Guidelines for Accreditation of Bamboo Nurseries, Tissue Culture Laboratories and Certification of Quality Planting Material

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National Bamboo Mission

Department of Agriculture, Cooperation and Farmers Welfare
Ministry of Agriculture and Farmers Welfare, Government of India
Krishi Bhawan, New Delhi

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MESSAGE

Bamboo is one of the most versatile and fastest growing groups of plant species. Our country has the highest area under bamboo, stretching from the North-Eastern region to Northern plains and from Central part to the Deccan Plateau. With its multifarious uses, bamboo has the potential to contribute significantly to the national objective of Doubling of Farmers Income as an important contributor to secondary agriculture. Accordingly, the restructured National Bamboo Mission (NBM) was launched in 2018 for holistic development of the complete value chain. The immense carbon sequestration potential of bamboo will enable NBM to also contribute to India's Nationally Determined Contributions (NDC) under the Paris Agreement.

Keeping in view the vast untapped potential of the bamboo sector, there is an urgent need to boost cultivation of commercially required species of the quality and quantity as required by our industry. The use of quality planting material is imperative as in all other agricultural commodities, but more so for bamboo, which is extremely difficult to identify in the juvenile stage due to its biological nature. Farmers would be completely discouraged from taking up plantations if they are provided substandard planting material or a species not having market demand. Hence, the importance of good planting material of the correct species is underscored to ensure better returns to the farmers.

It is heartening to note that the National Bamboo Mission has prepared "Guidelines for Accreditation of Bamboo Nurseries, Tissue Culture Laboratories and Certification of Quality Planting Material" since no such guidelines were available for guiding the States. I congratulate the National Bamboo Mission for this initiative which was possible only due to the convergence of policy makers, field practitioners and academicians. This inter-disciplinary synergy is the essence of the restructured NBM.

Sanjay

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June 3, 2019

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Foreword

The restructured National Bamboo Mission (NBM) envisages to promote holistic growth of bamboo sector by adopting area specific, regionally differentiated strategy and to increase the area under bamboo cultivation and strengthening of post harvest management and product development leading to marketing. Under the Mission, steps are being taken to increase the availability of 'Quality Planting Material' of required species by supporting the establishment of new nurseries and strengthening of existing ones. To address forward integration, the Mission is taking steps to strengthen marketing of bamboo products, establishing processing centres and imparting trainings to various stakeholders.

The foundation for the success of the restructured National Bamboo Mission would start with making available certified planting material so as to ensure improved productivity, continuous supply of raw material to industries, thus reducing dependence on imports and increased returns to the farmers. Distribution of planting material from unidentified source shall jeopardize the whole program, as well as demotivate farmers from adoption of bamboo. The use of high quality planting stock of the right species with the appropriate physico-chemical characteristics is of vital importance along with sound management practices, efficient harvesting and primary processing if sustained production of raw materials for the industry and efficient utilization is to be ensured.

It is envisaged that the Agroforestry Centres of ICAR located in State Agriculture Universities (SAUs) - All India Coordinated Research Projects (AICRPs), ICAR and ICFRE Institutes, will ensure supply of certified seeds, planting material, both vegetative and tissue culture, to the States for raising of accredited nurseries to enable certified planting material to reach the growers. Candidate Plus Clumps (CPCs) of different species of Bamboo would be identified and details of already identified CPCs would be shared with all stake holders, Tissue Culture Labs and Nurseries engaged in production of Quality Planting Material which would be made available on NBM website so as to use this as base material for multiplication of the propagules. This will be the first and foremost step in ensuring the production and planting of certified planting material in the field.

The present guidelines are meant strictly to be used by the State Level Accreditation Committee (SLAC) for accreditation of nurseries and certification of planting material of bamboos. Revision of these guidelines shall be done from time to time with improvement in technology and feedback from stakeholders. The backbone of the proposed certification system is the maintenance of traceability of each certified bamboo plant back to the proven superior quality CPC identified at species level and certified for its genetic antecedents and quality by ATLs or any reputed Govt Institution.

These Guidelines have been drafted to assist Government and private agencies engaged in Micro-propagation and nursery operations in their endeavour to provide certified quality

planting material is produced and reach the planting site (farmers). These will serve as guiding principles for the accrediting and certifying committees in the State Bamboo Missions for:

(i) Accreditation of Tissue Culture Laboratories engaged in micro-propagation of bamboos
(ii) Accreditation of Nurseries engaged in production of planting material ready to be planted in the field and
(iii) Certification of planting material raised therein;

And to achieve the following objectives:

i. An institutional mechanism to ensure availability of quality planting stock of different bamboo species through accredited bamboo nurseries having the necessary infrastructure, quality control procedures, checks and technical expertise.

ii. Lay down the procedure for documenting the passport data of the planting stock with reference to its precise species and clonal identity, geographical origin and demonstrated superior pedigree.

iii. Ensure that the planting material is multiplied in a manner that ensures quality of plants generated in the accredited nurseries.

iv. Make both the QPM producers and the planting agencies including farmers aware of the quality aspects of planting material.

v. To validate, verify and certify the origin of planting material with chain-of- custody type of documentation (paper trail) at all stages of production from mother plant to supply of planting material to consumers.

vi. Monitoring of the performance of nurseries and quality of plants produced through regular inspection and renewal of accreditation.

vii. Phase out plant material of seed origin in the times to come to plant superior clonal material raised through different multiplication techniques.

These guidelines are perceived to bring about a change in eco-system of bamboo plantations, the applicability not to be restricted only to plantations under the National Bamboo Mission, but to other programs and private initiatives too. These are envisaged to be dynamic and changes, as and when required, shall be effected with the approval of the Executive Committee of the NBM.

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DDG (Research), ICFRE	Convenor
DDG (NRM), ICAR	Member
Joint Secretary & DG NECTAR	Member
Director CFTRI Mysore	Member
Director, KFRI, Peechi	Member
Mission Directors – Maharashtra and MP	Member
Additional Commissioner (NBM), DAC&FW	Member Secretary

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During the course of preparation of this document, consultation with different States implementing NBM and efforts of all who have been directly or indirectly associated in giving the present shape to these guidelines is also thankfully acknowledged.

Abbreviations used

AICRP	All India Coordinated Research Project
ATL	Accredited Test Laboratory
CAU	Central Agricultural University
DBT	Department of Biotechnology
DNA	Deoxyribose Nucleic Acid
GoI	Government of India
GPS	Geographic Positioning System
HoFF	Head of Forest Force
ICAR	Indian Council of Agricultural Research
ICFRE	Indian Council of Forestry Research and Education
IPR	Intellectual Property Right
KFRI	Kerala Forest Research Institute
NBM	National Bamboo Mission
NCS-TCP	National Certification System for Tissue Culture raised Plants
PCCF	Principal Chief Conservator of Forests
QPM	Quality Planting Material
SAU	State Agricultural University
SBM	State Bamboo Mission
SLBNAC	State Level Bamboo Nursery AccreditationCommittee
TCP	Tissue Culture Raised Plants
TCPF	Tissue Culture Production Facility

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1. Introduction

The unique biological features of bamboo pose hurdles in its accurate identification, easy propagation and raising plantations. Flowering in bamboo is mostly through long cycles that are difficult to predict accurately, therefore, seeds are not a dependable means for propagation, unless from a certified source viz research labs or closely monitored identified superior clumps. Bamboo being an open pollinated plant will also result in a heterogeneous progeny. Commercial planting stock in bamboo is currently produced through a variety of modes of propagation and the resulting propagules show differences at various phases of growth, due to use of more often than not uncertified planting material.

At the nursery level, it is extremely difficult to identify all the bamboo species based on juvenile characteristics. Mix-up of species and misidentification are not uncommon. With the advent of DNA bar-coding techniques, the scope for precise identification of bamboos at species level has considerably improved and currently the techniques are applicable for the priority species (Suma *et al.* 2016). Reliable means are required for ensuring that the plants being produced in the nurseries and used for establishing plantations are properly identified at the species level and are of a superior pedigree. The conventional means for identification of bamboo species is based on morphological features of mature clumps especially the newly emerging culms and available flower characteristics. Several publications are available to guide the experts in proper identification of bamboo but precise identification is only possible by an experienced taxonomist.

Conventional genetic improvement strategies are largely not feasible in bamboo due to the long and unpredictable flowering cycles and consequently the lack of synchronous flowering for undertaking crosses. Therefore, only selection of clumps with desirable traits (such as culm height, culm straightness, internode length, internode girth/diameter, wall thickness, clump health, etc.) and/or proven to be superior in performance in field trials can currently be considered as genetically superior stock. Mass clonal multiplication of such plus clumps through conventional vegetative means or through micro-propagation to produce quality planting stock should be adopted. Misidentification of species and lack of information about varieties/landraces and the very serious issue of lack of information of the age *vis-a-vis* the flowering cycle of the mother clumps are the major impediments in bamboo propagation. Therefore, any programme aimed at improving the productivity should look at the ways and means of ensuring that properly identified and selected genetically superior mother clumps alone are propagated.

There is a need to identify the Candidate Plus Clumps of commercially important species and put a list with geo tagged location on the website of National Bamboo Mission and State Bamboo Missions. The parameters of Plus Clumps of few bamboo species as identified by MP State Bamboo Mission and which are indicative are given at Appendix-8. Similarly, the parameters for other bamboo species may be followed.

It is expected that the following broad guiding principles shall be kept in view by the agencies recognized and the expert members for accreditation of nurseries and certification of the Bamboo planting stock.

1.1 Identification of Bamboo Species and Clones:

Identification of bamboo species requires the involvement of an expert with adequate experience in the area. No guidelines are issued here for that reason. With the advent of DNA bar-coding techniques it will soon be the method of choice for identification of species.

Voucher specimens consisting of plant material particularly those parts with diagnostic value viz. the leaf sheath, inflorescence and seeds supplemented with photographs of the emerging culms, branching pattern etc. are required to be collected. The procedure for selection of clones would by itself ensure that the identification of the species is done by an expert. When seeds are collected for propagation, the above procedure should be given attention. The voucher specimens are best deposited at a recognized herbarium or research organization and a Catalogue No./Herbarium Accession No. obtained for future reference. Digital photographs of the diagnostic characteristics would also help in identification and to supplement the voucher specimen.

State Bamboo Missions shall endeavor to do geo-tagging of plus clumps and species-wise location of the clumps should be documented particularly with respect to the geo coordinates as ascertained by a GPS instrument and also marked on a map along with important landmarks. The complete information so generated should be uploaded on the web site of the NBM for use by all the stakeholders in the national interest. To guide the State Bamboo missions on the selection of CPCs, the criteria to identify the CPCs of few select species are given at **Appendix-8** which is indicative and not exhaustive.

The Mother stock of the clone to be multiplied should also be DNA fingerprinted so as to enable Intellectual Property Rights to be implemented if required as well as to avoid mixing and to carry out genetic fidelity tests for TC plants as a part of quality control. The transfer of QPM or superior propagules shall always be guided by IP Guidelines of the respective institutions.

Several publications in conjunction with the type herbarium specimens help the experts in the identification of bamboo species.

1.2 Seedlings, Clonal Planting Material:

The species identity of planting material in the nursery can often be confused and inadvertent mixing of lots is not uncommon. It is essential that the passport data of the parent plus clumps is maintained as the basis for establishing the species identity of the nursery stock and maintaining the chain of custody type of documentation and proper labeling in nursery and special care to prevent mixing of batches is to be taken. Good Nursery Practices will form the basis of ensuring that **inadvertent mixing of batches does not occur**. Since most of the bamboos are only vegetatively propagated, the planting stock should have undergone clonal trials at multiple locations, to establish the genotypic stability. Presently it may be difficult to get the material tested. However selected and source identified material from plus clumps are available and should be preferred over any routine source of unknown origin.

1.3 Maintaining Rhizome Garden/Clonal Bank:

The mother plants in the Rhizome Garden will be maintained under proper phyto-sanitary conditions so that the clumps are disease and pest free. The phyto-sanitary perspective of the quality of the planting stock has to be ensured in the certification process since it has a great influence on the performance in the plantation.

Symptoms of fungal and bacterial diseases of bamboo are well documented in the illustrated manual by Mohanan (1997). Inspection of the planting material for signs of diseases and prophylactic measures as part of the nursery management should be ensured. The growing stock should be free from diseases and pests and nutritional deficiency. The Nursery Log book /Register should record the treatment schedules and monitor the progress.

1.4 Overall Quality of Planting Material:

The quality of the bamboo planting material will also be determined by the cultural practices followed in the nursery. The vigor of the planting material is determined by the number of culms and the rhizome formation. The planting stock should exhibit well developed rhizome, well developed tillers with green and healthy leaves.

For sampling, the plants are removed from the container, washed in water to remove the soil from the root and rhizome system.

The following criteria for the quality of the shoot, rhizome and root system shall be followed in the Nursery:

i. **Shoot System**:
   a. *Good quality*: 4 sturdy shoots of 50 cm or more in length with healthy leaves.
   b. *Acceptable*: At least 3 sturdy shoots which are 50 cm or longer with healthy leaves.
   c. *Rejected*: Only 1-2 shoots or leafless/ poorly developed shoots.

ii. **Rhizome System:**
   a. *Well Developed*: Number of well developed rhizomes are the same as the shoots or more.
   b. *Acceptable*: Number of rhizomes at least the same as shoots.
   c. *Rejected*: Without any well developed rhizomes/with damaged rhizomes.

iii. **Root System:**
   a. *Well Developed*: Each shoot with robust rootsystem
   b. *Acceptable*: Planting material with at least two functional roots per shoot.
   c. *Rejected*: Lacking well developed root system.

iv. **Micro-propagation (Tissue Culture)**

The National Certification System for Tissue Culture Plants (NCS-TCP) of the Department of Biotechnology shall be adopted for the purpose of recognizing/accrediting/certifying bamboo micro-propagation facilities.

The NCS-TCP also includes specific standards for certification of bamboo which shall be adopted for the purpose of NBM.

The mode of plantlet regeneration adopted by the Tissue culture lab is to be specified. The number of cycles after which the plants have been regenerated and the batch size is to be properly documented. **Genetic Fidelity testing with molecular** markers through ATL or any reputed Government Institutions *e.g..,* Institutes under ICAR, ICFRE, CSIR, SAUs, Central Agriculture Universities (CAUs), is mandatory in the case of tissue cultured

plantlets. 0.1 % of the batch is to be subjected to the test in an approved laboratory following Good Laboratory Practices (GLP) as per the guidelines of the NCS-DBT.

Documentation of Nursery on Chain of Custody (COC) is to be ensured. Accredited Bamboo Nursery owners have to maintain a genuine record of the movement of the planting material from the source to nursery and from Nursery to the planting site.

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2. Accreditation Guidelines of Tissue Culture Units/Labs engaged in Micro-propagation of Bamboos

For the purpose of recognition of Tissue Culture Production Facilities the Certification System, titled "**National Certification System for Tissue Culture Raised Plants (NCS-TCP)**" issued by the Department of Biotechnology, Ministry of Science & Technology, Government of India, is available at website http://dbtncstcp.nic.in/Portals/0/Images/NCS_TCP_Book.pdf, shall be adopted.

All the recognized Tissue Culture Production Facilities (TCPF) under the NCS-TCP shall be eligible for producing bamboo TC propagules subject to certification of Tissue Culture raised plants as per procedure described in the NCS-TCP. Tissue culture raised plants ready to dispatch to the farmers will be tested for all known viruses and true to type in order to certify under NCS-TCP.

All such recognized units working in the state shall be listed by the respective State Bamboo Missions, with species, production capacity etc. for maintaining a data base in this regard which shall also be regularly updated on the website of NBM and SBM.

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3. Accreditation of Bamboo Nurseries engaged in production of Bamboo Planting Material

For the purpose of Accreditation of Bamboo Nurseries engaged in production of Bamboo planting Material, **State Level Bamboo Nursery Accreditation** Committees (SLBNAC). These shall be notified by NBM after the due process outlined below. These State level Bamboo Nursery Accreditation Committees will oversee the accreditation process in their respective States. The SLBNAC shall have the members/experts on bamboo apart from representation from the heads of the research wing and PCCF, HoFF of respective States. The list and contact details of the notified SLBNAC in each State will be posted on the NBM website.

A. The composition of State Level Bamboo Nursery Accreditation Committee for different States implementing restructured National Bamboo Mission shall be as under:

1	**Head of the State Bamboo Mission in respective States**	**Chairman**
2	Representative of PCCF (HoFF) of the State	Member
3	Representatives of State Forest Research Institute (SFRI)/ Research Wing of Agriculture/Horticulture Department	-do-
4	Two technical experts, one each i. **Taxonomy** and ii. **Propagation/Nurseries/Biotechnology** with expertise in bamboo research (to be nominated by the Head, State Bamboo Mission in consultation with Director/Head/In-charge of any one of the ICAR/ICFRE or KFRI Centre or Institutes/ State Agriculture Universities engaged in Research on Bamboos, falling within or nearest to the concerned state)	-do-
5*	Farmers Representative	-do-
6*	**Member Secretary**	-do-

*5 and 6 to be nominated by the SLEC.

The SLEC (State Level Executive Committee) under NBM chaired by the Chief Secretary of the respective State shall be the authority to constitute and recognize the State Level Bamboo Nursery Accreditation Committees.

B. The recommendations of the Technical Committee I of NBM shall be placed before the Executive Committee for recognizing the respective State Level Bamboo Nursery Accreditation Committees.

For accreditation of the Bamboo nurseries under NBM and/or certification of Bamboo Quality Planting Material, the applicants shall apply to the SLBNAC on prescribed formats enclosing the non-refundable prescribed fee of Rupees Five thousand only per nursery in the manner prescribed by SLBNAC. Thereafter the Chairman of respective SLBNAC on receiving the application on the prescribed form **(Appendix - 1)** from bamboo nursery owners having paid the prescribed fees shall visit and assess the nursery within **Forty Five** days in terms of compliance with the listed criteria in the Assessment Sheet **(Appendix – 2)**.

It is advised that prior to applying for accreditation of nurseries, the self assessment should be done by the persons interested in getting their nurseries accredited on the following lines.

A. Infrastructure:

(i) Available infrastructure- land, polyhouse, shade house, greenhouse, tissue culture lab, mist chamber, etc.
(ii) Area and Layout, protection, exposure to wind, floods, frost, etc., topography and soil type
(iv) Tools and equipments
(v) Water source, nursery shed, storage area for chemicals, fertilizers, etc.
(vi) Compost yard
(vii) Proximity to transport systems.

B. Seedlings/Propagules Production System:

(i) Growing methods- propagation techniques
(ii) Planting material used
(iii) Authentic source/ known origin
(iv) Whether clonal collection available for multiplication
(v) Traceability
(vi) Labeling
(vii) Qualification of all staff
(viii) Production and sale details of last three years
(ix) Ability to deliver bulk orders of at least 20000 plants
(x) Quality of water and method of irrigation
(xi) Extent of mechanization
(xii) Quality of substrate/ potting mix.

C. Management Practices:

(i) Number of years in operation
(ii Number of staff and labour engaged
(iii) Flow chart of production process
(iv) Record keeping
(v) Quarantine and phyto-sanitary measures
(vi) Protection measures
(vii) Providing information on planting and maintenance methods and facility for post-sale plant care.

D. Quality Parameters:

(i) Adoption of quality standards for the planting stock
(ii) Quality of the planting stock available for sale.

For the above parameters, points shall be assigned by the SLBNAC and based on points awarded for each parameter; the nursery shall be assessed for accreditation. The Committee may decide to accredit the nursery or reject the application based on the on spot assessment.

On assessment by the respective SLBNAC, those nurseries fulfilling and qualifying the prescribed standards will be issued a "*Certificate of Accreditation*" **(Appendix-3)** for three years only. The list of thus accredited nurseries shall be uploaded on the websites of the State Bamboo Mission and the National Bamboo Mission. In case of the nurseries rejected for accreditation, the intimation to this effect shall be sent by the Chairman, SLBNAC to the owner of the Nursery.

NOTE:

The rejected applications may be considered by the SLBNAC again for accreditation on having received the application for the same as fresh application along with the prescribed fee, when the applicants feel that they have fulfilled the prescribed parameters required for accreditation.

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4. Guidelines for Certification of Quality Planting Material of Bamboos

4.1 Procedure for Certification of Bamboo Planting Stock:

NBM will oversee the certification of Quality Planting Material across the country through the Technical Committee-1. The respective State Level Bamboo Nursery Accreditation Committee duly recognized by State Level Executive Committee (SLEC) shall also act as agencies to certify the Quality Planting Material of bamboos.

The list and contact details of the State Level Bamboo Nursery Accreditation Committeein each state under the NBM will be posted on the NBM website. The nursery owners interested to get their planting stock certified prior to sale shall apply on prescribed format **(Appendix -4)** alongwith non-refundable fee of Rupees One thousand only per 1000 plants drawn as sample @ 1 per cent of the lot/batch to the respective SLBNAC in the manner prescribed by the SLBNAC. The SLBNAC, on receiving an application on the prescribed format from bamboo nursery owners having paid the prescribed fees, shall visit, assess and evaluate the plantable stock within thirty days in terms of compliance with the listed criteria in the Assessment Sheet **(Appendix – 5)**.

For the above purpose,'**batch**'is defined as the propagules of the same age developed from same source/multiplication materialofidentified superior clone/candidate plus clump,multiplied through same procedure.

Thereafter theChairman, SLBNAC shall issue a "*Certificate of Bamboo Planting Stock"***(Appendix - 6)** to the nursery owner for the species and plantable number of seedlings/propagules with a copy of the same endorsed to the NBM.

Based on their assessment, the agency may certify or reject the planting stock offered for certification. After having certified the planting stock, Accredited Bamboo Nurseries at the time of sale will issue labels which will depict the essential information giving quality assurance to the bamboo grower with prescribed format **(Appendix - 7)** without fail. Also the record showing the details of the species, number of plants, purchaser and location with area proposed for planting shall be maintained by the Nursery owner for future reference.

4.2 **Certification of already existing Planting Stock**:

The quality of planting stock already available in the Government owned institutions *e.g.*CSIR, SAUs, Forest Departments, Horticulture Departments, ICAR, etc.nurseries and the stock raised from seed source shall be acceptable to be planted in the field strictly and only if it is established that the seed source/ source material is authentically identified and is of proven good quality as per the assessment and evaluation by the SLBNAC. The assessment of thepopulation from where the seeds have been collected may also be taken in to consideration. Experts in the Committee will corroborate and confirm the claims of quality seed raised planting stockwith the known time of flowering and seed collection. However, the nursery owner shall have to apply to the SLBNAC for certification of such Planting stock in application (**Appendix-4**).

For maintaining the quality and superiority of the planting stock it is envisaged that planting material raised from seed source shall be replaced by authentic clonal material in a phased manner.

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5. Miscellaneous regulations

5.1 Identification of Source of Planting Material:

a) Identification of bamboo at the species level is done by an acknowledged expert in bamboo taxonomy who shall be the nominated member in the accreditation agency mentioned above. Wherever feasible DNA bar-coding for precise identification shall be used to confirm the species identity.

b) Genetically superior bamboo clumps/Candidate Plus Clumps at the mature stage of growth and with the flowering cycle documented with certainty are only to be used for multiplication in the Accredited Bamboo Nurseries. This forms the origin of all certified planting material propagated and sold in accredited bamboo nurseries. The proof of genetically superior material obtained from authentic source is to be provided to the accreditation committee.

5.2 Mass Production of Planting Material:

Correctly identified seeds and genetically superior clones of bamboo obtained with the necessary certificates of origin from research Institutes of ICAR, ICFRE, KFRI, SAU only, will be mass propagated and the planting material conforming to the prescribed standards will be labeled as Certified Bamboo Planting Material by accredited bamboo nurseries.

5.3 Establishing and Maintaining Multiplication Gardens/ Demonstration Gardens by the State Bamboo Missions/BTSGs:

Rhizome Banks/Multiplication Gardens of important species will be established by the BTSGs including KFRI, Peechi; CBTC, Guwahati; ICFRE; CAFRI, Jhansi, on ICAR Centres or forest land in at least 2 ha area each at one or more than 'one location in different agro-climatic zones in the respective Statesand maintained by the All India Coordinated Research Project(AICRP) on Agroforestry Centresof ICARfor mass propagation of bamboo species in technical collaboration with the locally available research institutes/universities. They shall act as **Demonstration centres** for farmers and other stakeholders.

5.4 Maintaining Traceability:

Documentation of the Chain-of-Custody of vegetative material used for producing planting stock will be maintained by the accredited nursery at all stages right from the certified mother clump through any of the mass propagation systems to the point of

sale from where the farmers procure the labelled planting stock for which the stock register mentioning the source and sink shall be maintained by the accredited nursery (**Appendix 9-A and 9-B**).

i. The Bamboo Nursery having identified the species and specific clones for propagation in their premises shall maintain the necessary documentation authenticating the species and clonal identity including Chain of Custody (CoC). Clones will be maintained in the Rhizome Garden /Clonal Bank with their identity clearly labeled and used for further multiplication.

ii. Any of the popular clonal propagation methods can be used for mass propagation. This includes rooted stem cuttings, branch cuttings, layering, rhizome offsets and tissue culture. Macro-proliferation of the resulting planting stock is a method that can be followed to maintain stocks for many cycles. The details are given in the Guidelines and Manual for Certified bamboo Nurseries (Pandalai and Muralidharan, 2014a and 2014 b) and Muralidharan and Pandalai (2014).

5.5 Documentation of all Bamboo Nurseries in the State:

Record of all the bamboo nurseries accredited within the State intending to multiply and supply bamboo planting material shall be maintained by the State Bamboo Missions with regularly updation of the information for uploading on the website of the NBM. The State Bamboo Missions will be responsible for maintaining records about the nurseries such as address, owners contact, species, capacity, location, production capacity etc. Also State Bamboo Missions will periodically check their activities undertaken on regular basis.

5.6 Cancellation of Accreditation:

The owners of the accredited nurseries will ensure implementation of the above scheme in letter and spirit to make this effort successful.If anything contrary comes to the notice of the SLBNAC and which will directly or indirectly affect the production of quality planting material, the accreditation of such nurseries will be cancelled by the SLBNAC, with placing the names and location of those nurseries on the website of both State Bamboo Mission and National Bamboo Mission. Farmers, if they feel, may get their planting material tested for DNA, even after passage of time after the same has been planted in the field and may report the results to the SLBNAC for taking action against the nursery owner.

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6. References and Suggested Reading Material

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8. Muktesh Kumar (2002) Commercial Bamboos of Kerala. KFRI Handbook No. 12.KFRI.20 p

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10. Muktesh Kumar (2012) Bamboo Diversity and Taxonomic keys. KFRI Handbook No. 28. 99 p

11. Muralidharan E.M. and Pandalai, RC (2014) Certification of Bamboo Planting Material for Area Expansion Programme under National Bamboo Mission BTSG-KFRI, Peechi

12. Negi, S S and Naithani, H. B (1994) Handbook of Indian bamboos, Oriental Enterprises.

13. Pandalai R.C and Muralidharan E.M. (2014a) Guidelines for Establishment and Management of certified BambooNurseries BTSG- KFRI, KFRI, Peechi

14. Pandalai, RC and Muralidharan E.M. (2014b) Manual for Establishment and Management of Certified Bamboo Nursery, BTSG- KFRI, KFRI, Peechi

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16. Suma ArunDev, V.B. Sreekumar and E.M.Muralidharan (2017) DNA barcoding as a valuable molecular tool for certification of bamboo planting material KFRI Research Report No. 529, KFRI, Peechi. 38p.

17. Tewari, D.N. (1992) A monograph on bamboo. International Book Distributors, Dehra Dun

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7. APPENDICES

Appendix - 1

Format for Application for Accreditation of Bamboo Nursery

1	**Name of Applicant**		
2	**Name of Nursery**		
3	**Full Address**	**:**	**Email ID** **Mobile No**
4	**Location of Nursery**	**:**	**State: District :** **Town/village:** **GPS Coordinates:**
5.	**Constitution**	**:**	**Govt. / Private /Regd. Trust /Society:**
6.	**Year of establishment**	**:**	*(Mention year of initiating bamboo propagation)*
7	**Number of Trained staff**	**:**	*(Give category, number, technical qualifications and since when deployed)*
8	**Facilities** (*Give details only of facilities used exclusively for bamboo) also**Provide a layout map***	**:**	**Area:** **Fenced or not:** **Propagation facilities available:** **Mist chamber with area** **Green Houses with area:** **Nursery buildings: Masonry/Thatched/ other** **Water Source:** **Irrigation system:** **Production capacity:**
9.	**Species wise list of mother plants available for multiplication**	**:**	*(a)Species –* *(b)Part used for propagation-* *(c)Source from where procured-* *(d)Date/year of procurement*
10	**Species wise planting stock available with age**		*(a) Species* *(b) Batch with Number of plants* *(c) Age of plants*
	Fees paid	**:**	*(Give details of mode of payment)*
			(Signature of Applicant with seal and date)

Appendix -2

Assessment Sheet for Accreditation of Bamboo Nursery

(For use by the State Level Bamboo Nursery Accreditation Committee)

Name of the Nursery:
Name of the Owner:
Address in Full:
Contact Details: Phone: Mobile: E-Mail

Sl. No.	Particulars	Assessment/ Comments	Maximum Marks	Marks Obtained
1	**Infrastructure (15 Marks)**		15	
	• Available infrastructure - land, poly house, shade house, greenhouse, tissue culture lab, mist chamber, etc.			
	• Area and Layout, protection, exposure to wind, floods, frost, etc., topography and soil type			
	• Tools and equipment			
	• Water source, nursery shed, storage area for chemicals, fertilizers, etc.			
	• Compost yard			
	• Proximity to transport systems			
2	**Production System (35 Marks)**		35	
	• Growing methods- propagation techniques			
	• Planting material used			
	• Species-wise Authentic source/ known origin			
	• Whether clonal collection available for multiplication			
	• Traceability			
	• Labelling			
	• Qualification of staff			
	• Production and sale details of last three years			
	• Ability to deliver bulk orders of at least 20000 plants			
	• Quality of water and method of irrigation			
	• Extent of mechanization			
	• Quality of substrate/ potting mix			
3	**Management Practices (30 Marks)**			
	• Number of years in operation			
	• Number of staffand labour engaged with			

	qualifications/experience		30	
	• Flow chart of production process			
	• Record keeping			
	• Quarantine and phytosanitary measures			
	• Protection measures			
	• Providing information on planting and maintenance methods and facility for post-sale plant care			
4	**Quality Parameters (20 Marks)**		20	
	• Adoption of quality standards for the planting stock			
	• Quality of the planting stock available			
Total			**100**	

Total marks obtained and grading:

Marks obtained	Grade	Star rating
61 - 70	Good	*
71 - 80	Very Good	**
81 and above	Excellent	***

Note: Nursery assessed forless than 61 marks shall not be accredited.

Names and signatures of State Level Bamboo Nursery Accreditation Agency:

Sl. No.	Name and Address	Phone/ Mobile/ e- Mail	Signature
1			
2			
3			
4			
5			
6			

Date:
Place:

Chairman
State Level Bamboo Nursery Accreditation Agency

Note: The assessment sheet shall be retained by the Chairman, State Bamboo Mission for record and shall form the basis for issuing the Certificate of accreditation as perAppendix-3.

Appendix - 3

_____State Bamboo Mission

City, State

Certificate No: _____/ _____State/SBM/NRY/2019-20

Certificate of Accreditation of Nursery

After having inspected the Bamboo Nursery titled M/s_____ belonging toShri/Smt_____ located at _____ on dated_____ by the _____ State Level Bamboo Nursery Accreditation Committee and on its recommendation, the above said nursery is accredited for threeyears from this day, for production and sale of Quality Planting Material of Bamboo

Seal & Signatures

Date:
Place:

Chairman,
_____State Level Bamboo Nursery Accreditation Committee

Note: Three copies of this certificate shall be prepared for (i) NBM (ii) State Bamboo Mission and (iii) Nursery Owner

Appendix -4

Format for Application for Certification of Quality Planting Material of Bamboos

1. Name of the Nursery:

2. Name of the Owner:

3. Address in Full:

4. Contact Details:

   Phone: Mobile: e-Mail:

5. Species-wise

   (a) Source of Mother plants:

   (b) Batch size:

   (c) Age of the plants:

   (d) Size of containers:

6. Details of Fees deposited:
   (Rs. One Thousand Only per batch of 1000 plants)

Name and Signature
of the Nursery Owner

Date:

Appendix -5

Assessment Sheet for Certification of Quality Planting Material of Bamboos

(For use by the State Level Bamboo Nursery Accreditation Committee- Separate sheet may be used for different species of Bamboo)

Name of the Nursery:
Name of the Owner:
Address in Full:
Contact Details:Phone:

A. Name of Species			
i	Scientific Name	:	
ii	Variety name/Local name (if any)	:	
B.	**Origin/Source of Planting Material:**		
i	Source of planting material	:	*Seed/Tissue culture/Vegetative propagation with location of source material/organization*
ii	Accession No./Clone No.		
iii	Batch No.	:	
iv	Batch Size presented for assessment and certification	:	
v	Expected year of flowering	:	
C.	**Propagation**		
i.	Mode of Propagation	:	*(Seedlings/Rooted culm cuttings/ rhizome offsets/ /micropropagation. Indicate if macroproliferation was adopted and if so number of cycles)*
Ii	Details of certification from NCS-TCP, DBT for TC plants	:	

Mobile: E-Mail:

Details of assessment done:

Sl. No.	Particulars	Assessment/ Comments	Maximum Marks	Marks Obtained
1	**Genetic quality**			
	• From where the Nursery Owner got the Mother stock for multiplication		30	
	• Routine source/ source identified/ selected/ tested			
2	**Physical Quality**			
	• Status of rhizome		40	
	• Stage of tillers			
	• Status of leaves			
3	**Physiological/ health quality**			
	• free from nutritional deficiency		30	
	• free from disease and pests			
TOTAL			**100**	

Note: the sample plants drawn against a batch shall be certified for plantingonly if the representative plants obtain more than 60 marks.

Names and signatures of State Level Bamboo Nursery Accreditation Committee:

Sl. No.	Name and Address of the SLBNAC members	Phone/ Mobile/ E Mail	Signature
1			
2			
3			
4			
5			
6			

Date:
Place:

(Signature with seal)
Chairman
State Level Bamboo Nursery Accreditation Committee

Appendix - 6

Certificateof BambooQuality Planting Stock

(to be retained by the Nursery owner for each batch of planting material produced in an accredited nursery)

Certificate No: _____/ _____State/SBM/QPM/2019-20

After having inspected the batch of planting stock offered for certification in Bamboo Nursery titled M/s_____ belonging to Sh._____ located at _____ on _____ by the _____ State Level Bamboo Nursery Accreditation Committee, the species-wise batches with number of plants as detailed below are certified for planting into the field.

Sl. No.	Species	Batch	Number of Plants certified

Seal & Signatures

Date:
Place:

Chairman,
_____State Level Bamboo Nursery Accreditation Committee

Note: Three copies of this certificate shall be prepared for (i) NBM (ii) State Bamboo Mission and (iii) Nursery Owner

Appendix– 7

Format of Label to accompany the sold Certified Bamboo Planting Material

CERTIFIED BAMBOO PLANTING MATERIAL

Name of Bamboo Nursery: Certification No. Validity period: Address and contact number: Purchaser: Name , Address and Contact No.		
1	Name of Species with Common name (in local language) :	
2	Clone (No. and Name) with source and location of mother material:	
3	Number of Plants sold with Batch number	
4	Age of planting material :	
5	Expected date (year) of next Flowering:	
6	Price paid:	
7	Place/location and extent ofareaarea where the plants shall be planted ***(as per information provided by the purchaser)***	

Declaration

The information provided above is true as per records of the nursery maintained which can be verified at any date.

In case of complaints, write/call : Telephone: Email :

Date: Signature of Nursery Owner with seal

(Note: Three copies of this Label shall be prepared for (i) Purchaser (ii) State Bamboo Mission and (iii) Nursery Owner

Appendix - 8

Criteria to identify Candidate Plus Clumps (CPCs) of Selected Bamboo Species

Species	Culms per sq. m in a clump	No. of culms	Collar Diameter in cm	Percentage of bamboo Tapering	Wall thickness tapering	Wall thickness in cm	Length of mature bamboo in m	Branch to culm ratio	Body mass Index	Minimum criteria for CPC selection
1	2	3	4	5	6	7	8	9	10	11
Bambusabalcooa	>12	>10	>8	<10	<75	>3	>15	<10	>0.20	4
Bambusabambos	>12	>10	>8	<10	<75	>3	>15	<10	>0.20	4
Bambusastriata	>12	>10	>8	<10	<75	>3	>15	<10	>0.20	4
Bambusanutans	>12	>10	>8	<10	<75	>3	>15	<10	>0.20	4
Dendrocalamusstrictus	>30	>10	>6.5	<10	<75	>3	>10	<10	>0.20	4

Note: The list above is indicative and not exhaustive.

Species-wise Particulars of Bamboo Mother Stock for Multiplication brought into the accredited nursery

1)To be maintained in register by Nursery Owner, as and when new planting material is brought for multiplication in the nursery.

2)Separate sheet may be used for different species)

Name of the Nursery:
Name of the Owner:
Address in Full:
Contact Details: Phone: Mobile: E-Mail

Sl. No.	Date	Species	Category of multiplication material procured (Rhizomes, Branch Cuttings, Tissue Culture Raised Plants, Seeds, Seedlings, Saplings)	Source of procurement	Quantity/Numbers procured
1					
2					
3					
4					
5					

Important:

1. In case multiplication material is taken from CPC please mention authentic month/year of Gregarious Flowering:
2. Location of CPC (with Coordinates)
3. Size of batch and source:
4. General Health of Planting Stock:

Date:

Signature of Nursery owner with Seal of the Nursery

Place

Species-wise Particulars of Outgoing Quality Planting Material of Bamboos

Name of the Nursery:
Name of the Owner:
Address in Full:
Contact Details: Phone: Mobile: e-Mail

Sl. No.	Name, address, contact details of purchaser (Individual, Company/Firm	Date of sale	Name of Bamboo Species	Number of plants sold	Location and area where planted (as per column 7 of Appendix-7)
1					
2					
3					
4					
5					

Important:

1. **Size of batch and source:**
2. **General Health of Planting Stock:**
3. **Location where the material is to be planted:**
4. **Plantation for commercial, industrial, community or household purpose:**

Date:

Place **Signature of Nursery owner with Seal of the Nursery**