

Seed Setting in *Dendrocalamus strictus* Nees. (Male Bamboo) in Himachal Pradesh

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Abstract

Male bamboo (*Dendrocalamus strictus* Nees.) is a promising renewable natural resource and its benefits are spread through employment provision, income generation and environment protection. Present study was undertaken to study seed set in culms and clumps during mass flowering, to grow seedlings in nursery from seed for meeting demands for planting stock in natural forests located in Parwanoo, Kothi and Namhol in HP in the altitudinal range of 712—950 m above msl. The seed sources differed non-significantly among themselves in respect of all morphological characters. Study concluded that selection of phenotypically superior material/clumps will be useful for improved genetic gain in the extension of bamboo cultivation. Bamboo based agro-forestry models will provide high economic returns, improve the soil and will fill the gap of national forest cover providing raw material to industry and domestic use of rural community.

Key words : Male bamboo, *Dendrocalamus strictus*, Seed setting, Flowering behavior, Regeneration.

Bamboos are the most important forest produce for rural communities in Asia and Pacific. About 130 species are reported from India (1). The largest forest cover/area under bamboo is in India with 10.03 million ha of bamboo forests or 12.8% of the total forest area. The principal bamboos are *Dendrocalamus strictus* Nees and *Bambusa arundinacea* with an overall production of 5 million tons. In Himachal Pradesh, eight species are reported and major share is of *Dendrocalamus strictus* Nees. (2). Bamboos are eco-friendly material and have wide application and uses at the domestic and industrial level. *Dendrocalamus strictus* (male bamboo) has multiple uses including house construction, basket making, mats, furniture, agriculture implements, tools handles and chinks for doors and windows and fodder also. Over the years, the demand for its raw material culms has increased greatly due to over growing human population. This demand cannot be met indefinitely unless we go for large scale plantation of the forest wealth. Drier hill slopes and the drier plains are highly suitable for raising plantation of this resource. But most important limiting factor for the cultivation of this bamboo is lack of information regarding its flowering behavior, seed setting and regeneration. At

present regeneration work is being carried out by using traditional vegetative method i.e. offsets and rhizomes. These offsets and rhizome are bulky, heavy and difficult to transport. Therefore, these methods are impractical for use in large scale plantation programs. Hence, it becomes essential to grow seedlings in nursery from seeds for meeting demands for planting stock. So, keeping in view the importance of this species, the present study was undertaken to assess seed set in culms and clumps during mass flowering, as it will help in plant ecology, environmental conservation and regeneration potentials.

Methods

The investigations were conducted in the Department of Tree Improvement and Genetic Resources, College of Forestry Dr Y. S. Parmar University of Horticulture and Forestry, Nauni, Solan (HP). Twenty one flowering clumps of *Dendrocalamus strictus* from different parts of Himachal Pradesh with a considerable geographic distance isolating each seed source, were selected in natural forests, located in Parwanoo, Kothi and Namhol ranging from latitude 30°55' N—31°15' N and longitudes 76°50' E—

Table 1. Effect of different locations on morphological characteristics of clump of *Dendrocalamus strictus* Nees.

Location	Average number of culms per clump	Average length of culm (m)	Average diameter of culm (cm)
Parwanoo	48.72	9.460	5.107
Kothi	36.28	9.091	5.013
Namhol	31.42	8.874	4.874
CD	NS	NS	NS
Mean	38.714	9.127	4.99
SD	13.27	0.6014	0.315
Range	18.61	8.34—10.2	4.58—5.49

77° 06' E within the altitudinal range of 712—950 m above msl.

The total no. of culms present in the clumps were counted individually. The selected culms were cut and height was measured with the help of tape. After cutting the culm, the diameter of the culm was taken at the fourth internodes from base, with the help of caliper. The flowering culms in the clump were counted individually. The number of flowering branches found at the internodes was counted for each selected culm. The no. was counted by taking the average inflorescence of three branches per culm. Florets of three inflorescence were counted per branch and their average taken to define the number of florets per inflorescence. Height of the inflorescence was recorded with the help of electronic analytical balance (Libdoer Aeu-210 of Shimadzu). The individual inflorescence was shaken on a muslin cloth and no. of seeds, per inflorescence was counted. Insects attacks on seeds were recorded by taking the inflorescence from different culms. Data obtained were subjected to statistical analysis using randomized block design and CRD as described by Panse and Sukhatme (3) and Chandel (4). The statistical analysis for each parameter was carried out on mean value and analysis of variance was setup.

Results and Discussion

The results were recorded from three sites viz. Parwanoo Kothi and Namhol. From each site, seven clumps were selected and labelled as C₁, C₂ up to C₇ for Parwanoo, C₈, C₉ up to 14 for Kothi and C₁₅, C₁₆

Table 2. Effect of locations on the flowering characteristics of culm.

Locations	Average number of flowering culms/ clump	Average number of flowering branches/ culm	Average number of inflorescence/ branch	Average number of florets/ inflorescence
Parwanoo	48.429	13.357	12.379	215.829
Kothi	36.286	11.857	11.041	207.680
Namhol	31.429	12.857	10.804	186.500
CD	NS	NS	0.7042	NS
Mean	38.71	12.69	11.40	203.43
SD	13.27	1.257	0.896	13.55
Range	18–61	11–16.75	9.33–13	142–280

up to C₂₁ for Normhol.

Table 1 reveals that the differences in average number of culms/ clump are non-significant. The average number of culms/clump was the highest in Parwanoo (48.72) followed by Kothi (36.28) and the minimum was recorded for Namhol (31.42). Average length of culm was found to vary non-significantly for all the seed sources. Further, the maximum average culm length was recorded for Parwanoo (9.46), followed by Kothi (9.09) and minimum was recorded for Namhol (8.87). Parwanoo also showed the maximum value for average diameter of culms (5.10) followed by Kothi (5.01) and Namhol (4.87). The data were statistically non-significant.

Maximum average number of flowering culms/ clump was recorded for Parwanoo (48.42), followed by Kothi (36.28) and the minimum for Namhol (31.42), but the differences were non-significant. Table 2 elucidated the highest value for average number of flowering branches/Culm for Parwanoo (13.35), followed by Namhol (12.85) whereas the minimum was observed for Kothi (11.85). The data were statistically non-significant. Average number of inflorescence per branch showed significant difference among the different seed sources. The seed source of Parwanoo (12.37) recorded the maximum followed by Kothi (11.04) and the minimum was recorded for Namhol (10.80). Average number of florets per inflorescence was statistically non-significant for all seed sources. However, the highest value was recorded for Parwanoo (215.8), followed by Kothi (207.68) and mini-

Table 3. Effect of locations on the morphological characteristics of seeds.

Locations	Average wt. of inflorescence (g)	Average no. of seeds per inflorescence	Average length of seed (mm)	Average breadth of seed (mm)	Average weight of 100 seeds (g)	Average yield of seeds per culm (g)
Parwanoo	7.24	42.98	7.487	4.489	3.221	230.3
Kothi	7.00	42.95	7.481	4.491	3.181	176.0
Namhol	8.12	41.13	7.386	4.391	3.156	167.7
CD	NS	NS	0.0599	0.0497	NS	NS
Mean	6.95	42.35	7.45	4.45	3.186	191.35
SD	0.756	9.937	0.067	0.061	0.068	56.49
Range	5.7—8.8	23—53	7.3—7.5	4.3—4.5	3.1—3.3	103.328

imum for Namhol (186.5). Average weight of the inflorescence was found to vary non-significantly. Table 3 shows that the highest weight was recorded for Namhol (8.12) followed by Parwanoo (7.24) and the lowest was recorded for Kothi (7.00). Average number of seeds per inflorescence was found to be statistically non-significant. Data also reveals that Parwanoo seed source (42.98) depicted the maximum value followed by Kothi (42.95) and the maximum was found for Namhol (41.13).

Ochrophora montana was found in the inflorescence during gregarious flowering in bamboo, particularly in Parwanoo and Kothi areas. They feed on seeds while they are still in the formative stage on the flowering branches. Nymph and adult were found to suck the sap of bamboo seeds. There was no damage to the seeds by the insect in the Namhol area. Growth characteristics of *Dendrocalamus strictus* among the different seed sources showed little variation. The non-significant variations among seed sources on the characteristics viz. average no. of culm/clump (18—61) average length of culm (8.34—10.2) and average diameter of culm (4.58—5.49) were found. Since the seed sources had less variation in altitude, climate and edaphic conditions, their performance did not vary much from one site to another. Apart from this, genetic constitution of seed source does not vary much as a result of similar environmental conditions throughout their distribution in the study areas. These findings are contrary to the study of Kocher et al. (5) and these are not in line with the findings of Haridason et al. (6) who noticed a wide range of variation in no. of culms/clump, length of culm and diam-

eter of culm among eight important bamboos viz. *Bambusa pallida*, *B. tulda*, *B. nutans*, *B. balcooa*, Nagal and Nal (*Bambusa* spp.), *Dendrocalamus strictus* and *Dendrocalamus hamiltonii*.

Floret samples collected from the clumps represent different seed sources showed none of the variation in character viz. average no. of flowering culms per clump (38.71), average no. of flowering branches/culm (12.69), average no. of florets/inflorescence (203.43), average weight of inflorescence (6.95) and average number of seeds per inflorescence (42.35). The differences were found to be non-significant among the different seed sources. Out of the six floral characteristics studied, only one character viz. average no. of inflorescence/branches (11.40) was found to vary significantly. Among the seed sources, altitude, environmental conditions did not affect the floral characteristics except average number of inflorescence/branch. From these characteristics, it is concluded that all the areas were good for collection of seed during mass flowering. From the observations on different morphological traits, it was evident that all these traits showed non-significant differences. Extent of variation among the clumps of *Dendrocalamus strictus* was less. The seed sources differed non-significantly among themselves in respect of all the morphological characteristics. Thus it is concluded that selection of phenotypically superior material / clumps could be useful for raising and extension of bamboo cultivation and its utilization in low and mid-hill zones of Himachal Pradesh through genetically superior planting stock using seed setting as a tool base for improved genetic gain.

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