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Research Article

BIOMASS ACCUMULATION AND NUTRIENT DISTRIBUTION OF MELOCCANA BACCIFERA (ROXB.) KURZ. IN KOLASIB FOREST, MIZORAM INDIA

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ABSTRACT
Mizoram is popularly known as land of bamboos. The predominant bamboo species in Mizoram is *Maloccana baccifera* which covers a large area of forest. This paper deals with the growth, biomass accumulation and nutrient distribution of the same in natural condition. The result shows that the number of culms grown in six year old *Meloccana baccifera* plantation varies from 2165 to 4190 culms/ha.; the biomass ranges between 8.212 to 09.025 kg/culm and 195391 kg/ha to 36256.07 kg/ha. The order of nutrient concentration in all the four components- leaf, branch, culm and rhizome of the species is found in the order of K>N>Mg>Ca>P.

Key Words: *Bamboo, Maloccana Baccifera, Species, Growth, Biomass, Nutrient, Rhizome*

INTRODUCTION

The bamboos are giant woody tree like grasses. It has a long history as an exceptionally versatile and widely used resource to human kind. Bamboos occur in the natural vegetation of the tropical and temperate regions of the globe, but are found abundantly in tropical Asia, including India. India is the second richest country in bamboo genetic resource after China. In India, there are around 125 species of bamboos under 23 genera (Sharma, 1987; Varmah and Bahadur, 1980) of which about 66% of bamboo species are concentrated in North Eastern states of the country (Biswas, 1988). Their strength, straightness, lightness combined with extraordinary hardness, range in size, abundance, easy propagation and the short period in which they attain maturity make them suitable for a variety of purposes and hundreds of different uses have been reported from times immemorial. Even today, the bamboo continues to find new uses, such as paper making, rayon industry, construction, architecture, engineering, technology, handicrafts, food and medicine. No doubt, this amazing tree grass has played a significant role in the life and activities of man and perhaps no growing thing on earth has so many and as varied uses as the bamboo speaks off.

Mizoram, one of the North Eastern states of the Union of India is endowed with a rich forest cover of dense bamboo thickets and high rising trees. Around 75% of the geographical area of Mizoram is under bamboo cover found at heights ranging from 400 m. to 1500 m. above the sea level. Bamboo is mainly found along the river banks and abandoned jhum (slash and burn) land as dominant secondary vegetation. Bamboos as an important component of Mizoram forest play a significant role on ecology of the area; life and culture of the people. Out of 21 species of bamboos recorded in Mizoram, *Meloccanaebaccifera* (Roxb.) Kurz. (Mautak in Mizo) is the most important bamboo species in Mizoram (Jha and Laha, 2000; Rai and Jha, 2003). More recently, curiosity about the peculiar plant with their wide spread distribution, rapid rate of growth and multipurpose use has attracted the researchers as well as forest management.

The observation on growth and development of forest bamboos were worked out (Hasan, 1975; Biswas, 1995). However a report on growth and nutrient dynamic of bamboo in Mizoram after the flowering and growing of new shoots from the seeds is not yet known. Therefore, an elaborate study is carried out on the growth, biomass accumulation and nutrients distribution of bamboo (*Meloccana baccifera)* in the natural forest after flowering and growing new crop from seeds. But the raising of bamboo by seed is restricted since bamboos flower after long intervals of 35 to 40 years. So people in general propagate the bamboo

vegetatively by rhizome. But fortunately in Mizoram *Meloccana baccifera* along with other bamboos gave flowers during 2006 to 2007 after long interval of 45 years of time, giving opportunity to study in situ seed germination and growth.

Study Area and Methods

The study area is in Kolasib forest division of Kolasib district which lies in the extreme north of the state of Mizoram. The district stretches from 23^o 50' to 24^o 35'' North latitude and 92^o 30'' to 93^o00'' East longitude with humid subtropical hillocks as its distinctive feature. The average annual maximum and minimum temperature recorded is 27.22^oc and 18.61^oc respectively. The average annual maximum rainfall is 3650 mm and 2576 mm as its minimum rainfall.

The five sites for study areas were selected at different altitudes of the forest area ranging from 100 m to 1000 m. The study was carried out during the year 2007 to 2013. There was magnificent bamboo flowering in Kolasib forest during the year 2006 to 2007. A year later, i.e in 2008 the bamboo seeds germinated in abundance facilitating the required observation for the same. The numbers of culms in these selected sites were counted restricting to quadrates of 10×10 m^2. Thereafter five culms from each study site were selected randomly and observation was made for the basal area girth (DBH) height and number of nodes in all culms.

Next, for the estimation of the total biomass in relation to organic productivity, .three culms along with one of its rhizomes were randomly selected and gathered from each study site. The component parts of the material i.e, leaves, branches, culms and rhizome were subdivided and the weight of each component was estimated in the field and brought to the laboratory in plastics bags as subsamples and were dried in the oven at 150^o C. Then it was estimated and the average weight of the sample was used to calculate the total standing biomass of the studied area per hectare by multiplying with the total number of the bamboos in the mentioned area. The nitrogen and phosphorus content was estimated using a technicon, auto analyzer and the nutrients K, Ca, & Mg were analyzed by using an atomic absorption Spectrophotometer.

RESULTS AND DISCUSSION

The number of culms produced from six year old bamboo forest of five study areas A, B, C, D & E is furnished in Table-1. The data shows that the number of culms per hectare ranges between 2165 (B) to 4190 (E); average maximum height is 10 m (D); average maximum at breast height (DBH) is 7cm (A) and maximum average new shoots are 1528 (C).

The Table 2 furnishes the collection of biomass per culm basis where the leaf biomass ranges from 0.195Kg (B) to 0.256Kg (C); the branch biomass ranges from 0.276Kg (C) to 0.324 Kg (E) and culm biomass ranges from 07.142 to 08.030 Kg (B).

The rhizome biomass ranges between 0.403Kg (E) to 0.405Kg (D) and over all grand total mass varies from 08.212 kg (A) to 09.025Kg (B). Based on the collection of biomass per culm, the collection of biomass (DM) per hectare is observed and given in table III. It is noticed that the highest amount of total dry biomass (DM) is 36256.07Kg/ha and lowest record is 19539.13 Kg/ha.

Table IV indicates the concentration of nutrients component present in percentage. The data shows that the percentage concentration of nutrients in order of nitrogen, phosphorous, potassium, calcium and magnesium is 0.65%, 0.09%, 0.75%, 0.25 % and 0.35% in leaf; 0.05%, 0.08 %,0.80 %,0.24% and 0.32% in branch; 0.45 %,0.07%, 0.75%, 0.21% and 0.28% in culm and 0.40%, 0.06%, 0.60%, 0.18% and 0.25% in rhizome. This shows that the order of nutrients concentration is K>N>Mg>Ca>P in all the mentioned component parts of *Meloccana baccifera.*

The nutrient elements – K, N, Mg, Ca & P are found in same nutrient order in all four components- leaf, branch, culm & rhizome as K>N>Mg>Ca>P. This shows its variations from the previous studies of *Dendrocalamus hamiltonii* (Toky and Ramakrishnan, 1983), *Bambosa balcoa*; *Dendrocalamus strictus*, *Thyrostachys olivery* (Tewari *et al.*, 1994) and *Bambosa bamboo* (Shanmughave and Francis, 1995), but keeps the agreement with *Bambosa khasiana* .The total amount of nutrients elements are calculated per

hectare basis (table V), where nitrogen is 187.20 kg, phosphorus 29.85 kg, potassium 303.87 kg & magnesium 117.22 kg. The productivity of bamboo is studied on the basis of the number of culms & new shoots produced annually. The production of new culms generally depends on the degree of congestion, the age and the rainfall of the previous year (Shanmughavel, 1995). The total standing biomass is calculated on the basis of number of culms per hectare multiplied by the total above ground biomass of the sample culms, according to which the grant total dry matter measured 19539.13 kg/ha to 36256.07 kg/ha DM at the age of six. When this was compared with other biomass measurement made for *Bamboosa vulgaris* (Chinte, 1965) measuring 6-7 tons, 297 tons for *Bamboosa bamboo* (Shanmughave and Francis, 1992) and 719 tons for *Gigantochloa scortechnii* in Malaysia (Othman, 1992), the accumulation of biomass in *Meloccana baccifera* plantation was much lesser measuring 1.95 ton to 3.63 tons approximately.

Table 1: Characteristics of *Meloccana baccifera*

Growth Characters	**SAMPLE CHARACTERS**				
	A	**B**	**C**	**D**	**E**
Total Culm(no/ha)	3634	2165	2970	3280	4190
Average Height(m)	8±4	9±2	7.6±3	10±3	8.2±4
Average DBH(cm)	17±2	19±3	16±4	17.5±4	18±5
Average New Shoots	1230±16	1080±18	1528±9	1190±8	1360±7
No. of nodes(nos)	31±4	23±5	28±2	26±4	29±3

Table 2: Collection of Biomass in Culm Basis

Samples	**Biomass(Kg/ Culm)**			**Total above ground Biomass (Kg)**	**Rhizome (Kg)**	**Grand Total biomass (Kg)**
	Leaf	**Branches**	**Culm**			
A	0.215±0.10	0.323±0.22	07.250+.02	07.788±0.32	0.424±0.32	08.212±0.64
B	0.195±0.30	0.290±0.40	08.030±0.4	08.515±0.74	0.510±0.61	09.025±1.35
C	0.256±0.08	0.276±0.50	07.425±0.3	07.957±0.61	0.441±0.40	08.398±0.87
D	0.246±0.25	0.318±0.62	07.142±0,6	07.706±0.93	0.465±0.26	08.717±1.33
E	0.251±0.30	0.324±0.24	07.675±0.4	08.250±0.58	0.403±0.50	08.653±1.08

Table 3: Collection of Biomass in Hectare

Samples	Biomass (Kg/ Culm)			Total Above ground Biomass (Kg)	Rhizome (Kg)	Grand Total biomass (Kg)
	Leaf	Branches	Culm			
A	781.310	1173.78	26346.50	28301.59	1540.82	29842.41
B	422.175	62785.	17384.95	18434.97	1104.15	19539.13
C	760.320	819.72	22052.25	23632.29	1309.77	24942.06
D	806.880	1043.04	23425.76	25275.68	1525.20	26800.88
E	1051.69	1357.56	32158.25	34567.50	1688.57	36256.07

Table 4: Nutrient concentration in Biomass Component (%)

Nutrients	Leaf	Branch	Culm	Rhizome
N	0.65± .030	0.50± 0.21	0.45± 0.18	0.40± 0.25
P	0.09± 0.20	0.08± 0.16	0.07±0.012	0.06± 0.44
K	0.75 ±0.26	0.80± 0.35	0.75 ±0.18	0.60 ±0.28
Ca	0.25± 0.33	0.24 ±0.26	0.21± 0.55	0.18± 0.12
Mg	0.35± 0.28	0.32± 0.26	0.28± 0.16	0.25± 0.15

Table 5: Nutrient Concentration in Biomass Component in Hectare

Nutrients	Leaf (Kg)	Branch (Kg)	Culm (Kg)	Rhizome (Kg)	Total (Kg)
N	5.97	67.20	109.23	5.73	187.20
P	0.69	11.00	16.99	0.86	29.85
K	5.73	107.49	182.05	8.60	303.87
Ca	1.19	32.25	50.25	2.58	85.13
Mg	2.68	42.99	67.97	3.58	117.22

The study also showed that nutrient potassium is predominant over N, Ca, Mg, P like in *Dendrocalamus hamiltonii* (Chinte, 1965) and *Bambusa bamboo* (Shanmughave & Francis, 1992) with nutrient order of K>N>Mg>Ca>P which is different from *Bambusa khasiana* where the nutrient order is K>N>Ca>Mg>N (Prichett,1979). The study and observation made showed clearly that *Maloccano baccifera* is the fastest multiplying species of bamboo in Mizoram. It can produce adequate mineral nutrients cycling in jhum (shifting cultivation) in short period of time. Besides, it has multiple utility in Mizoram. The study

recommended that the bamboo *Maloccana baccifera* is suitable for the ecological and economy of the region.

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