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短　報

Biomass content of black *Petung* bamboo (*Dendrocalamus asper* (Schult.) Backer ex Heyne cv. Black)

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Abstract

A key issue in the profitability of bamboo plantations is the productivity that can be expected. This study aimed to understand bamboo biomass as well as carbon biomass on *Dendrocalamus asper* cv. black that was propagated by culm and rhizome cuttings after five years planted. In this study, there were two kinds of black *petung* bamboo that have been used as samples, namely *Dendrocalamus asper* cv. black that was propagated by culm and rhizome cuttings. This study was conducted in bamboo compartment of Bali Botanic Garden. Destructive sampling was used to determine bamboo biomass. Bamboo culms were divided into four parts such as leaves, branches, stems and roots for analysis. The results revealed that averaged bamboo biomass and carbon biomass per hectare for *Dendrocalamus asper* cv. black propagated by culm and rhizome cuttings were 38.3 tons and 19.2 tons, and 83.4 tons and 41.7 tons respectively.

Keywords: *Dendrocalamus asper* cv. black, biomass, carbon

1. Introduction

Bamboo is a type of plant intensively managed both as crop production and crop intercropping or agro forestry (Kumar *et al.* 2005). Approximately 110 species of bamboo growing in nature and cultural lands in Indonesia, while 130 types grown in India and an estimated 400 species growing in China (Dransfield and Widjaja 1995; Kumar *et al.* 2005; Yiping and Henley 2010). Bamboo has a long history as a versatile plant and is widely used, such as usability for the construction of the house, feed, food, raw materials for pulp and paper, control soil erosion and conservation of soil nutrients (Sharma 1987; Christanty *et al.* 1996).

Petung Bamboo (*Dendrocalamus asper*) has several cultivars, one of which is black cultivar, which is often used by industry as raw material for handicrafts. In addition to the functionality and high economic value, the potential for biomass production was also relatively high. Some

studies have estimated the total biomass of several species of bamboo with destructive sampling methods, but no one has tried to calculate the potential of biomass and carbon sequestration in black *petung* bamboo (*Dendrocalamus asper* cv. Black).

This study aims to determine the bamboo biomass and carbon biomass at each black *petung* bamboo, propagated by culm and rhizome cuttings after five years planted in the bamboo compartment of Botanical Gardens Bali. Further studies on a larger scale is needed to make modeling a bamboo forest in mitigating climate change, due to the bamboo forest ecosystem capable of storing substantial quantities of carbon (Fu Maoyi 2007).

2. Methods

To estimate the biomass production potential of black *petung* bamboo, twenty bamboo culms cut (aged 5 years), which were randomly selected from two hectares compartment of bamboo collection (8° 16'36 .80" S; 115° 09'28 .80" E; 1250 to 1400 m above sea level). Wet weight of all the bamboo parts (roots, culms and rhizomes, branches and leaves) were recorded directly after harvesting, using calibrated scales. Air dry weight recorded after a constant weight, bamboo samples saved and stored in a protected and a homogeneous environment, and this is done to speed up the constant conditions. Dry weight is considered as biomass (Brown 1997), while the biomass carbon is 50% of the weight of biomass (dry weight) (IPCC 1996). The number of culms of each clump were also recorded, and then extrapolated into the hectare, assuming a spacing of 5 x 5 m, resulting 400 bamboo clumps (KAU 2002).

3. Results and discussions

The results have been obtained some data, such as the number of culms in each clump, clump in a number of hectare, bamboo biomass and carbon biomass weights, where the weight of carbon biomass is defined as the carbon that is stored in all the bamboo parts (leaves, branches, culms, rhizomes and roots). Research results are presented in Table 1.

Table 1. Research results

Species	Number of culms (per clump)	Number of culms (per hectare)	Bamboo biomass (ton/ha)	Carbon biomass (ton/ha)
Dendrocalamus asper cv. black (propagated by culm cutting)	7	2,800	38.3	19.2
Dendrocalamus asper cv. black (propagated by rhizome cutting)	10	4,000	83.4	41.7

The results showed that black *petung* bamboo, propagated by culm cutting has less number of culms in each clump than black *petung* bamboo propagated by rhizome cutting. This is consistent with the fact that developed in the community, the number of culms produced from bamboo which is propagated by rhizome more than bamboo which is propagated by culm

cutting. But the quality of the culm (fiber, starch and density) resulting from the propagation of culm cutting is better than the results of rhizome cutting propagation (Sujarwo *et al.* 2012). In addition to counting the number of culms per clump, clump counting also carried out per hectare, it is done by extrapolating a spacing of 5 x 5 m, and can get 400 clumps on each hectare.

Biomass calculation was done by weighing the constant dry weight from all parts of bamboo such as leaves, branches, culms, rhizomes and roots. The results revealed that the constant dry weight of black *petung* bamboo propagated by culm and rhizome cuttings were 13.68 kg and 20.85 kg respectively. To find out the content of carbon biomass can be used the assumption of 50% of the biomass, so has been obtained 6.84 kg and 10.425 kg respectively of carbon biomass. When converted to units of hectares, the potential for biomass and carbon biomass of black *petung* bamboo reached 38.304 tons and 19.152 tons for black *petung* bamboo propagated by culm cutting, while 83.4 tons and 41.7 tons for black *petung* bamboo propagated by rhizome cutting. Comparison data between black *petung* bamboo biomass and some kinds of plant species in different ecosystem types, fully presented in Table 2.

Table 2. Comparison between black *petung* bamboo biomass and other plants in different ecosystems

Species / Ecosystem types	Biomass (ton/ha)
Dendrocalamus asper cv. black (propagated by culm cutting)	38.3
Dendrocalamus asper cv. black (propagated by rhizome cutting)	83.4
Phyllostachys pubescens (Maozhu) high yield stand	169.4
Phyllostachys pubescens (Maozhu) middle yield stand	115.0
Neosinocalamus affinity	62.3
Bambusa rigida	83.0
Dendrocalamus latiflorus	39.2
Phyllostachys nidularia cv. Smoth sheath	13.0
Acidosasa edutis Wen	14.0
Indosasa sinica (better site condition)	182.1
Indosasa sinica (poor site condition)	126.9
Conifer-broad leaf mixed stand	377.5
Ever-green broad leaf stand	398.6
Pinus massoniana	108.8
Cunninghania lanceolata	54.5
Natural secondly stands	114.0

Source: Maoyi (2007)

Table 2 shows black *petung* bamboo that was propagated by rhizome cutting contains a greater biomass, when compared with *Phyllostachys nidularia, Acidosasa edutis, Dendrocalamus latiflorus, Cunninghania lanceolata, Neosinocalamus affinit,* and *Bambusa rigida,* but still lower when compared to the tree, because tree is a type of vegetation that can store biomass and carbon in large enough quantities. But it is possible for a bamboo forest ecosystem to be developed as an option for mitigating climate change, because bamboo is a plant of rapid growth and highly productive (can be harvested each year), is widely used for the

manufacture of handicrafts and building products, as well as the ecosystems which more stable than the tree ecosystem. In addition, Indonesia is a rich country in diversity of bamboo species in the world, so bamboo is a plant species selected for green projects (Maoyi 2007).

4. Conclusions

The average biomass and carbon biomass per hectare for black *petung* bamboo (aged five year) propagated by culm and rhizome cuttings were 38.3 tons and 19.2 tons and 83.4 tons and 41.7 tons respectively. The results showed that black *petung* bamboo (*Dendrocalamus asper* cv. Black) has a potential carbon sequestration; this is an opportunity to develop a broader scale in relation to global climate change mitigation.

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