



Dendrocalamus Strictus: An Important Bamboo Species in India

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This species occupies 53 per cent of total bamboo area in India. This is one of the predominant species of bamboo in Uttar Pradesh, Madhya Pradesh, Orissa and Western Ghats. Widely distributed in India in Semi dry and dry zone along plains and hilly tracts usually up to an altitude of 1000 m., also commonly cultivated throughout the plains and foot hills. *Dendrocalamus strictus* is widely adaptable to temperature as low as -5°C and as high as 45°C. This species is mainly found in drier open deciduous forests in hill slopes, ravines and alluvial plains. It prefers well-drained, poor, coarse, grained and stony soils. It occurs naturally in tracts receiving as low as 750 mm of rainfall and also in extensive gregarious patches or as an understory in mixed forests and teak plantations.

Common bamboo (*Dendrocalamus strictus*) occurs in deciduous forest all over India except in North Bengal, Assam and moist region of West coast (Troup, 1921; Varmah and Bahadur, 1980). The districts which are rich in bamboo forest include Balaghat, Bastar, Bilaspur, Mandla, Hoshangabad, Betul, Raipur, Shahdol, Sidhi, Panna etc.

Dendrocalamus strictus, that grows in dry deciduous forest, occupying 4.005 million ha constituting 45% (Singh, 2002). *Dendrocalamus strictus* occurs naturally in the form of “bamboo brakes” (Champion and Seth, 1968) in Shiwalik hills of three districts viz., Panchkula, Ambala and Yamuna Nagar of Haryana State to an extent 3500 ha. Compact bamboo brakes are located in Thadugarh (353.30 ha); Banoi (103.00 ha); Bar Godam (181.8 ha); Buwana (262.10 ha); Khadin (20.60 ha) of Pinjore range, Balawala (120 ha) and Singhwala (180 ha) beats of Raipur Rani range. Kalesar (258.00 ha); Natural Patti (28.00 ha) of Kalesar range. Together they account for 1507 ha and remaining 1500 ha are sporadically cover with bamboo.

Floral biology:

Culms 8-16 m high, 2.5-8 cm diameter, pale blue green when young, dull green or yellow on maturity, much curved above half of its height; nodes somewhat swollen, basal nodes often rooting, lower nodes often branches; internodes 30-45 cm long, thick walled.

Culm-sheaths variable, lower ones shorter, 8-30 cm long with golden brown stiff hairs on the back, sometimes glabrous in dry localities, striate, rounded at the top, margin hairy; ligule 2-3 mm high, toothed; auricles small, blade triangular, awl-shaped, hairy on both sides.

Leaves linear-lanceolate, small in dry localities, upto 25 cm long and 3 cm broad in moist areas, rounded at the base into a short petiole, tip sharply acuminate with twisted point, rough and often hairy above softly hairy beneath; ligule very short.

Inflorescence a large panicle of large dense globular heads 4-5 cm apart; rachis rounded, smooth. Spikelets spinescent, usually hairy, the fertile intermixed with many sterile smaller ones, 7.5-12 mm long and 2.5-5.0 mm broad, with 2 or 3 fertile flowers; empty glumes 2 or more, ovate spinescent, many -nerved; flowering glumes ovate, ending in a sharp spine surrounded by ciliate tufts of hair; palea ovate, emarginate, lower ones 2 keeled, ciliate on the keels and 2-nerved between



them, uppermost not keeled, often nearly glabrous, 6-8 nerved. Stamens long- exerted; turbinate stalked, hairy above and surmounted by a long style ending in a purple feathery stigma. (Passport data on *Dendrocalamus strictus* compiled by V. K.W. Bachpai).

Seed storage:

The seeds if not sown immediately after collection, may be stored in bags. If it is be sown after one year, it should be dried and stored in sealed tins. The seeds can be stored for longer duration by keeping over silica gel or anhydrous calcium chloride in desiccator at 3°C to 5°C after reducing moisture content to 8 per cent (Gupta and Sood, 1978). Hydration and dehydration treatments also reduced loss of viability (Sur *et al.*, 1989). Abnormalities observed in seeds during storage were such as coagulated ball embryo, concentrated sporulation of storage fungi, embryo detachment along the epithelial layer, black encrustation of inner walls, discontinuous black spots, embryoless endosperm, jelly like bamboo fragments, shrunken embryo, shredded endosperm and pitly air space (Karivaratharaju *et al.*, 1987).

Flowering:

Dendrocalamus strictus has two kinds of flowering behaviour (a) Sporadic and irregular flowering (b) Periodical gregarious flowering (Brandis,1906; McClure, 1966). Sporadic flowering takes place in isolated clumps and only a few culms flower. The culm which flowers may or may not die. Sporadic flowering in *Dendrocalamus strictus* takes place almost every alternate year practically in all bamboo areas during November to May. Important characteristics of sporadic flowering are: i) Scattered nature of flowering only few clumps involved in flowering, ii) Only a few culms flower in a clump, iii) the culms may or may not die after flowering, iv) usually it takes place irregularly almost every years.

Gregarious flowering in *Dendrocalamus strictus* is a recognised phenomenon. The characteristics of gregarious flowering are: i) flowering occurs almost in the entire area, ii) it involves almost all or some proportion of clumps, iii) flowering takes place in all the culms in a clump, iv) flowering followed by the death of the clump, v) it follows a cycle which occurs after long interval, vi) it progresses in a definite direction like an epidemic wave beginning at one definite edge of an area and vii) it takes a few years, commonly 2 to 4 years to complete flowering in the area. The period between two gregarious flowerings over the same area is believed to be somewhat constant and is called physiological cycle.

Factors affecting gregarious flowering:

Age of the crop- Only those clumps flower and subsequently die which have attained the age of physiological maturity.

Site quality- Observations in Shahlol circle (Madhya Pradesh) indicate that site quality has considerable affect on bamboo flowering. In the same area, good sites tend to delay and decrease the extent of gregarious flowering.

Management practice- In areas where clumps are properly worked the proportion of flowered clumps comparatively less while unworked and congested clumps, the proportion of flowered clumps is more.

Biotic interference- Biotic interferences such as, grazing and fire, increase the intensity of gregarious flowering. The bamboo forests located near village have greater flowering intensity, while those located in comparatively protected areas away from habitation flowered partially. The areas with heavy biotic interference coupled with poor site quality leads to almost hundreds per cent flowering and death of plants. This may be due to the fact that areas subjected to heavy biotic pressure did not have younger crop (Dwivedi, 1988).



Nursery and plantation techniques:

Natural regeneration- After gregarious flowering or sporadic flowering, under natural conditions, the seeds germinate soon after the first monsoon showers. It is observed that large number of seedlings survive particularly on newly exposed soils.

Artificial regeneration- i. Seedling- When fruiting occurs seeds are collected by sweeping the ground under the clumps during seed fall. Mature seeds are separated from the chaff by winnowing. Seeds are better to collected before the onset of monsoon. One kilogram contains approximately 30,000 seeds. Germination varies from 25 to 61 per cent. A temperature of 30°C and 50°C to 50 to 70 per cent moisture level in the germinating medium is ideal for germination. Degluming the seeds accelerates germination.

A good irrigated nursery with standard sunken beds (12 x 1.25 x 0.3) m is preferred. The soils in the bed is worked and sterilized by burning the debris and mixed with farmyard manure. Seeds are pre-treated for 24-48 hrs. in cold water. About ½ kg of seeds are sown in bed in drills 24 cm apart and lightly covered with soil. Germination starts after 7 days and completes in about 17 days. One year old seedlings are transplanted in the pits of 30 cm³ at the espacement of 6 m x 6 m. However, it was reported that 2-year- old seedlings give better survival percentage. The roots of the seedlings should not be exposed to sun and care should be taken that the buds on the rhizomes are not injured.

ii. Vegetative propagation- Different methods like offset planting, rhizome planting, rooting of culm cuttings and tissue culture are used. One-year-old culms are cut through with a slanting cut above 90 or 120 cm from the ground and the rhizomes to which they are attached are dug up with roots intact and cut off to a length sufficient to include a well-developed bud. Planting is done before the onset of the rainy season. Rhizomes are separated from the mother plant during the onset of monsoon and planted in the pits of 45 x 45 cm. Culm cuttings can be used for propagation when seeds are not available. About 40 to 70 per cent of rooting in culm cuttings depending on the period of collection, age of culm and treatment with growth regulating substances. Cutting treated with NAA 100 ppm during February to March gave maximum rooting response (Surendran and Seethalakshmi, 1985). Horizontal planting in the nursery beds was better than the vertical and oblique planting methods. Seasonal variation in rooting response is reported and it is attributed to the variation in nutrient contents in the culm (Gupta and Pattanath, 1976). Observations on fertilizers and spacing trials in the nursery of less than two years, indicated that closer spacing is better and the application of NPK enhance the biomass production by three times (Patil and Patil, 1990). Considerable work has been done on the tissue culture of this species. The various explants used are node, seeds, seedling, shoot excised embryo and other methods like multiple shoot production, rooting and in-vitro flower induction are used (Zamora, 1994).

Silviculture and management:

Site requirements- *Dendrocalamus strictus* grows on periodically all types of soils provided there is good drainage. It does not grow on water logged or heavy soils such as pure clay or a mixture of clay and lime. Well-drained localities with sandy loam are the best for bamboo growth. The species is found growing well in the areas having a rainfall between 750 mm-4000 mm and it flourishes in regions where the relative humidity of the air is low. The species is usually not found on precipitous slopes or on flat ground unless it is well-drained. It prefers hilly ground and is resistance to frost and drought.

Growth- The main period of growth of the bamboo is 2-3 months during which time they attain their full height and diameter. The development of lateral branches takes place during the second season of growth. After the first season silicification and hardening of culms take place. Growth is completed about 2 months after the rainy season. There is an initial short period of 14-18 days showing maximum rate of growth (22-33 cm/day) accounting for 25 to 56 per cent followed by moderate growth (11 to 16 cm/day) and subsequently slow growth (9 to 13 cm/day). During the day time, height increment is about 40 per cent as against the night increment of 60 per cent. Maximum



growth per day is 37 cm. the months of June-July-August is the season of continuous vegetative activity which indicates that there exists a definite periodicity with regard to growth (Shanmugananthan et al., 1980).

Thinning-The effect of 3 levels of thinning, 3 cutting age groups and 2 felling cycles on culm yield was studied over a period of 10 years in natural stands of Buho (*Schizostachyum lumanpao*). The levels of the 3 factors studies are as follows: Thinning (Heavy, Moderate and Light); Cutting age (3 years and above, 4 years and above and 5 years and above); and felling cycle (every years and every two years). The result indicate that moderate thinning, cutting 3 years and above and felling cycle of 2 years is the optimum prescription for managing Buho natural stands (Lakshmana,1994).

Yield- It has been estimated that one hectare may contain a growing stock of 4000 to 5000 culms (250 to 300 clumps) and provide an annual harvest of 750 to 1000 culms on a three year felling cycle. From a plantation having a spacing of 5 x 5 m yield is about 3.5 t/ha/year. In favourable localities, *D. strictus* in each clump has 30-50 culms of 15-18 m height and 6-10 cm diameter.

Felling cycle suggested is 3 to 5 years. Although a three year felling cycle has been adopted, a cutting cycle of 4 years is preferable since it allows the clumps rest and the rhizomes are not distributed too frequently. Congestion can occur by cutting the culms from the periphery of the clumps, grazing and extraction by neglecting the cutting rules. This can be avoided by observing the general 'horse shoe' pattern for cutting. Cultural operations like thinning, cleaning, protection from fire and grazing need to be followed (Bachpai).

Pest and diseases:

Young shoots are susceptible to fungal attack. The green young shoot turns brown and comes off easily when pulled, leaving the area of transformation soft and brown, smelling strongly of molasses. Preventive measure is drenching the clumps with blue copper in advance. Many diseases like, damping off caused by *Fusarium* spp., leaf spots, leaf blight and leaf rusts caused by species of *Alternaria*, *Colletotrichum*, *Dactylaria*, *Dusturella* and *Helminthosporium*, culm rot caused by *Fusarium oxysporum*, culm sheath rot by *Glomerella cingulate* and little leaf disease by Mycoplasma-like organisms are reported from Kerala (Mohanana, 1990). The major spermoplane fungi reported on stored seeds were species of *Fusarium*, *Drechslera*, *Curvularia*, *Alternaria*, *Dactylaria*, *Aspergillus*, *Chaetomium* and *Penicillium* (Mohanana, 1990). A rust due to *Dasturella bambusina* affects bamboo. The other causal agents are white ants and rodents. The application of termiticide and rodenticide will reduce the damage considerably.

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