INTRODUCTION

Bamboo clumps produce new shoots/culms/poles annually and at the same time, old bamboo culms/poles (over 5 years old) start deterioration and dying. If bamboo poles (matured) are not harvested regularly, the productivity and quality of poles and shoots reduces drastically. If over-harvested, the productivity drops and can lead to degradation of clumps. Therefore, sustainable and selective harvesting coupled with proper management practices is key to healthy bamboo clumps which could provide annual income opportunities for harvesters, growers and processors.

IMPORTANCE OF AGE COMPOSITION (BAMBOO CULMS) IN A CLUMP

Though individual bamboo poles or culms stand apart, the underground portion (rhizome system) of bamboo clump is inter-connected.

- Bamboo culms or poles of different age groups in a bamboo clump, perform different functions to ensure the suitability of bamboo clump. Young bamboo poles (year 1-2) only have capacity to produce bamboo shoots for future generation. They have high starch and moisture content – not durable. Old bamboo poles 3 years and above are mature, they have no capacity to produce bamboo shoots.

- Uniformity of raw material is critical for production of high quality, standardised and industrial products. Bamboo poles of similar physical, mechanical and chemical properties (with age-grading) will ensure production of uniform and standardised products.

SUSTAINABLE MANAGEMENT

1. Spacing: Low clump density will suffer from canopy exposure, low soil moisture and strong competition from weeds. Plantation with high clump density/overstocking at planting will also result in low productivity from smaller plants due to the intense competition among the plantlets for light, space, soil moisture and nutrients. Maintaining an optimal density of clump is crucial for optimal yields.
SUSTAINABLE MANAGEMENT

2. **Number of poles in a clump**: Reasonable number of standing bamboo poles in a clump is necessary for bamboo shoot / culm production (optimizing quantity and quality). Over density result in smaller, bent and twisted poles. The details are shown in below:

- Low number of poles in clump – lacks regeneration
- Large number of poles – difficult to harvest, no space
- Sparse clump – easy to harvest and manage

3. **Age composition**: Equal number of age 1, age 2 and age 3 needs to be maintained, the proposition is 1: 1: 1. For example, if you maintain 12 culms / poles in a clump. The number of poles of year 1 = 4, year 2 = 4 and year 3 = 4. The spacing between clumps, number of culms to retain and age composition are shown in below table:

<table>
<thead>
<tr>
<th>Bamboo variety as per size</th>
<th>Spacing (Clumps)</th>
<th>Number of Poles in a clump</th>
<th>Age composition</th>
<th>Photos</th>
</tr>
</thead>
<tbody>
<tr>
<td>Small diameter bamboo species (&lt; 6 cm diameter DBH)</td>
<td>At least 4 X 4 M</td>
<td>~ 21</td>
<td>Year 1: 7&lt;br&gt;Year 2: 7&lt;br&gt;Year 3: 7</td>
<td><img src="https://example.com/small_bamboo1.jpg" alt="Small" /> <img src="https://example.com/small_bamboo2.jpg" alt="Small" /> <img src="https://example.com/small_bamboo3.jpg" alt="Small" /></td>
</tr>
<tr>
<td>Medium diameter bamboo (6-10 cm diameter DBH)</td>
<td>At least 5 X 5 M</td>
<td>~15</td>
<td>Year 1: 5&lt;br&gt;Year 2: 5&lt;br&gt;Year 3: 5</td>
<td><img src="https://example.com/medium_bamboo1.jpg" alt="Medium" /> <img src="https://example.com/medium_bamboo2.jpg" alt="Medium" /> <img src="https://example.com/medium_bamboo3.jpg" alt="Medium" /></td>
</tr>
<tr>
<td>Large diameter bamboo (&gt; 10 cm diameter DBH)</td>
<td>At least 7 X 7 M</td>
<td>~12</td>
<td>Year 1: 4&lt;br&gt;Year 2: 4&lt;br&gt;Year 3: 4</td>
<td><img src="https://example.com/large_bamboo1.jpg" alt="Large" /> <img src="https://example.com/large_bamboo2.jpg" alt="Large" /> <img src="https://example.com/large_bamboo3.jpg" alt="Large" /></td>
</tr>
</tbody>
</table>
4. De-budding: In the case of some species with profuse and prominent branching in the bottom portion undertake de-budding till one-third height of bamboo in bottom portion. In the case of bamboo species with no branching at the bottom de-budding is not needed.

5. Age marking

Different colour paints: Three different colour paints are required, one for each year of a three-year cycle. Culms that are older than 3-4 years should be logged, as they become weak and brittle and can be expected to die. After the culms attain full height during the first year, they are marked with paint. A scheme for identifying culm age are shown in the below table. Please note, this is mostly suitable for on-farm bamboo plantation as well as intensely managed forest plantation.

<table>
<thead>
<tr>
<th>Colour</th>
<th>Age (Year)</th>
<th>Rotation-2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Red</td>
<td>Current: 0-1 years (2018)</td>
<td>Current: 0-1 years (2021)</td>
</tr>
<tr>
<td>Yellow</td>
<td>1-2 years (2019)</td>
<td>1 – 2 years (2022)</td>
</tr>
<tr>
<td>Blue</td>
<td>2-3 years (2020)</td>
<td>2 – 3 years (2023)</td>
</tr>
</tbody>
</table>
6. Culm / shoot retaining

Why select strong bamboo shoots to grow?

Diameter of future culm is established when shoot activation and partial elongation of new shoots are underway. If more shoots produced from a single mother culm, more difficult for the mother to supply nutrients and food, resulting in stunted growth and death of some shoots / culms. It is recommended to allow one or maximum two strong shoots to grow from a single mother culm and cull the rest.

MANAGEMENT METHODS

Weeding, soil loosening and mounding: Soil-loosening in bamboo plantations is important, as maintaining a good soil structure in the stand will be beneficial to the growth of shoots and root system, as well as water conservation. Inside the bamboo clump do shallow digging and soil loosening (<10 cm deep), and surrounding bamboo clumps deeper digging of approx. 20 cm is recommended. At the same time, old and decayed cut bamboo handles and rhizomes can also be removed. Please note, soil loosening is not recommended for bamboo clumps in steep slopes to avoid soil erosion.

Fertilization: With the extraction of bamboo poles for value addition, soil minerals and nutrients are also extracted. Two to three baskets (15 – 20 Kg) of manure or compost can be added to the clump.

Soil mounding: After mixing the manure or fertilizer with soil, mound the bamboo clumps with excavated soil, and create a small trench surrounding the clump to hold water. Weed cutting, soil loosening and mounding can be done once a year – just before the rainy season. Alternatively, this could also be done twice – Once before the beginning of rainy season; and another before the end of rainy season.
New culms are commonly produced on the periphery of the clump (young culms / rhizomes are the ones which produce new shoots (1-2 years old)). So, the tendency of the bamboo collectors/ harvesters are to harvest the bamboo poles on the outside periphery of bamboo clump, which is young and immature affecting the sustainability of the clump as well as the durability of the bamboo products / poles used are low.

Mature bamboo poles in sympodial bamboo clumps are commonly found on the inner core of the bamboo clump.

Two techniques managing congested or clustered bamboo are commonly practiced. They are (a) Tunnel technique and (b) Horse-shoe technique.

1. Tunnel technique

Make 60 cm wide path one end to other end of the clump. Make sure the tunnel created passes through the central part of the clump. As most of the mature bamboo poles are in the center of the clump, tunnel is created so that one can enter the center, harvest and drag the bamboo poles.

2. Horse-shoe technique

Make 60 -100 cm wide path from the periphery or outside of bamboo till the center of the clump. Select the location or side of the clump where there is minimum number of young bamboo poles, to avoid cutting of young poles.
BEST TIME TO HARVEST

- Post rainy season or early dry season is the best time to harvest bamboo poles. During the post rainy season, starch content is comparatively lower (since new shoots consumed most of the nutrient in the clump). With low starch content and relatively less moisture content, the bamboo poles are least susceptible to attacks by fungi, borers, termites and other pests.
- Harvesting or felling should not be done during shoot emergence and growing periods as harvesting operation will damage the tender growing shoots.
- Harvesting should not be done in end of dry season and early rainy season as the bamboo plant body have lot of accumulated starch and nutrients to feed the emerging shoots. Bamboo poles harvesting during this period will be susceptible to borer and insect attacks due to high starch concentration.
- Year after year, the size of the tunnel and horse-shoe will expand and with right culm density, harvesting operation will be easier and cost effective.

FELLING/ CUTTING METHOD

Cut the culms in a slanting matter (45 Degree) just above the lower most node (~ 10 -15 cm) to minimise wastage, avoid sprouting and at the same time rainwater will not stagnate in cavity of stump portion.

Right cutting method

Wrong harvesting method
CARE DURING FELLING/HARVESTING

- Branches and twigs from harvested poles need to be cleaned from the mother culms.
- Dead, rotten and deformed culms and stumps should be cleaned.
- Harvesting and felling operations should not be undertaken in culm emergence period.

FOUR BASIC THUMB RULE TO REMEMBER

Cut the small, keep the big.
Cut the old, keep the young.
Cut the crowded, keep the scattered.
Cut the sick, keep the strong.

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