

ABSTRACT

A preliminary research on water balance in 4 forest stand has been conducted with two main objectives. The first objective is to determine the value of essential components of water balance in the forest stand. These essential components of water balance consist of evapotranspiration (evaporation and transpiration), throughfall, stemflow and interception which are representing the growth and morphological characteristics of a particular tree. The second objective is to compare these values of water balance components among several chosen forest stands; i.e. acasia, albizia, balsa and cajeput. Data of these two objectives will be very useful in choosing the most suitable species for a given physical environment of a particular watershed with the main aim of water yield improvement.

Precipitation (P), throughfall (TF), stemflow (SF) and climatic factors such as temperatur and global radiation were measured daily. Soil moisture content was measured in about 7 days interval as an observed soil moisture (Sl). Intercep- was calculated from P minus TF and SF. Potential Evapotranspiration (ETP) was calculated by Jensen-Heise method. Actual evapotranspiration (ET) was calculated based on crop coefficient and soil moisture drying rate factor. The validity of calculated ET was demonstrated by the fitness of calculated soil moisture content (NM) and Sl. To account for the contribution of rainfall to the change in soil moisture content and its influence on transpiration, ET were separated into evaporation (E) and transpiration (T) with respective coefficients KS and KC in which $KS + KC = 1$. The calculated soil moisture was considered to be equivalent with Sl if differences of NM and Sl in a certain period of time was smaller than 5 percent.

This preliminary research was carried out in Bulaksumur, Yogyakarta. All of the stands forest chosen in the study were pure stands of fully grown trees.

The result of water balance analysis showed that TF values in the stand of acasia was 75.0 percent; albizia 77.6

percent; balsa 70.1 percent and cajeput 75.9 percent of total rainfall. SF values in the stand of acasia was 7.9 percent; albizia 4.3 percent; balsa 11.9 percent and cajeput 9.1 percent of total rainfall. Interception in the stand of albizia was 18.3 percent; balsa 17.9 percent; acasia 15.4 percent and cajeput 12.6 percent of total rainfall.

Differences in canopy coverage intensity, size of leaves and their configuration caused different transpiration and evaporation rates. Transpiration in the stand of balsa was 22.8 percent; cajeput 21.9 percent; albizia 21.7 percent and acasia 21.3 percent of rainfall. Evaporation in the floor of acasia stand was 3.5 percent; albizia 3.2 percent; cajeput 2.9 percent and balsa 2.5 percent of total rainfall.

Transpiration characteristics of each species of the observed plants are indicated by the relationship of KC vs Time in the form of a polynomial regression which its respected coefficients : in the acasia stand $C_1=0.9200135$, $C_2=5.464808E-04$, $C_3=-1.390412E-04$, $C_4=8.02961E-07$, $C_5=1.165031E-08$, $C_6=-1.101694E-10$, $C_7=2.443396E-13$; in the albizia stand $C_1=0.9352872$, $C_2=2.777936E-05$, $C_3=-1.768064E-04$, $C_4=1.830728E-06$, $C_5=4.707473E-09$, $C_6=-1.014891E-10$, $C_7=2.73145E-13$; in the balsa stand $C_1=0.9451002$, $C_2=4.278168E-03$, $C_3=-2.858862E-04$, $C_4=3.620728E-06$, $C_5=-1.297936E-08$, $C_6=-2.710249E-11$, $C_7=2.471007E-13$, $C_8=-3.710017E-16$; in the cajeput stand $C_1=0.9397752$, $C_2=2.670495E-03$, $C_3=-2.088771E-04$, $C_4=1.830397E-06$, $C_5=5.0891E-09$, $C_6=-9.762149E-11$, $C_7=2.563318E-13$.

Actual Evapotranspiration in the stand of balsa was 25.2 percent; cajeput 25.0 percent; albizia 24.9 percent and acasia 24.5 percent of total rainfall. The difference in root systems and the rate of ET of each tree species caused differences in soil moisture utilization in soil solum. Acasia and cajeput utilized available soil moisture at a depth of soil layer less than 300 cm, while albizia and balsa utilized available soil moisture up to 300 cm or deeper.

INTISARI

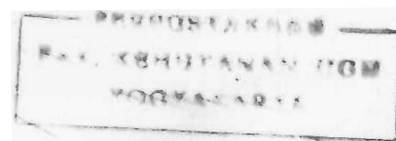
Penelitian ini bertujuan untuk menentukan dan membandingkan kebutuhan air evapotranspirasi (transpirasi dan evaporasi) aktual, throughfall, aliran batang dan intersepsi tegakan hutan tanaman akasia, albisia, balsa dan kayu putih. Data tersebut merupakan anasir pokok daur air di hutan yang mencirikan jenis dan keadaan pertumbuhan tegakannya. Hasil penelitian ini sangat bermanfaat dalam memilih jenis tanaman hutan yang sesuai untuk reboisasi dan perbaikan daur air suatu kawasan aliran (watershed).

Variabel-variabel curah hujan (P), throughfall (TF), aliran batang (SF), perubahan lengas tanah dan faktor cuaca seperti temperatur dan radiasi matahari diukur, sedang intersepsi dihitung berdasarkan P dikurangi TF dan SF. Evapotranspirasi potensial (ETP) dihitung menggunakan metoda Jensen-Heise. Evapotranspirasi aktual (ET) dihitung berdasarkan koefisien transpirasi tanaman dan faktor kelengasan tanah yang kebenarannya perhitungannya dibandingkan dengan perubahan lengas tanah terukur. Untuk mengetahui perubahan lengas tanah yang disebabkan oleh adanya hujan dan pengaruhnya terhadap transpirasi, maka ET dipisah menjadi E dan T dengan koefisien masing-masing KS dan KC ($KS+KC=1$).

Analisis neraca air menggunakan variabel-variabel di atas menghasilkan lengas tanah terhitung (NM). Harga NM dianggap sama dengan lengas terukur (Sl) bila selisih total selama periode waktu tertentu lebih kecil dari 5 persen. Hasil perhitungan demikian itu memberikan harga KC sebagai karakteristik transpirasi tanaman yang bersangkutan sesuai dengan keadaan setempat.

Penelitian ini masih bersifat pendahuluan, maka tegakan hutan yang dipilih merupakan komunitas tunggal. Penelitian dilakukan di Bulaksumur, Yogyakarta.

Hasil analisis neraca air menunjukkan bahwa harga TF pada tegakan akasia 75 persen; albisia 77,6 persen; balsa 70,1 persen dan kayu putih 75,9 persen dari curah hujan. Dan harga SF pada tegakan akasia 7,9 persen; albisia 4,3 persen; balsa 11,9 persen dan kayu putih 9,1 persen dari curah hujan.



Intersepsi pada tegakan albisia 18,3 persen; balsam 17,9 persen; akasia 15,4 persen dan kayu putih 12,6 persen dari curah hujan.

Kecepatan pertumbuhan yang berbeda menyebabkan laju transpirasi berbeda. Transpirasi pada tegakan balsam 22,8 persen; kayu putih 21,9 persen; albisia 21,7 persen dan akasia 21,3 persen dari curah hujan. Penutupan tajuk dan ukuran daun penyusunnya berbeda menyebabkan evaporasi di bawah tegakan hutan berbeda. Evaporasi di bawah tegakan akasia 3,5 persen; albisia 3,2 persen; kayu putih 2,9 persen dan balsam 2,5 persen dari curah hujan.

Karakteristik transpirasi tiap jenis tanaman hutan yang diteliti dinyatakan oleh hubungan KC dengan waktu dalam bentuk persamaan polinomial dengan koefisien polinomialnya

1. Untuk tegakan akasia : $C_1=0,9200135$; $C_2=5,464808E-04$
 $C_3=-1,390412E-04$; $C_4=8,02961E-07$; $C_5=1,165031E-$
 $C_6=-1,101694E-10$; $C_7=2,443396E-13$

2. Untuk tegakan albisia : $C_1=0,9352872$; $C_2=2,777936E-05$
 $C_3=-1,768064E-04$; $C_4=1,830728E-06$; $C_5=4,707473E-09$;
 $C_6=-1,014891E-10$; $C_7=2,73145E-13$

3. Untuk tegakan balsam : $C_1=0,9451002$; $C_2=4,278168E-03$;
 $C_3=-2,858862E-04$; $C_4=3,620728E-06$; $C_5=-1,297936E-08$;
 $C_6=-2,710249E-11$; $C_7=2,471007E-13$; $C_8=-3,710017E-16$

4. Untuk tegakan kayu putih : $C_1=0,9397752$;
 $C_2=2,670495E-03$; $C_3=-2,088771E-04$; $C_4=1,830397E-06$;
 $C_5=5,089101E-09$; $C_6=-9,762149E-11$; $C_7=2,563318E-13$

Evapotranspirasi aktual pada tegakan balsam 25,2 persen; kayu putih 25 persen; albisia 24,9 persen dan akasia 24,5 persen dari curah hujan. Perbedaan jenis dengan ET yang berbeda mengakibatkan pemanfaatan lengas tanah berbeda kedalamannya. Tegakan akasia dan kayu putih memanfaatkan lengas tanah tidak melebihi kedalaman 300 cm, sedang pada tegakan albisia dan balsam memanfaatkan lengas tanah mencapai atau bahkan mungkin melebihi kedalaman 300 cm.