GREEN SKILL DEVELOPMENT PROGRAMME (GSDP)

TRAINING MANUAL

MICRO-ENTREPRENEUR (BAMBOO CRAFTS) – NTFP (PLANT ORIGIN)

GSDP Certificate Course (NSQF Level 4)
Batch Size: 20 | 420 Hrs

Prepared by

SIKKIM STATE EIACP HUB
FOREST AND ENVIRONMENT DEPARTMENT
Government of Sikkim

Sponsored by

सत्यमेव जयते

Ministry of Environment, Forest and Climate Change,
Government of India

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(Theory: 100 Hrs; Practical: 200 Hrs; Employability Skills: 60 Hrs; OJT: 60 Hrs)

1 Month i.e 30 working days @8 hrs per day [Time: 9am to 5 pm]

GSDP COURSE MODULE

NOS and Module Details	Theory Duration	Practical Duration	OJT (Man)	OJT (Rec)	Total Duration
SGJ/N1829 – Importance of Non-Timber Forest Produce and Handicrafts and livelihood generation. NOS Version No. 1.0| NSQF Level 4	**10**	**20**	-	-	**30**
Module 1: Importance of NTFPs and locally available NTFPs	5	10	-	-	15
Module 2: Importance of Handicrafts and livelihood generation	5	10	-	-	15
SGJ/N1833 –Preservation Conversion & primary processing in Bamboo. NOS Version No. 1.0 | NSQF Level 4	**30**	**60**	-	**-**	**90**
Module 10: Introduction of bamboo industry	7.5	15	-	-	22.5
Module 11: Preservation of bamboo	15	30	-	-	45
Module 12: Conversion & primary processing	7.5	15	-	-	22.5
SGJ/N1834 – Products making in bamboo industry NOS Version No. 1.0 | NSQF Level 4	**30**	**60**	**-**	**-**	**90**
Module 13: Agarbatti stick making	7.5	15	-	-	22.5
Module 14: Bamboo composites	15	30	-	-	45
Module 15: Product making	7.5	15	-	-	22.5
SGJ/N1835: Finishing of products in Bamboo industry NOS Version No. 1.0 NSQF Level 4	**30**	**60**	**-**	**-**	**90**
Module 16: Furniture making Design and Joinery	15	30	-	-	45
Module 17: Finishing/Seasoning of products	7.5	15	-	-	22.5
Module 18: Low cost bamboo housing	7.5	15	-	-	22.5
DGT/VSQ/N0102 NOS Version No. 1.0 | NSQF Level 4	**-**	**-**	-	-	**60**
Module 3: Employability Skills (60 hours)	-	-	-	-	60
On the Job training			60	-	**60**
Total Duration	**100**	**200**	**60**	**0**	**420**

I. ABOUT BAMBOO

Bamboo, which is also known as Poor Man's Timber or Green Gold of Forest, is a woody and fast growing tall grass, belonging to subfamily Bambusoideae of the family *Poaceae*. This subfamily is differentiated from the other members of the Poaceae by the presence of petiolate blades with tessellate venation, sheathed and mostly hollow culms. Bamboo has an extensive underground network, which is called rhizome and over the ground, a hollow stem called culm arises from the rhizome, generally known as bamboo. The emergence new culm is called shoot. The single culm attains its maximum diameter and maximum height in a period of 80-120 days after emergence from the ground. The culm is jointed; the joint is called nodes and the culm section starts and end in the solid nodes. The culm section between nodes is called the internodes. After completion of its full growth, branches and leaves are developed from its nodes, typically from lower part in case of some bamboo like *Bambusa pallid, Bambusa vulgaris* etc, and from middle and top part in some other bamboo like *Bambusa tulda, Dendrocalamus hamiltonii* etc. Morphological characters like girth, height, thickness, internodes length etc. are different in different species.

Bamboos are indigenously found in all the continents except Europe. There are 1250 species under 75 genera in the World (Soderstrom & Ellis, 1987) and cover about

14 million hectares of the earth surface. Among the bamboo growing countries China stands first in species diversity with 450 species under 33 genera (Li, 1998). India is the second largest diversity centre for bamboo with 128 species under 18 genera (Seethalakshmi & Kumar, 1998). Bamboo of India is mainly distributed in 5 geographical zones such as North East India, Western Himalaya, Eastern Himalaya, Peninsular India and Andaman and Nicobar Islands. Among these, the North East India is the largest bamboo diversity centre for Indian bamboos with 92 species under 18 genera and Peninsular India including Western Ghats is the Second diversity centre with 22 species under 8 genera (Biswas, 1994). Bamboo has potential of providing ecological, economical and job security to the people. From the utilization point of view there is no other plant equivalent to that of bamboos as important to the rural as well as urban people. Bamboo has more than 1500 documented application ranging from cradle to coffin, and other various applications such as handicrafts, furniture items, charcoal, various household items, bamboo mat, board, corrugated roofs etc.

Bamboo addresses the four major global challenges of the World such as:

a. **Livelihood Security:** Worldwide over 600 million people generate income from bamboo. The annual World trade in bamboo and related products is estimated at over US $ 15 billion. Bamboo offers the excellent opportunities for employment and income generation.
b. **Shelter Security:** Safe, durable and affordable housing. Generally bamboo houses suffer very little damage during the earthquake.
c. **Ecological Security:** Conservation of forest through timber substitution, re-greening of degraded areas and protecting against soil erosion etc.
d. **Food Security:** At present, over 11 million tones of edible bamboo shoots are consumed around the world every year. China alone exports over US $ 20 million annually. Bamboo shoots have high nutritional value and low fat and good source of fibre, vitamins, cellulose and amino acids. It is reported that bamboo shoot is effective in cancer prevention and also to increase appetite and decrease blood pressure and cholesterol. So bamboo shoot is also known as Heart Protective Vegetable**.**

Bamboos in India:

There are many reports regarding number of genera and species of India. Gamble (1896) reported 115 species from the Indian sub-continent of which 63 species fewer than 13 genera were mentioned from present India (Naithani 2008).The work of Tewari (1992) is the first comprehensive work on Indian bamboos after independence. He described 125 species under 23 genera, Seethalakshmi and Kumar (1998) reported 128 species under 18 genera. According to Naithani (2008) India is represented by 115 species belonging to 23 genera.

In India, bamboos are distributed in five different geographical zones Northeast India, Western Himalaya, Eastern Himalaya, Peninsular India and Anadaman and Nicobar Island. North-Eastern region of India comprising has more than 50 percent of bamboo species reported from India (Biswas 1988, 1994; Tewari 1992). Naithani (2008) reported 89 species under 18 genera from North East India. Peninsular India, baster region of Madhya Pradesh, Andamans and foot hills regions of Eastern Utter Pradesh are also quite rich in bamboo resources.

The total growing stock of bamboo in India is around 80.428 million tones (Naithani 2011). The clump forming bamboo constitute over 67.3% and 32.7% are non-clump forming bamboo in India. Adkoli (1994) estimate 83% of

total growing stock comprising main species *Dendrocalamus strictus* 53%, *Bambusa bambos* 15% and *Melocanna baccifera* 15%. According to Naithani (2011) amongst the growing stock of bamboos in India, the largest proportion is of *Dendrocalamus strictus* (45%), followed by *Melocanna baccifera* (20%), *Bambusa bambos* (13%), *Dendrocalamus hamiltonii* (7%), *Bambusa tulda* (5%) and *Bambusa pallida* (4%).

Bamboos in Sikkim:

The vegetation of Sikkim can be broadly classified into Tropical, Subtropical, Temperate and Alpine region. Sikkim is recognized as a **Hotspot of Biodiversity**, with only 0.22% of the geographical area of the country, Sikkim harbour around one–third of the flowering plants of India. Sikkim has thirty one species one variety and one forma of bamboos. In the lower elevation (Tropical belt), the species of *Bambusa, Dendrocalamus* are common bamboo genera, whereas in middle elevation (Sub-tropical belt*)* species belonging to *Melocanna, Phyllostachys* and *Cephalostachyum* dominate and at higher elevation (Temperate belt) *Arundinaria,* and *Thamnocalamus, Yushania* are principal genera. *Phyllostachys nigra, Yushania microphylla, Yushania pantilingii* are rare species of bamboos in Sikkim.

Table I: List of Bamboos used for making handicrafts and furniture in Sikkim

SN	Botanical Name	Local Name	Uses
1	*Ampelocalamus patellaris*	Neba bans (Nep.); Pagjiok (Lepcha).	Used for weaving
2	*Arundinaria racemosa*	Sanu Malingo (Nep.); Miknu (Bhutia)	Used for making mat, drinking straw etc.
3	*Bambusa bambos*	Kandaybans (Nep.)	Used for making handicrafts &furniture.
4	*Bambusa nutans*	Mal bans (Nep.); Jhushing (Bhutia); Mahlu (Lepcha).	Used for making baskets, musical instruments, handicrafts & construction of houses.
5	*Bambusa pallida*	Deo bans (Nep.)	Used for making basket.
6	*Bambusa tulda*	Sigaray bans (Nep.); Borem (Bhutia).	Used for making handicrafts, furniture making baskets & construction of houses.
7	*Cephalostachyum capitatum*	Gopay bans (Nep.); Payong (Lepcha).	Used for making rope, mats, baskets, musical instruments etc.
8	*Cephalostachyum latifolium*	Palom (Lepcha)	Used for making baskets and mats.

SN	Botanical Name	Local Name	Uses
9	*Dendrocalamus giganteus*	Dhungre bans (Nep.); Giant bamboo (Eng.).	Used for making furniture.
10	*Dendrocalamus hamiltonii*	Choya bans (Nep.); Pasing (Bhutia).	Used for making handicrafts.
11	*Dendrocalamus hookeri*	Tokray bans (Nep.).	Used for making container, handicrafts and construction of houses.
12	*Dendrocalamus sikkimensis*	Bhalubans (Nep.); Padyang (Lep.).	Used for making handicrafts.
13	*Dendrocalamus strictus*	Latthibans	Used for making furniture.
14	*Drepanostachyum falcatum*	Nigalo (Nep.)	Used for weaving
15	*Drepanostachyum intermedium*	Titay nigalo (Nep.)	Used for weaving
16	*Himalayacalamus falconeri*	Singhane (Nep.)	Used for weaving.
17	*Himalayacalamus hookerianus*	Paryang (Nep.); Prong (Lepcha).	Used for making carrying baskets, mate, rope for weaving etc.
18	*Melocanna baccifera*	Philing bans (Nep.).	Used for weaving of baskets and other articles.
19	*Phyllostachys aurea*	Kata bans (Nep.).	Used for making handicrafts.
20	*Phyllostachys edulis*	Chiniya bans	Used for making

SN	Botanical Name	Local Name	Uses
		(Nep.).	handicrafts.
21	*Pseudostachyum polymorphum*	Morali bans (Nep.).	Used for weaving baskets, mats and making musical instruments.
22	*Teinostachyum dullooa*	Tokrebans (Nep.)	Used for making baskets, mats, rope etc.
23	*Thamnocalamus spathiflorus*	Ratonigalo (Nep.)	Used for making musical instruments.
24	*Yushania maling*	Malingo (Nep.); Phum (Bhutia);Miknu (Lepcha).	Culms are largely used for making baskets, walls and musical instruments.
25	*Yushania pantlingii*	Ranimlingo (Nep.).	Culms are used for making mats.

Bambusa nutans

Himalayacalamus hookerianus

II: CULM HARVESTING AND HANDLING

The following rules apply for harvesting culms:

- Harvesting should be selective: only mature culms should be harvested.
- Only harvest culms during the dry winter season. The starch content of bamboo is lower during period of dryness. Lower starch content in the culm will make them less susceptible to attack by borers, etc.
- Use very sharp tools. It is highly advisable to disinfect harvesting tools using bleach. This lowers the risk of infecting the plants.
- Cut each culm right above the first node from the ground level. This is necessary so that water is not allowed to accumulate in the protruding internodes. The accumulation of water may result in rotting and invites insects to lay their eggs.
- Mulch each clump after harvesting.

After they are cut, the branches and leaves of the Culm should be stripped off. These should be neatly piled around the clump to provide organic materials for mulching. As a thumb rule and depending upon the species, the number of culm (average) harvested should follow the following:

- 3 Culms per Clump after 4/5 year.
- 4 Culms per Clump after 5/6 years.
- 5 Culms per Clump after 7 years.

If the plantation is situated near a river, the culms may be allowed to soak in water for a few weeks to aid in the removal of starch and protect them from beetle attack. Otherwise the stripped culms should be hauled to an area where they are sorted and air-dried. Good practices to enable drying will help minimize losses due to biodegradation of the culms. The large culms should be stacked horizontally on parapets where there is good air circulation. Smaller culms may be piled horizontally.

III: BAMBOO PRESERVATION TECHNIQUES

There are many preservation techniques both as Traditional Methods as well as Chemical Methods.

1) **Traditional (non-chemical) Methods**: These are simple and cost-effective but in general not appropriate for long term protection of bamboo. The process associated with these methods are as below:

   a) **Self-culm curing**: In this process the selected culm is cut at the base and left for a few days within the clump which provide leaning support. The bottom of the harvested culm, should preferably not touch the ground and may be placed over a stone etc. When the leaves, branches etc turn yellowish brown, the culms are removed and transported to the storage site.

   b) **Smoking:** Baking over fire after applying oil on the surface is a traditional method of preservation of green round bamboos. This causes rapid drying of the outer shell and induces partial charring and decomposition of starch and other sugars.

   c) **Soaking in water**: Soaking of bamboo poles in water (3-4 weeks) is an easy and widely followed method for increasing the durability of bamboo. During soaking in water, most of the sap present in bamboo is leached out. This treatment improves resistant to borers and some stain fungi. Slivers to be used for handicraft products may also be boiled in fresh water for 30 to 60 minutes gives good results.

2) **Chemicals treatment methods:** Treatment with chemical preservative is well established method providing good protection even in adverse conditions. Depending upon the carrier solvents, bamboo preservatives are divided into two categories: Non-fixing and Fixed type preservatives.

a) **Non-fixing Preservatives**: Non fixing bamboo preservatives mainly consist of boron salts, which are effective against borers, termites and fungi (except soft rot fungi). They are not toxic and can be used for treating bamboo products like baskets, dry containers, etc.

The most easily available non-fixing type preservative consists of boric acid and borax.

Boric acid/ borax: Treating bamboo with borax and boric acid is the most popular bamboo preservation method (for indoor use) around the world because it is effective and environmentally friendly. The combination of boric acid and borax in a ratio of 1:1:5 are available commercially in premixed powder form (e.g. Folibor or Solu Bor). The ratio is based on kilograms per 100 liters of water e.g. Boric acid/borax in a ratio of 1:1: 5 actually means a mixture of 1 kg of boric acid and 1.5 kg of borax in 100 liters of water. Bamboo can be impregnated by submerging or spraying with this solution.

b) Fixed preservatives

These are proportionate mixture of different salts which react with each other and become chemically fixed.

Different types of preservatives available are:

- Copper chrome boric: The preservative comprises of boric acid, copper sulphate and sodium in the proportion of 1:5: 3.

- Coal tar creosote: Creosote and diesel fuel mixture of (1:1) proportion can be injected by drilling holes at the internodes. The oil covers the inner walls throughout the cross structural area. The holes after injection can sealed and the poles are rolled for better distribution once in two days for a week before use.

- Chromate zinc chloride: This consist of zinc-chloride and sodium or potassium dichromate in the ratio of 81.5; 18.5.

IV: TRAINING ON BAMBOO HANDICRAFTS

a) **Tools & materials**: The basic tools required for handicrafts making are saw, knife, hammer, bamboo chisel, bamboo planer, metric tape, pencil, marker, drilling machine, daw, cross cutter, splitter, hot glu gun etc. The other requirements are bamboo culm, fevicol, nails, colours, sine paper, glue etc.

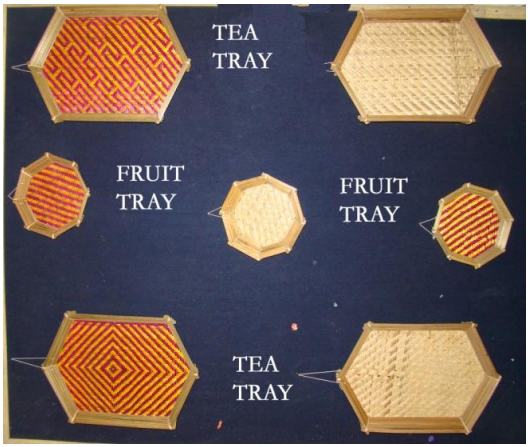
b) **Products**:

i) Bamboo basket: Select 1-2 years old culm of *Dendrocalamus hamiltonii* (Choya bans) or *Bambusa tulda* (Sigaray bans) and cut during dry season (November-February) after cutting do treatment (Traditional or chemical) according to product. Make sliver of treated bamboo and wave in different design and make different products.

ii) **Bamboo dustbin**: Select 3-4 years old culm of *Bambusa nutans* (Mal bans) and cut during dry season (November-February) after cutting do treatment (Traditional or chemical) according to product. Make stick of treated bamboo and make different products.

iii) **Bamboo lamp set**: Select 1-2 years old culm of *Bambusa tulda* (Sigaray bans) and cut during dry season (November-February) after cutting do treatment (Traditional or chemical) according to product. Make sliver of treated bamboo and wave to make products.

iv) **Bamboo tray**: Select 1-2 years old culm of *Dendrocalamus hamiltonii* (Choya bans) or *Bambusa tulda* (Sigaray bans) and cut during dry season (November-February) after cutting do treatment (Traditional or chemical) according to product. Make sliver of treated bamboo and wave in different design.



V: MARKETING OF BAMBOO HANDICRAFTS

During 2015-16 & 2016-17 the export of bamboo & bamboo products from India was Rs.0.11 Cr. and Rs.0.32 Cr. respectively. The indigenous bamboo artisans of Sikkim cannot not solely depend on bamboo activities for their livelihood due to lack of technological interventions. This has resulted in decline of bamboo artisanship and it has become unattractive field for new generation artisans.

There is a need to shift focus from the traditional handicrafts to value added industrial uses like bamboo mat, board, and flooring, shoot processing which have greater potential in employment generation export. Technology upgradation, improvement in artisan's skill and upgradation of handicrafts products also need to be made so as to make this sector more financially attractive.

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Courtesy

Text and Images

Dr. Tika Prasad Sharma

Bamboo Expert, Sikkim

Email: sik@envis.nic.in Website: http://sikenvis.nic.in Tel (O): 03592-280381

SIKKIM STATE EIACP HUB
Forest and Environment Department
Government of Sikkim
Deorali, Gangtok -737102

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