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RESEARCH PAPER

Estimating the clonal multiplication potential of different bamboo species through branch mini-cutting

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Abstract: Assessing the efficiency of nodal cutting in clonal propagation is crucial for understanding how bamboo culms can be effectively propagated through branch mini cutting. This capability varies across various bamboo species. Enhancing the quantity of mini-cuttings from branches can enhance the clonal propagation of bamboo, ultimately resulting in a greater production of propagated material.The potential of mini-cuttings from branches on various aspects were evaluated based on data gathered from published sources. The study was conducted in twelve bamboo species *i.e.Bambusa vulgaris* (green), *Dendrocalamus brandisii*, *Bambusa balcooa*, *Guadua angustifolia*, *Bambusa vulgaris (yellow)*, *Bambusa nutans*, *Bambusa multiplex* (green), *Bambusa multiplex* (yellow), *Dinchloa compactiflora*, *Ochlandra scriptoria*, *Dendrocalamus stocksii*, *Guadua parvifolia.*The divergence in branch mini-cutting potential among these bamboo species is quite striking. *Bambusa vulgaris* (Green) exhibited maximum potential up to 1,76,400 branch mini-cuttings per clump per year. Close behind is *Dendrocalamus brandisii*, with a noteworthy yield of 70,818 mini-cuttings, In stark contrast, *Guaduaparvifolia* lags behind with the lowest branch mini-cutting yield, offering a mere 6,240 mini-cuttings per clump per year. This variation in branch mini-cutting potential emphasizes the importance of species selection in bamboo clonal propagation.

Key words: Branch mini cuttings, Clonal propagation, Propagated material

Introduction

Bamboo belongs to family Poaceae, a woody grass family. Bamboo has an extensive and ancient association with humanity, finding widespread use in household items and expanding into industrial applications due to advancements in processing techniques and rising market requirements.There are more than 90 genera and 1200 species of boundary worldwide. In India there are about 125 indigenous, 11 exotic species representing 23 genera of bamboos (Anon, 2007). Bamboo occupies a dominant position in the understory of tropical, temperate and subtropical forests in the world (Hogarth and Belcher, 2013).

As the global population continues to grow, and living standards improve, the disparity between the demand and supply of bamboo for purposes such as pulping and other uses is widening. Natural bamboo forests, due to their low productivity and declining population, are unable to meet these demands. To bridge this gap, it becomes necessary to establish intensively managed high-density bamboo plantations and explore unconventional propagation methods, such as branch cuttings (Tripathi *et al.,* 2020).

The life cycle of many bamboo species is characterized by a distinctive pattern, where they have extended periods of vegetative growth, followed by synchronized flowering and senescence of the entire population across large areas. This phenomenon occurs at irregular intervals, varying from 6 to 120 years (Janzen, 1976). Their gregarious flowering pattern affects seed availability and regular raising of seedling becomes impractical. Moreover, the limited viability of bamboo seeds and their poor storage characteristics further hinder the possibility of regular seedling cultivation (Sujatha *et al.,* 2008). Hence, propagating through branch mini cuttings becomes important because they serve as an efficient means of mass propagation.

Assessing the capability of nodal cuttings for clonal propagation is crucial for understanding the potential of bamboo culms in a clump in producing branch cuttings. The potentiality varies between the species. A higher quantity of branch mini cuttings can enhance clonal propagation, resulting in an increased availability of Quality Planting Material.

Material and methods

The potentiality of branch mini-cuttings was computed using secondary data. Secondary data on various aspects were calculated from publishes sources such as (Bennet and Gaur, 1990; Gaikwad *et al.,* 2021; Benton, 2015; Rane *et al.,* 2016) (Table 1). The following commercially important bamboo species were focused *viz.,Bambusa vulgaris* (Green variety), *Dendrocalamus brandisii*, *Bambusa balcooa*, *Guadua angustifolia*, *Bambusa vulgaris* (Yellow variety*)*, *Bambusa nutans*, *Bambusa multiplex* (Green variety), *Bambusa multiplex* (Yellow variety), *Dinchloa compactiflora*, *Ochlandra scriptoria*, *Dendrocalamus stocksii* and *Guadua parvifolia.*

Mean number of culms per clump, mean culm height, number of nodes per metreof culm, number of 1st degree and 2nd degree branches per metre of culm were compiled from different sources. Practical verification of these values was done by observing in the bamboosetum maintained at the College of Forestry, Sirsi.

To arrive at the potentiality of each species to supply mini-cuttings, the following equation was adopted.

i. Number of harvestable mini-cuttings per clump (N)

N = [(B+C) × A × D]

A - Mean number of culms/clump

B - Mean number of mini-cuttings available per meter length of 1st degree branch

C - Mean number of mini-cuttings available per meter length of 2nd degree branch

D - Mean culm height (meter)

ii. F = Number of mini-cuttings/clump/year

F = (E×3)

It was assumed that 3 times in a year such cuttings can be harvested from clump.

E - Number of mini - cuttings clump [(B+C) × A × D]

F - Number of mini - cuttings/clump/year (E x 3)

Results and discussion

Surprisingly large variation was observed among species, *Bambusa vulgaris* (Green), maximum number of branch mini-cuttings can be available per clump per year (1,76,400) followed by *Dendrocalamus brandisii* (70,818), where there are maximum number of culms (Table 1 and Fig.1). The minimum number of branch mini-cuttings can be obtained per clump per year is from *Guadua parvifolia* (6,240). Maximum number of culms is also obtained in *Dendrocalamus brandisii* reported by Gaikwad *et al.* 2021 (Table 2 and Fig.1).

Bambusa multiplex (green) exhibits the highest average count of mini-cuttings attainable per meter length of the first-degree branch (24). *Bambusa balcooa* stands out with the greatest average quantity of mini-cuttings achievable per meter length of the second-degree branch, amounting to 60. Notably, *Dinchloa compactiflora* and *Ochlandra scriptoria* do not possess second-degree branches (Table 2 and Fig.1).

Table 1. References for various bamboo species

Species	References
Bambusa vulgaris (Green variety)	Anon, 2016
Dendrocalamus brandisii	Bennet and Gaur, 1990; Gaikwad *et al.* 2021
Bambusa balcooa	Bennet and Gaur, 1990; Gaikwad *et al.* 2021
Guadua angustifolia	Benton, 2015; Anon, 2016
Bambusa vulgaris (Yellow variety)	Anon, 2016
Bambusa nutans	Bennet and Gaur, 1990; Gaikwad *et al.* 2021
Bambusa multiplex (Green variety)	Anon, 2016
Bambusa multiplex (Yellow variety)	Anon, 2016
Dinchloa compactiflora	Bennet and Gaur, 1990; Anon, 2016
Ochlandra scriptoria	Benton, 2015
Dendrocalamus stocksii	Anon, 2023; Rane *et al.* 2016
Guadua parvifolia	Anon, 2016

The maximum number of culms per clump observed in *Bambusa vulgaris* (green) *i.e.* 90 followed by *Bambusa vulgaris* (yellow) *i.e.* 60, then by *Bambusa nutans* (45) reported by (Benton, 2015). The minimum number of culms per clump observed in *Bambusa balcooa* (14).

Bambusa balcooa is one of the most important commercial species with high demand, hence use of nodal cutting could be easily adapted by farmers and produce upto 50,000 clonal sapling. This innovation may help to reduce or the dependency on expensive tissue culture plants as well as provide a much control to produce desirable plants to farmers.

Growth and developmental characteristics of individual bamboo species are greatly influenced by their genetic makeup,

Table 2. Number of branch mini-cuttings potential to be harvested non-destructively from one full grown clump, in different bamboo species

Bamboo Species	A	B	C	D	E	F
Bambusa vulgaris (green)	90	9	40	20	88,200	1,76,400
Dendrocalamus brandisii	37	9	20	33	35,409	70,818
Bambusa balcooa	14	9	60	30	28,980	57,960
Guadua angustifolia	22	9	30	30	25,740	51,480
Bambusa vulgaris (yellow)	60	4	16	20	24,000	48,000
Bambusa nutans	45	9	30	13	22,815	45,630
Bambusa multiplex (green)	40	24	40	7	17,920	35,840
Bambusa multiplex (yellow)	35	20	30	7	12,250	24,500
Dinchloa compactiflora	40	9	-	33	11,880	23,760
Ochlandra scriptoria	30	22	-	10	6,600	13,200
Dendrocalamus stocksii	20	11	10	9	3,780	7,560
Guadua parvifolia	20	6	20	6	3,120	6,240

Column Headings:

A - Mean number of culms/clump

B - Mean number of mini - cuttings available per meter length of 1st degree branch

C - Mean number of mini - cuttings available per meter length of 2nd degree branch

D - Mean culm height (meter)

E - Number of mini - cuttings clump [(B+C) × A × D]

F - Number of mini - cuttings/clump/year (E x 3)

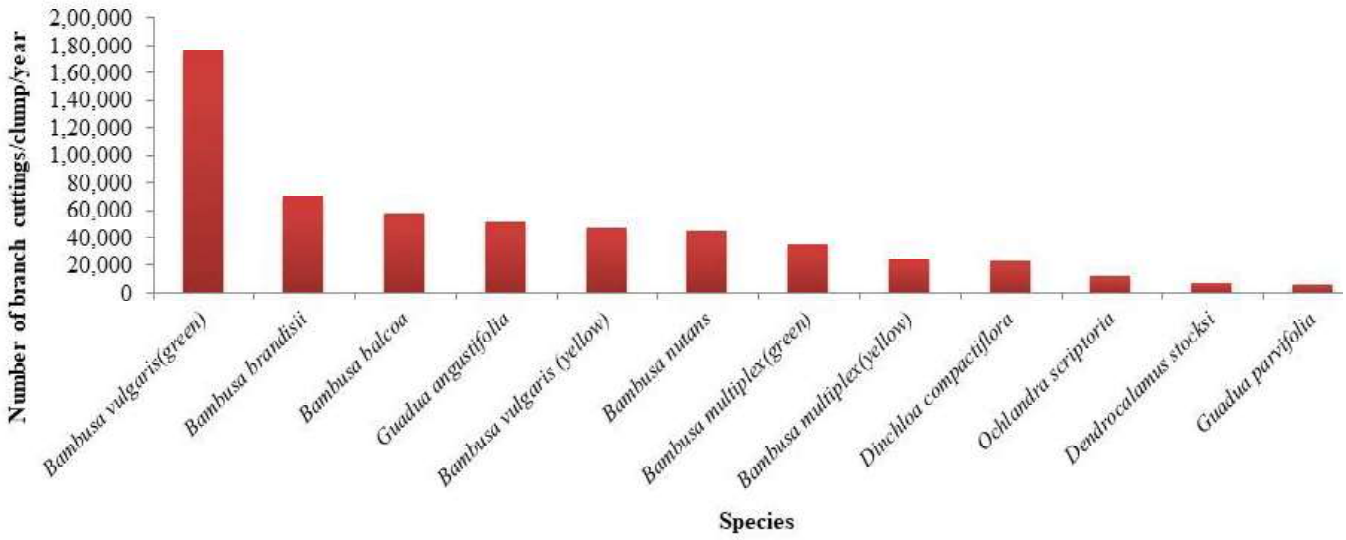

Fig 1. Potentiality of branch mini-cuttings of different bamboo species

prevailing climatic conditions, genotype and environmental interactions (Gaikwad *et al.*, 2021).

Conclusion

In conclusion, the potential for clonal propagation of bamboo through branch mini-cuttings varies significantly among different bamboo species. *Bambusa vulgaris* (green) and *Dendrocalamus brandisii* stand out as species capable of producing a substantial number of mini-cuttings per clump annually, with 176,400 and 70,818 mini-cuttings, respectively. On the other hand, *Guadua parvifolia* exhibits the lowest potential in this regard, yielding only 6,240 mini-cuttings per clump per year. These findings highlight the importance of considering the specific bamboo species when planning for clonal propagation and the potential for increased propagation material.

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