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Ashwini M Wadhu
M.Sc. Student (Forest Biology and Tree Improvement), College of Forestry, DBSKKV, Dapoli, Maharashtra, India

AD Rane
Associate Professor, College of Forestry, DBSKKV, Dapoli, Maharashtra, India

SS Desai
Assistant Professor, College of Agriculture DBSKKV, Dapoli, Maharashtra, India

VD Tripathi
Assistant Professor, College of Forestry, DBSKKV, Dapoli, Maharashtra, India

PR Kolhe
Officer Incharge AKMU, DBSKKV, Maharashtra, India

VR Narvankar
M. Sc. Student (Forest Biology and Tree Improvement), College of Forestry, DBSKKV, Dapoli, Maharashtra, India

SS Ghole
M.Sc. Student (Forest Biology and Tree Improvement), College of Forestry, DBSKKV, Dapoli, Maharashtra, India

Corresponding Author:
Ashwini M Wadhu
M.Sc. Student (Forest Biology and Tree Improvement), College of Forestry, DBSKKV, Dapoli, Maharashtra, India

Suitability of *Dendrocalamus stocksii* in structural work

Ashwini M Wadhu, AD Rane, SS Desai, VD Tripathi, PR Kolhe, VR Narvankar and SS Ghole

Abstract
Dendrocalamus stocksii is a one of the important crop belonging to the family Poaceae and sub family Bambusoideae. It is naturally distributed in the Central Western Ghats of Maharashtra, Goa, Karnataka and Kerala. It is widely used as a building material for scaffolding, housing, furniture, fences, stakes, handicrafts, decorative arts and other farming equipment, while the young shoots are edible. College of Forestry has 63 accessions of *Dendrocalamus stocksii* collected from all over Western Ghats and planted at Biodiversity Park as a germplasm in 2014. Each accession collected from different location and possesses different genetic variations. The basal diameter of 10 selected superior old culms ranged from 48 – 55 mm. The average number of strips estimated per culm ranges from 141.3 – 172 strips. The different parameters of *D. stocksii* were observed for scaffolding purpose such as the average diameter (40.32 to 50.7 mm), height of culm (6.5 to 12 m), commercial height (3.43 to 7.8 m), number of nodes (28 to 36), tapering (pass), straightness of culms (pass), culm wall thickness (16 to 22.5 mm), fresh weight (6.04 to 8.35 kg) and dry weight (5.04 to 6.73 kg), and strength of culm (14.85 to 18.44 Gpa).

Keywords: *Dendrocalamus stocksii*, manga CPCs, yield performance of CPC series, strips, scaffolding

1. Introduction
Bamboo was considered as in the category of 'Tree', but in 2017, the amending Section 2(7) of Indian Forest Act, 1927 is passed, so now bamboo is no longer a tree and felled bamboo too is not timber and it is consider under the Non-Forest-Timber.
Dendrocalamus stocksii is a strong, arborescent, thornless and mid-size bamboo species with loosely spaced solid erect culms. It is naturally distributed in the Central Western Ghats of Maharashtra, Goa, Karnataka and Kerala. It is commonly known as Manga and Marihal (Viswanath et al., 2013) [8]. *D. stocksii* is cultivated widely in Western Ghats, as a major source of income and livelihood where it gives a steady income to farmers. *D. stocksii* has remarkable ecological and economic importance (Singhal and Gangopadhyaya, 1999) [7].
It is widely used as a building material for scaffolding, housing, producing furniture, fences, stakes and other farming equipment, as well as handicrafts, crafts, and other decorative arts (Viswanath et al., 2013) [8]. According to VIII World Bamboo Congress, the productivity of bamboo can be enhanced by manifolds, by the selection of superior clumps, and by multiplying them for use in plantations. The existence of a lot of variability in bamboos in phenotypic and genotypic characters can be exploited using suitable methods of quantitative genetics for improving the productivity of bamboos in the country.

2. Material and Methods
There was no work done previously related to strips making and scaffolding in *D. stocksii*, but it has the best suitability for strips and scaffolding purpose. Hence we were conducted this study. The experiment was conducted at the Biodiversity Park and Wood workshop of the College of Forestry, Dapoli (M.S.) during the year 2021-2022. College of Forestry has 63 accessions of *Dendrocalamus stocksii* collected from all over Western Ghats and planted at Biodiversity Park as a germplasm in 2014. Each accession collected from different location and possesses different genetic variations. All 63 accessions were evaluated for their growth performance. Visually superior clumps were identified and marked. Various physiological, morphological, and genetical parameters were evaluated for each accession. The CPCs were selected based on comparative approach and grading for desirable characteristics.

2.1 Yield performance o CPC series
Yield performance of *D. stocksii* CPCs was estimated in various terms as follows: Number of

harvestable culms/years, Number of strips per Culm per Clump, Width of strips, Total weight of strips per culm, Number of slivers per strips.

- **Criteria for Strips Making:** The species should have long internodal length, thicker walled, hollow in nature and straight culms.
- **Criteria for Scaffolding:** The species should have bigger diameter, thick hollow tube structure, straight and tapered culms.

3. Statistical analysis

The data were analyzed by using AGRESS 7.0 statistical software.

4. Results and Discussion

4.1 Growth Performance of CPC series

The correlation matrix indicates that basal diameter positively correlated with other parameters namely 5th internodal diameter, culm height, commercial height and culm biomass. Hence, the criteria for selection of CPC were based on basal diameter of old culms. As culm diameter has had a positive correlation with all the other culm character, this character was selected to identify superior culms. The selection of phenotypically superior clumps was based on comparative approach with the mother data and grading for desirable characteristics. The basal diameter of 10 selected superior old culms ranged from 48 – 55 mm. It is has been well understood that culm diameter and height should be considered for the selection of superior bamboo clones for the purpose of scaffolding and furniture (Criteria for selection of superior bamboo varieties, propagation and plantation establishment - Fu Maoyi (bioversityinternational.org)). The growth data of selected CPCs were presented in the figure 1.

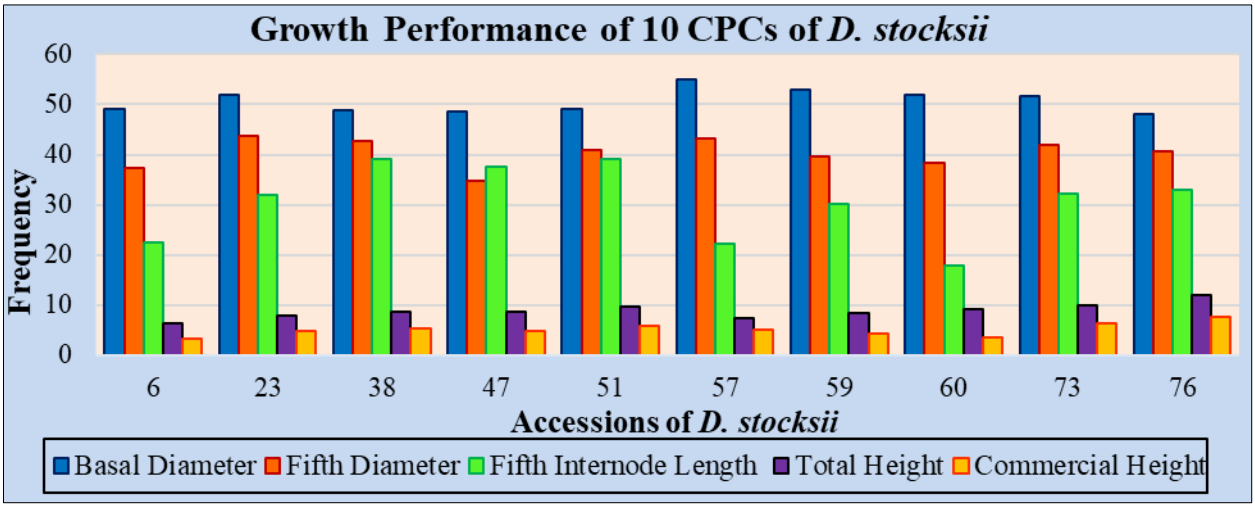

Fig 1: Growth Performance of 10 CPCs of *D. stocksii*.

4.2 Yield performances for strips and scaffolding

D. stocksii CPC series has long internodal length (> 30 cm) with thicker walled, hollow and straight culms which are suitable for strips making purpose. On and average 158.6 strips were extracted per culm from the CPC series.

Table 1: Comparative yield performance of *D. stocksii* CPC series for strips

CPC series	Accession code	Harvestable culms/year	No. of strips/culm	Width of strips/ culm (mm)	Thickness of strips (mm)	Length of strips (cm)	Wt. of strips/culm (kg)	No. of slivers/culm
CPC 1	06	5.67	141.3	14.06	11.13	18.33	3.85	863.7
CPC 2	23	8.00	157.3	12.47	12.67	23.67	4.28	999.7
CPC 3	38	8.67	148.7	17.06	11.17	20.00	3.94	960.3
CPC 4	47	6.67	167.3	13.67	12.33	20.67	4.18	999.7
CPC 5	51	8.67	162.0	15.13	14.87	23.00	4.27	1,006.7
CPC 6	57	8.33	154.7	14.67	12.67	26.33	3.96	999.7
CPC 7	59	6.67	158.7	13.47	11.57	22.33	3.96	959.7
CPC 8	60	7.00	164.7	12.57	12.87	28.33	4.17	999.7
CPC 9	73	7.67	172.0	17.47	14.57	27.67	4.39	1,015.3
CPC 10	76	7.33	159.3	11.63	11.33	22.33	3.95	960.3
Mean		7.47	158.6	14.22	12.52	23.27	4.09	976.5

Strip thickness of the bamboo species ranged from 14.87 mm to 11.133 mm, with CPCs of *D. stocksii* species providing thicker strips. The higher culm wall thickness at the base is due to the solidness at the base.

Table 2: Yield of promising *Dendrocalamus stocksii* (Manga) CPC series for scaffolding

Name of Descriptors	Basal Diameter (mm)	Fifth Internode Diameter (mm)	Fifth Internode Length (cm)	Height (m)	Commercial Height (m)	No. of Internodes	Taper	Straightness	Culm Wall Thickness (mm)	Avg. Fresh Wt.	Avg. Dry Wt.	Strength (GPa)
CPC 1	49.2	37.4	22.4	6.5	3.43	29	Pass	Pass	18.4	6.04	5.04	18.44
CPC 2	52	43.6	32	8.05	4.87	29	Pass	Pass	20	8.35	6.39	16.55
CPC 3	48.8	42.8	39.02	8.8	5.4	30	Pass	Pass	22.2	6.4	5.22	15.21
CPC 4	48.6	34.8	37.7	8.58	4.77	28	Pass	Pass	20.1	8.29	6.73	14.85
CPC 5	49.2	40.8	39	9.7	6	36	Pass	Pass	16	7.15	6.16	17.4
CPC 6	55	43.2	22.2	7.53	5.13	35	Pass	Pass	22.5	7.89	7.14	16.54
CPC 7	52.8	39.6	30.2	8.43	4.27	29	Pass	Pass	21.5	7.82	6.17	15.55
CPC 8	51.8	38.4	18	9.17	3.53	30	Pass	Pass	20	7.34	6.72	17.3
CPC 9	51.6	42	32.22	9.9	6.5	29	Pass	Pass	22.1	7.05	6.06	15.5
CPC 10	48	40.6	33	12	7.8	34	Pass	Pass	21.8	7.88	6.72	18.3
Mean	50.7	40.32	30.57	8.86	5.17	30.9	-	-	20.46	7.421	6.24	16.56

D. stocksii CPC series has 45- 60 mm Diameter with thicker hollow tube structure having straight and tapered culms which are suitable for scaffolding purpose. It is a close associate of *Mes bamboo* have a habit of producing solid culms at the base and also the ratio of culm diameter to culm wall thickness is 1:3. This ratio is beneficial for value addition in bamboo especially strips and furniture (Rane *et al*., 2019) [3].

5. Conclusion

- Basal diameter showed very significant and positive relationship with fifth internodal diameter, total culm height, commercial height and also influencing clump biomass.
- CPC series shows the best growth and yield performance.
- Tapering was observed among all the accessions.
- It is conclude that the selected 10 CPC series are suitable for the strips and scaffolding purposes.

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