

INBAR Working Paper

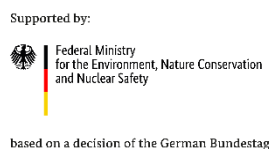


Technical Bulletin/Manual

Guidelines for Lung Bamboo (*Bambusa longissima* sp. nov.) Propagation by Offsets and Planting

Nguyen Van Tho, Nguyen Khac Lam, Manh Loc Khoa

2020





©The International Bamboo and Rattan Organisation 2020

This publication is licensed for use under Creative Commons Attribution-NonCommercial-ShareAlike 3.0 Unported Licence (CC BY-NC-SA 3.0). To view this licence visit:

<http://creativecommons.org/licenses/by-nc-sa/3.0/>

About the International Bamboo and Rattan Organisation

The International Bamboo and Rattan Organisation, INBAR, is an intergovernmental organisation dedicated to the promotion of bamboo and rattan for sustainable development. For more information, please visit www.inbar.int.

About this Working Paper

This research was carried out by the International Bamboo and Rattan Organisation (INBAR) as part of the CGIAR Research Program on Forests, Trees And Agroforestry (FTA) and the project of Production-driven Forest Landscape Restoration under REDD+ through Private Sector-Community Partnerships as an Asian Regional Learning Exchange (FLOURISH).

FTA is the world's largest research for development programme to enhance the role of forests, trees and agroforestry in sustainable development and food security and to address climate change. CIFOR leads FTA in partnership with Biodiversity International, CATIE, CIRAD, INBAR, ICRAF and TBI. FTA's work is supported by the CGIAR Trust Fund: <http://www.cgiar.org/funders>

FLOURISH is a four-year project which aims to develop partnerships between local communities and the private sector to achieve forest restoration, increase food productivity, and improve local livelihoods in Lao PDR, Thailand and Viet Nam. The project has financial support from the Federal Ministry for the Environment, Nature Conservation, and Nuclear Energy of Germany, via the International Climate Initiative, and is led by The Center for People and Forests in partnership with INBAR, the Technische Universität Dresden (Germany), and Nan Community College (Thailand).

International Bamboo and Rattan Organisation

P.O. Box 100102-86, Beijing 100102, China Tel: +86 10 64706161; Fax: +86 10 6470 2166

Email: info@inbar.int

© 2020 International Bamboo and Rattan Organisation (INBAR)

List of Abbreviations

| | |
|----------|--|
| FLOURISH | Production-driven forest landscape restoration under REDD+ through private sector-community partnerships as Asian regional learning exchange project |
| REDD+ | Reducing emissions from deforestation and forest degradation and the role of conservation, sustainable management of forests and enhancement of forest carbon stocks in developing countries |

Table of Contents

| | |
|--|-----------|
| Section I: BAMBOO TERMINOLOGY | 2 |
| Section II: PROPAGATION OF <i>B. LONGISSIMA</i> SP. NOV. BY OFFSET PLANTING..... | 4 |
| 1. Why propagate through offset planting? | 4 |
| 2. Precautions | 4 |
| 3. Propagation method of <i>B. longissima</i> sp. nov. through offset planting | 5 |
| 4. Limitations..... | 15 |
| Section III: TENDING, THINNING AND PROTECTION OF PLANTATION OF <i>B. LONGISSIMA</i> SP. NOV. | 16 |
| 1. Tending..... | 16 |
| 2. Thinning..... | 18 |
| 3. Protection | 18 |

Introduction

Bamboo belongs to the subfamily Bambusoideae of the grass family Poaceae. There are 1642 bamboo species distributed in Asia, Africa, America and Oceania and are most commonly found in Asia. Over 35 million hectares of bamboo forest are found in the tropics and subtropics, and the total value of bamboo products amounted to almost 60 billion USD in 2017. Bamboo is used in food production, house construction, flooring, musical instruments, medicine, beer, activated carbon, ornamental crafts and handicrafts, and bamboo forest is cultivated to attract eco-tourism and reduce greenhouse gas emissions.

Lung bamboo, *Bambusa longissima* sp.nov., is a small arborescent bamboo with pachymorph rhizomes. Its culm internodes are long, reaching over a metre. The culms are soft and used to weave handicrafts for export, such as lanterns, plates, baskets and incense sticks, and to produce activated carbon. Lung bamboo is currently only found in Vietnam and is distributed throughout the provinces of Nghe An, Thanh Hoa and Son La. In Nghe An province, Lung is distributed in Que Phong and Quy Chau districts with a total Lung forest area of 26,994.12 ha in 2018, containing 5,815.01 ha of pure natural Lung forest, 21,111.41 ha of Lung mixed woody trees natural forest, and 26.7 ha of Lung plantation forest (accounting for 0.25%). The total volume of Lung bamboo forest is around 220 million culms, mainly in natural forests mixed with woody trees. Lung bamboo is often distributed across difficult forest terrain, making it difficult to exploit. Nghe An province set the goal of rehabilitating 6,000 hectares of Lung bamboo natural forest, planting 270 hectares of new Lung plantation forest, and increasing the total volume of Lung forest to 241.81 million culms by 2025. However, the main problem currently affecting Lung bamboo development is the lack of effective propagation methods.

This manual aims to support people who work in bamboo forestry with the propagation of Lung bamboo using offset planting. The manual offers step-by-step guidelines for the selection of sites for Lung clump mother plants, techniques for detaching offset planting, planting, maintenance and protection.

This manual comprises three sections. Section One provides an illustrated explanation of terms used in the manual, and Section Two offers step-by-step instructions for propagating through offset planting. Section Three explains how to maintain Lung bamboo plantations.

Authors

Section I: BAMBOO TERMINOLOGY



Rhizome: An underground bamboo stem bearing roots



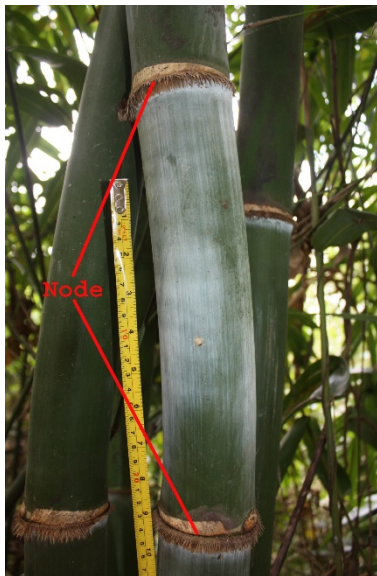
Clump: A cluster of bamboo stems that are generated from a single bamboo plant or interconnected



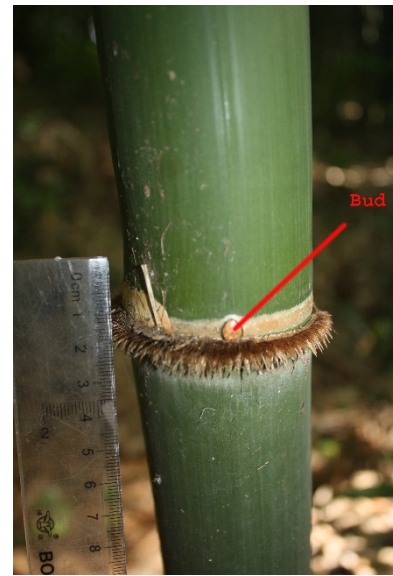
Culm: A segmented aerial axis that emerges from a bamboo rhizome



Internode: Portion of bamboo between two nodes



Node: junction of adjacent internodes in a segmented axis of a graminaceous plant



Bud: Nascent state of culm or branch on rhizome node or culm node



Culm sheath: one of the sheathing organs borne singly at each node of the culm proper



Offset: lower part of culms (usually 3–5 nodes, about 1–2.5m in height) with the rhizome axis basal to them and their roots



Shoot: a young culm at any stage of its development short of maturity in height

Section II: PROPAGATION OF *B. LONGISSIMA* SP. NOV. BY OFFSET PLANTING

1. Why propagate through offset planting?

The offset planting method is a traditional method that is popularly used for bamboo propagation. This method has a high success rate because it involves the transferral and planting of a complete plant system. The varieties are separated from the bamboo clump, including the rhizomes, roots and the associated culm parts—all elements required to develop into new trees.

B. longissima sp. nov. has many almost-equal small branches per node, but there is not the main branch and aerial root on the branch base. Therefore, propagation methods using branch cuttings and layering are unsuitable. Moreover, the culm wall is thin and dries very quickly when cut. It is very difficult to propagate using culm cuttings. Therefore, propagation of *B. longissima* sp. nov. by culm cutting is the most feasible method while research on tissue propagation for this species is lacking.

2. Precautions

A well-grown clump of *Bambusa longissima* sp.nov., free from pests and diseases and without flowering, should be selected.

Each offset planting should consists of a cluster of two or three culms of *B. longissima* sp. nov., one of which is between 6 and 12 months old with sufficient branches and leaves.

Buds on the rhizomes, culm or branches at the base of the culm should not be rotten or dry. Lung bamboo varieties should not be detached during growing season.

Use a sharp tool to cut the culm and the neck of the rhizome linked to the mother plant's rhizome. Offset plants must be carefully transported to avoid damage to culms and buds.

Moisturization of planted offset plants during the early stages after planting is an important factor in determining this method's success rate.

3. Propagation method of *B. longissima* sp. nov. through offset planting

3.1 Selection criteria for offset planting of *B. longissima* sp. nov.

The quality of seed sources plays an important role in determining the growth and development of *Bambusa longissima* sp.nov. Seed materials must be gathered from a clump of *B. longissima* sp. nov. that shows good growth without pests or flowers. Each offset plant consists of a cluster of two or three culms of Lung bamboo, one of which should be between 6 and 12 months old with sufficient branches and leaves. Buds on the culm or branches at the base of the culm must not be rotten or dry.



This clump of *B. longissima* sp. nov. is overexploited, shows poor growth and is not suitable for breeding.



Clump of *B. longissima* sp. nov. showing good growth and meeting seeding standards.



Fertile bud on culm

Fertile branches on bottom internodes

3.2 Technique of detaching offset planting

Propagation of Lung bamboo by offset planting must be carried out in several steps, as follows:

- 1) Cut down the identified bamboo culm cluster at two to three nodes above ground (around 50 to 120 cm). Retain the culm at above the second or third node from 10 to 15 cm. Check for prominent buds on culms and branches at the nodes.
- 2) Excavate the soil surrounding the selected cluster without damaging the rhizome and buds and identify the rhizome neck that links it to the rest of the clump. Cut the identified rhizome neck using a crowbar or spade.



Practice photos of detaching offset planting

3.3 Site selection criteria

When selecting a plantation site for Lung bamboo, the points outlined below must be considered.

- 1) Climate: The average annual temperature is over 22°C (rainy season temperatures range between 24 and 28°C). The average annual air humidity is over 80%. The average annual rainfall is over 1500 mm, with a concentrated rainy season from April to October.
- 2) Soil: Land belonging to the natural distribution area of Lung bamboo should be selected as a priority. The most suitable soil is fertile with good moisture-holding capacity. Flooded soils, saline soils, acid sulphate soils, lateritic soil, and soils with stone content above 8% are unsuitable.
- 3) Light requirements: Lung bamboo does not grow well under canopy of other trees. It is suitable to be lighted by sunlight. Lung can be planted in gaps in natural forests with an area of over 100 square meters, and can be intercropped with plantation forests, natural forests with a density of timber trees of over 10 cm in diameter, which is lower than 100 the trees per hectare.
- 4) Topography: Hills and low mountains are suitable when the slope is less than 35°.

3.4 Planting method and density

3.4.1. Planting method

Offset plants of *B. longissima* sp. nov. can be planted as large areas of pure forest, in gaps in natural forests, or scattered in private garden and along streams. The conditions for each specific method are as follows:

- Pure Lung bamboo forest: The offsets should be planted in newly exploited or bare soil. The whole area should be planted where the topography has a slope of less than 25°. Three-quarters of the hill /mountain area should be planted if the slope is between 25° and 35°.
- Planting Lung bamboo in gaps in natural forests: The offsets should be planted in clusters with an area of 100 metres squared or more in natural forests but not under forest canopy.
- Dispersed planting: Lung bamboo may be planted in household gardens, along rivers and streams.

3.4.2. Planting density

Density is an important factor that determines crop productivity and growth. Appropriate densities will limit competition for light on the ground and mineral nutrition and water underground.

The appropriate planting density of Lung bamboo is 400 trees per hectare with 5 x 5 m spacing.



Practice photos of designing propagation model of Lung bamboo by offset planting

3.5 Planting season

The best time to undertake propagation of Lung bamboo by offset planting in nurseries is during the pre-rainy season from March to April.

3.6 Vegetation treatment

1) Comprehensive vegetation treatment: This applies to pure planting methods and involves the paring of all shrubs, vines and unwanted trees. The pared vegetation is heaped on the vegetative beds, and the direction of the beds should be perpendicular to the main slope direction. The vegetation is not burned.



Practice of designing the propagation model



Vegetation treatment

2) Cluster vegetative treatment: This applies to methods of planting in gaps in natural forest and dispersed planting methods. All shrubs, vines and unwanted trees should be pared, and the pared vegetation is heaped up and not burned.

3.7 Soil preparation

The soil should be prepared at least 15 days prior to planting to provide the soil with humidity. The soil preparation process involves three steps: digging holes, fertilising and filling the holes.



Practice photos of pit digging technique

Pit digging: Before the pit is dug, the location must be cleared of weeds at the location. The topsoil is tidied aside near the pit, and the pit is dug to a size of 60 x 60 x 50 cm (length x width x depth). Fertilising and pit filling: One-third of the hole is filled with fine topsoil and mixed evenly in the hole with 1 kg of Song Gianh HC-15 microbiological fertiliser or Que Lam microbiological fertiliser per hole. The hole is then completely filled with soil.



Practice photos of fertilising technique

3.8 Planting

Particular care should be taken in transporting the culm clusters of *B. longissima* sp. nov. from the breeding place to the planting site to avoid damage to the buds on the branches, culms and rhizomes.

Plastic sack strips 3-4 cm wide may be used to tightly wrap tightly the culm of the offset plant, except for the culm bud.



Practice photos of wrapping culms of the offset plant by plastic sack



Practice photos of planting technique



Photos of the planted culm clusters covered with weed and treated by rooting solution



Watering for the planted cluster



Uppermost culm of the planted clusters covered by nylon bag

Planting should take place on overcast days when the soil in the pit is sufficiently moist. A hole should be dug in the middle of the prepared pit to a depth of around 20 cm. The culm neck of the culm clusters of *B. longissima sp. nov.* should be placed 5 to 7 cm below ground. The culm clusters should be placed upright and the soil in the pit should be filled and compacted. Then the pit should be filled with a thin soil layer of 5 cm in depth and not compacted and covered with weeds or straw surrounding the planted culm clusters to preserve moisture.

After planting, the highest internode of each planted culm cluster should be treated with 100 ml of Indole-3-butyric acid (IBA) rooting solution 200 ppm or Naphthaleneacetic acid (NAA) rooting solution 200 ppm.



Clusters of *B. longissima* sp. nov. planted by offset planting for 8 days

4. Limitations

- Only a small number of offsets may be separated from each parent clump.
- The buds of the mother culm and rhizomes may be damaged during detaching.
- The growth of the mother clump is affected by the loss of several one-year-old culms.
- Bamboo propagation through offset planting is hindered by the difficulty of detaching and transporting large-sized bamboo species.
- Buds in the rhizomes and the culms may be damaged during transportation.
- This method is not applicable to large-scale afforestation.

Section III: TENDING, THINNING AND PROTECTION OF PLANTATION OF *B. LONGISSIMA* SP. NOV.

1. Tending

During the first three-year period, the newly planted cluster of *Bambusa longissima* sp.nov. is required to compete fiercely with grass and shrubs for mineral nutrition, water and light. Weeds and shrubs around the cluster of *Bambusa longissima* sp.nov. are home to pests and diseases. Therefore, grass and shrubs should be removed during the tending process.



After 40 days of planting, the clump of *B. longissima* sp. nov. begins to generate new culm and needs to conduct tending



After 40 days of planting, the clump of *B. longissima* sp. nov. did not generate new culm and needs to conduct tending

1) Tending during the first year

- Number of times and seasons of tending: The plantation of *B. longissima* sp. nov. should be tended twice within the first year. The first occasion should be one month to one month and a half after planting. The second occasion should be between October and November.

- Tending content during the first year: Grasses and shrubs around planted holes should be removed. The soil should be loosened in a semicircle around 20 cm from the base of the planted clump of *B. longissima* sp. nov. The soil should be loosened to around the planted clump 30 cm wide and to a depth of 15 cm. The dead clusters of *B. longissima* sp. nov. should also be planted.



Propagation model of *B. longissima* sp. nov. after two months of planting was tended

2) Tending of second year and third year

- Number of times and seasons of tending: The *B. longissima* sp. nov. plantation should be tended three times in the second and third years. The first occasion should be during the pre-rainy season, from February to March. The second time should be between July and August. The third time should be between October and November.

- First tending in second and third years: All shrubs, vines and unwanted trees across the entire *B. longissima* sp. nov. plantation should be pared back. Weeding should be performed and the soil to a depth of 20 cm and around 1.2 m in diameter around the base of the Lung bamboo clump. The plantation should be fertilised using 3 to 5 kg of decomposed mud per clump of *Bambusa longissima* sp.nov. or 2 kg of Song Gianh HC-15 microbiological fertiliser per clump.

- The second tending in the second and third years: All shrubs, vines and unwanted trees in the entire *B. longissima* sp. nov. plantation should be pared back.

- Third tending in second and third years: all shrubs, vines and unwanted trees across the entire *B. longissima* sp. nov. plantation should be pared back. Weeding should be performed and the soil loosened to a depth of 20 cm and a diameter of around 1.2 m around the base of the *Bambusa longissima* sp.nov. clump.

2. Thinning

Thinning is conducted for four-year-old *B. longissima* sp. nov. plantations. The three-year-old culms of the Lung bamboo forest are only cut close to the the base. The branches and tops of the culms are neatly arranged. Thinning takes place during the dry season from November to February of the following year.

3. Protection

Lung bamboo shoots are sometimes eaten by worms. The worms are managed and prevented by weeding and loosening the soil around the Lung bamboo clump in the forest during the third tending. The soil is loosened to a depth of 20 to 25 cm and a diameter of 1.2 m.

- Fire prevention: Branches should be cleared after thinning or selective harvesting.

- Cattle and unauthorised people should not be permitted to enter the *B. longissima* sp. nov. plantation.



www.inbar.int

@INBAROfficial