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Study on the Biomass Measuration for the Artificial Forest of *Calotropis gigantea* (L.) *Dryand.*

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Abstract

Based on artificial forest of *Calotropis gigantea* (L.) *Dryand.* area of 20.1 hm², planted in the base of seed management station in Yuanjiang County, Yunnan Province, according to the average standard wooden method, the stand biomass was calculated in this paper. Based on the survey data of representative sample trees, the single-tree biomass model was constructed.

Keywords

***Calotropis gigantea* (L.) *Dryand.*, Artificial Forest, Biamass, Model**

1. Introduction

Calotropis gigantea (*Calotropis gigantea* (L.) *Dryand.*) is a perennial, evergreen erect shrub of CalotropisR.BR, Asclepiadaceae, blossoming and fruiting in the year planted. Height of the shrub is generally to 3 m or so. There are 6 shrub species found so far in the world, only one species in China, *Calotropis gigantea* (*Calotropis gigantea* (L.) *Dryand.*), distributing mainly in Southwest China and South China at wild state. Currently, the shrub is widely concerned because of its medicinal value, biological agent development value, fiber development value and development value of energy, etc. In addition to the plantation of the shrub with rapid growth, resistance to barren and drought, not taking up fertile farmland for its plantation and other characteristics, and utilization of the waste (stone) desertification land development into natural woody fiber plant, which not only can open new fiber raw material source for the textile industry, but also replace a large number of cultivated land, and increase the income of farmers (Editorial Committee of flora of Chinese Academy of Sciences, 1977) (Fei, 2011) (Tuntawiroon, 1984) (Li, 2007), will achieve the unity of ecological benefits, social benefits and economic benefits.

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However, the industrialization of cultivation and the application for *Calotropis gigantea* have not been formed specially in urgent need of in-depth study in the aspects of basic research. In this paper, based on artificial forest of *Calotropis gigantea* (L.) *Dryand.* area of 20.1 hm², planted in the base of seed management station in Yuanjiang County, Yunnan Province, according to the average standard wooden method, the stand biomass was calculated. Based on the survey data of representative sample trees, the single-tree biomass model was constructed.

2. Material and Method

2.1. Studied Area

Studied area was located in the base of seed management station in Yuanjiang County, Yunnan Province, 3 km away from Yuanjiang County Town. In the base, 20.1 hm² of the artificial forest of *Calotropis gigantea* was planted as pilot forest in May 2013.

10 representative sample plots, 0.04 hm²/each plot, were selected, and by comprehensive investigation method, tree height, diameter, leaf characteristics in each sample plot were measured (see **Table 1**).

2.2. Methods

2.2.1. Single Tree Biomass Determination of *Calotropis gigantea*

1) To select 3 average standard trees in each representative sample plots, 30 sample trees in all, and measure their related factors in Dec. 2013.

2) To dug up the average standard trees by its roots, and measure their height, ground diameter etc.

3) To measure full fresh weight (W_f) including ground and underground parts of the average standard trees, and measure the dry weight (W_d) in lab.

4) To calculate relative water content (P_r%), the formula as follows:

$$P_r = \frac{W_f - W_d}{W_f} \times 100\%$$

5) To calculate single tree biomass determination.

2.2.2. Model Construction of Single Tree Biomass for the Artificial Forest of *Calotropis gigantea*

Total biomass models of single tree, ground and underground parts were constructed based on 30 average standard trees data.

3. Results and Analysis

3.1. Water Content of Different Organs of *Calotropis gigantea* Single Tree

Through the process and analysis for 30 average standard trees in the lab, average relative water content of single tree of *Calotropis gigantea* is 68.1%, in which, the average relative water content of the branch is 61.5%, the average relative water content of the leaf is 79.8%, the average relative water content of the flower is 82.8%, the average relative water content of the fruit is 85.3%, the average relative water content of the root is 62.6%. The average relative water content of different organs of *Calotropis gigantea* ranks: fruit > flower > leaf > root > branch.

3.2. Biomass of Different Organs of *Calotropis gigantea* Single Tree

Based on 30 average standard trees, total biomass of *Calotropis gigantea* single tree was calculated, total bio-

Table 1. Basic Data of 10 sample plots.

	1	2	3	4	5	6	7	8	9	10
Number/hm²	1500	1100	2200	2200	1100	1500	1500	2200	1100	1500
Average height (m)	1.2	1.3	1.5	0.9	1.8	1.0	1.2	1.2	1.4	1.3
Average ground diameter (cm)	3.5	3.4	3.6	3.2	3.6	3.0	3.3	3.4	3.3	2.9

Table 2. Biomass regression models of the single tree for *Calotropis gigantea*.

Organs	Biomass models	Correlation coefficient	Error bar
Total biomass	$W_t = 0.0198 \times (D^2H)^{1.2122}$	0.845	11.5
Overground	$W_u = 0.0647 \times (D^2H)^{0.6543}$	0.911	10.2
Underground	$W_g = 0.0684 \times (D^2H)^{0.3021}$	0.942	9.8

W_t: total biomass weight of single tree, W_u: overground biomass weight of single tree, W_g: overground biomass weight of single tree, D: ground diameter of single tree, H: tree height.

mass to achieve 520.0 g, in which, the branch 262.6 g, accounting for 50.5% of whole tree, the leaf 93.7 g, accounting for 18.0%, the flower 10.8 g, accounting for 2.1%, the fruit 9.1 g, accounting for 1.8%, the root 143.8 g, accounting for 27.6%. The biomass of different organs of *Calotropis gigantea* ranks: branch > root > leaf > flower > fruit.

3.3. Stand Biomass of Artificial Forest of *Calotropis gigantea* in Studied Area

Based on standard sample plots investigation, total area of artificial forest of *Calotropis gigantea* is 20.1 hm^2, 1671 trees/hm^2, then, sum biomass of the per unit area is 868.92 kg/hm^2 and total biomass in the studied area of 20.1 hm^2 is 17465.29 kg.

3.4. Biomass Model Construction of the Single Tree of *Calotropis gigantea*

Based on 30 average standard trees data in studied area, the regression models of the single tree of *Calotropis gigantea between* biomass and tree height, ground diameter were established (see **Table 2**).

According to the regression model above, on the basis of the 30 average standard trees, total biomass of *Calotropis gigantea* single tree was calculated, total biomass to achieve 525.0 g.

4. Conclusion

1) *Calotropis gigantea* is a kind of new resource-type shrub species, and key cultivation techniques and the basic science research urgently need to be done.

2) In this paper, the stand biomass is calculated by means of average standard sample tree, which can be used as a reference of forest carbon reserves measurement of *Calotropis gigantea stand.*

In this paper, the biomass models of single tree of *Calotropis gigantea* are initially established, which have a useful role in biomass calculation and carbon reserves measurement for *Calotropis gigantea* artificial forest.

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