-test Sig t, it is obtained for 0,001, because the Sig value of t <0.05 indicates a difference in the beginning infiltration rate (outside cluster) are significant in each season. It is seemed that the beginning infiltration rate (outside cluster) in dry season is higher than the rainy season.
c. For the ending infiltration rate (near cluster), the average in dry season is 2.23 mm/minute and the average during the rainy season is 6.21 mm/minute. Based on the results of different test using a t-test Sig t, it is obtained for 0,001, because the Sig value of t <0.05 indicates a difference in the ending infiltration rate (near cluster) are significant in each season. It is seemed that the value of ending infiltration rate (near cluster) in dry season is higher than the rainy season.
d. For the ending infiltration rate (outside cluster), the average in dry season is 1.24 mm/minute and the average during the rainy season is 0.01 mm/minute. Based on the results of different test using a t-test Sig t, it is obtained for 0,001, because the Sig value of t <0.05 indicates a difference in the ending infiltration rate (outside cluster) are significant in each season. It is seemed that the value of the ending infiltration rate (outside cluster) in dry season is higher than the rainy season.
e. For the overall infiltration rate (near cluster), the average in dry season was 102.90 mm/minute and the average during the rainy season is 51.19 mm/minute. Based on the results of different test using a t-test Sig t, it is obtained for 0,001, because the Sig value of t <0.05 indicates a difference in the overall rate of infiltration (near cluster) are significant in each season. It is seemed that the overall value of infiltration rate (near cluster) in dry season is much higher than rainy season.

f. For the overall infiltration rate (outside cluster), the average in dry season was 11.97 mm/ minute and the average during the rainy season is 6.44 mm/minute. Based on the results of different test using a t-test Sig t, it is obtained for 0,001, because the Sig value of t <0.05 indicates a difference in the overall rate of infiltration (outside cluster) are significant in each season. It is seemed that the overall value of infiltration rate (outside cluster) in dry season is higher than rainy season.

g. For a Constanta infiltration (near cluster), the average in dry season was 0.251 and the average during the rainy season was 0.463. Based on the results of different test using a t-test Sig t, it is obtained for 0,002, because the Sig value of t <0.05 indicates a difference in the Constanta infiltration (near cluster) are significant in each season. It is seemed that the value of the Constanta infiltration (near cluster) in rainy season is higher than dry season.

h. For a Constanta infiltration (outside cluster), the average in the dry season was 0.166 and the average during the rainy season was 0.197. Based on the results of different test using a t-test Sig t, it is obtained for 0,001, because the Sig value of t <0.05 indicates a difference in the Constanta infiltration (outside cluster) are significant in each season. It is seemed that the value of the Constanta infiltration (outside cluster) in rainy season is higher than dry season.

From the results, it is concluded that there are any significant differences in four variables between dry season and rainy season. In the dry season, the beginning infiltration rate, ending infiltration rate, and overall infiltration rate higher than rainy season. But in rainy season, the Constanta infiltration is higher than dry season.

CONCLUSION

Based on the measurement of the physical condition of environment around the Sagu Baruk palm, it was obtained the following conclusion. In the physical soil condition, there is a significant difference between the depth of 0-20 cm and 100-250 cm. With a characteristic of higher percentage of sand at a depth of 0-20 cm and higher percentage of clay at a depth of 100-250 cm, the permeability level, bulk and depth porosity of 0-20 cm higher than the depth of 100-250 cm. In the micro-climate comparison, it was seemed any difference in air humidity, air temperature, soil moisture, and wind velocity in both for dry and rainy season. In rainy season, soil humidity and soil moisture higher than dry season, but in dry season the air temperature and wind velocity is higher than rainy season. In the comparison of soil chemical analysis of N soil, P_2O_5, K_2O and C organic, that four variables showed that there is no significant difference among the three types of altitude. The infiltration capacity equation model and Constanta infiltration was suitable around Sagu Baruk palm. Based on the comparison of Constanta infiltration and infiltration rate inter seasons, it is seemed that in dry season is higher than rainy season, but Constanta infiltration in rainy season is higher than dry season.The infiltration capacity near the cluster was higher than outside one on the dry and rainy season..

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