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BASELINE STUDY FOR ASSESSING POTENTIAL FOR IMPROVEMENT OF PRODUCTIVITY OF BAMBOO

(FINAL TECHNICAL REPORT OF THE PROJECT KFRI RP 712.3/2015)

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Abstract of Project Proposal

Code	**KFRI RP 712.3/2015**
Title	**Baseline Study for Assessing Potential for Improvement of Productivity of Bamboo**
Objectives	a) To characterize culm physical properties in different species of bamboo planed in Kerala B) The assess culm biomass and biomass accumulation potential of different species bamboo planted in Kerala.
Project period	September 2015- September 2016
Funded by	National Bamboo Mission under its Project `Bamboo Technical Support Group – KFRI'
Scientific personnel	U.M. Chandrashekara V.P. Raveendran

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BASELINE STUDY FOR ASSESSING POTENTIAL FOR IMPROVEMENT OF PRODUCTIVITY OF BAMBOO

A. Abstract

In the rapidly changing socio-economic and marketing opportunities, both at the regional and national level, cultivation of different species of bamboo is gaining importance. The National Bamboo Mission has initiated programmes to increase the area under bamboo plantations in government and private lands outside forests to supplement farm income and contribute towards resilience to climate change as well as availability of quality raw material requirement of industries. As part of a NBM funded programme, the Kerala Forest Research Institute undertook a project to promote cultivation of 14 species of bamboo *(Bambusa balcooa* Roxb., *Bambusa bambos* (L.) Voss, *Bambusa nutans* Wall. ex Munro, *Bambusa tulda* Roxb., *Bambusa vulgaris cv. wamin* McClure, *Bambusa vulgaris* Schrad. ex Wendl., *Bambusa wamin* E.G.Camus, *Dendrocalamus asper* (Schult.) Backer, *Dendrocalamus hamiltonii* Nees & Arn. ex Munro, *Dendrocalamus longispathus* (Kurz) Kurz, *Dendrocalamus sikkimensis* Gamble ex Oliv., *Dendrocalamus strictus* (Roxb.) Nees, *Gigantochloa rostrata* K.M.Wong and *Thyrsostachys oliveri* Gamble), prioritized by the NBM as commercially important species, in the State of Kerala. Since these species were planted in the same geographic region and clumps are of same age (5-year old), a study was undertaken on their culm characteristics and biomass production potential. The total number of culms per clump in different species varied between 5 and 32 and with lowest number in *D. strictus* and highest in *B. bambos*. The mean culm diameter was high in *B. bambos* (8.0 cm). Culm wall thickness and culm weight in different species did not correlate significantly. Partitioning of culm biomass among stem, branches and leaf components in different bamboo species indicated a common pattern with 67%, 23% and 10% of total culm weight distributed among stem, branches and leaves respectively. This observation may be useful to estimate the total culm biomass, once the weight of any one of the three components is known. Regression equations between culm diameter and weight of each culm component, and also between d^2h (culm diameter^2 x culm height) and weight of

each culm component were developed. In ten out of fourteen species studied there exists significant correlation between biomass of three components (stem, branch, leaf) and dbh or $((dbh)^2 \times h$. However, in *B. balcooa, B. nutans, B. tulda, D. strictus,* correlation between leaf biomass and independent variable (dbh or $((dbh)^2 \times h$) was weak. The estimated total biomass in 5-year old bamboo farms of different species varied from 10.6 t ha^{-1} (*D. sikkimensis*) to 95.7 t ha^{-1} (*B.bambos*). The annual biomass production was also comparatively high in *B. bambos* (19.8 t ha^{-1} yr^{-1}) and low in *D. longispathus* (2.5 t ha^{-1} yr^{-1}).Thus attempts may be made in the State to promote different species of bamboo considering farmers' requirement, marketing opportunities, and requirement of bamboo-based micro and macro industries. At the same time package of practice to enhance their biomass production potential need to be evolved.

B. Introduction

Biomass is the total quantity of organic matter per unit area present in an ecosystem at a given time and may relate to a particular species or, a group of species of a community as a whole. The biomass accumulated in a given unit period (generally, one year period) represents the productivity. Productivity is one of the most important functional attributes of an ecosystem and this provides basic energy and matter for all the other biotic components of the ecosystem (Billore and Mall, 1977). Importance is given for assessing plant productivity in an ecosystem as it provides basic energy and matter for all the other biotic components of the ecosystem. At the same, productive potential of a species or a community is also an indication of their contribution to overall organic matter production in a given a given ecosystem.

In the tropics, it is estimated that the energy generated from sunlight per hectare per year is equivalent to that generated by 2,000 tonnes of dry biomass. In addition, the tree community has the potential to generate 200 dry tonnes of biomass per hectare per annum through photosynthesis and this is equivalent to 10 per cent energy yield from sunlight. However, available literature indicates that that maximum productivity in tree community with the fast growing abilities could reach 20 tonnes per hectare per annum. On the other hand, studies have shown that with the right genetic material, growing condition and management, bamboo can yield up 80 dry tonnes per hectare per annum. Apart from its ability to produce biomass at

a faster rate and contribute significantly for carbon sequestration, bamboo has the ability to a serve as the viable substitute for timber and tropical hardwoods (Nath et al., 2015). Thus, bamboo has gained global importance as a major biomass resource, as a traditional source of energy and other multiple uses with high growth rates, and as a prominent bioresources which is having the ability to provide a number of potential ecosystem services including carbon sequestration (Zhang et al., 2014). In a rapidly changing scenario of socio-economic and marketing opportunities, bamboo is being elevated from the "poor man's timber", to the status of the "timber of the 21st century" (http://agricoop.nic.in/bamboo/bamboomission.html). It may be mentioned here that one of the objectives of the National Bamboo Mission is to increase the area under bamboo plantation in non- forest Government and private lands to supplement farm income and contribute towards resilience to climate change as well as availability of quality raw material requirement of industries. Similarly, the Kerala Forest Research Institute has recognized the fact that the scope of bamboo plantation has to go beyond forest jurisdiction to non-forest lands in order to develop a strong bamboo resource base and strengthen economy related to bamboo in the State of Kerala. Thus, the Institute has initiated several activities for lending support to stakeholders by providing both propagules and technical guidance for cultivating and managing bamboos. For instance, during the year 2010-11, as part of different research and extension projects a total of 14 species of bamboo, prioritized by the National Bamboo Mission as commercially important species were planted in the State (Chandrashekara and Raveendran, 2018) and all these species are included in this study. Since these species are planted in the same geographic region, the knowledge generated on the growth and biomass production potential is important for sustainable commercial utilization of these species. At the same time, some of the previous studies (Shanmughavel and Francis, 1996; Isagi et al., 1997; Yen et al., 2010; Yen and Lee, 2011; Jijeesh, 2013) indicated considerably high level of biomass accumulation in a short period in some bamboos species, such as *Bambusa balcooa, Bambusa bambos, Phyllostachys pubescens and Phyllostachys makinoi.* These studies also highlighted the fact that comparative assessment of different species of bamboos for physical and biomass production and accumulation properties of culms in clumps of same age are very important not