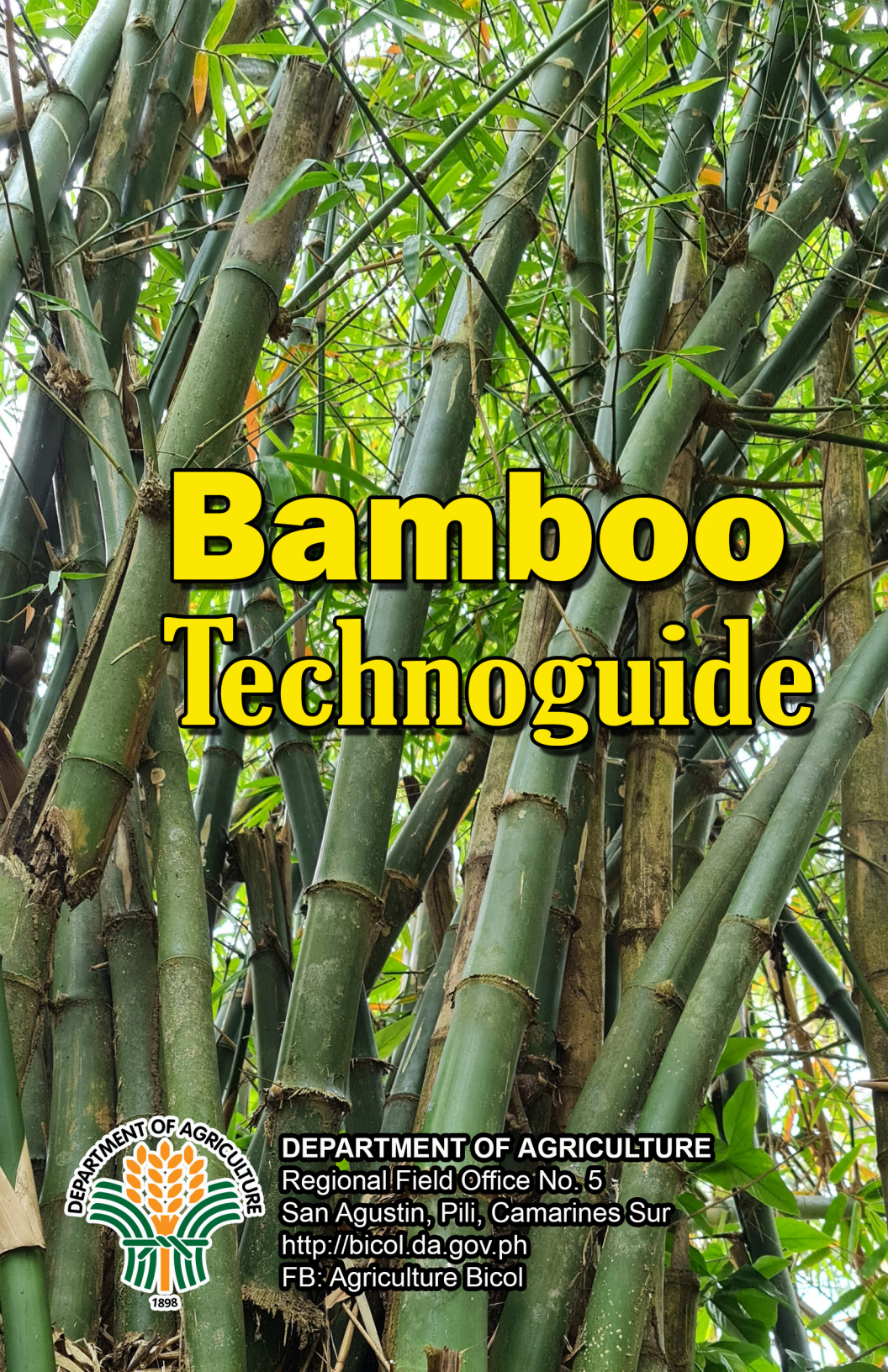

Bamboo Technoguide

DEPARTMENT OF AGRICULTURE
Regional Field Office No. 5
San Agustin, Pili, Camarines Sur
http://bicol.da.gov.ph
FB: Agriculture Bicol

FOREWORD

From "poor man's timber," to "green gold," bamboo has been a symbol of strength and flexibility due to its wide range of products and markets.

In the Memorandum issued by Agriculture Secretary William Dar on February 7, 2020, the High Value Crops Development Program (HVCDP) was directed to include bamboo as one of the priority crops under HVCDP.

DA Bicol HVCDP will focus on the development of the bamboo industry as a source of income for farmers and entrepreneurs through the showcase of bamboo technologies and creation of a venue for agri-learning and development.

A20-hectare bamboo technology demonstration sites in the Bicol region is underway in Del Gallego, Camarines Sur.

Another component of the bamboo project is the production of IEC materials for dissemination to farmers to help in the promotion of the bamboo industry in the region. This IEC material will help prospective bamboo growers learn some production techniques and economics of bamboo production.

RODEL P. TORNILLA, MABE
Regional Executive Director

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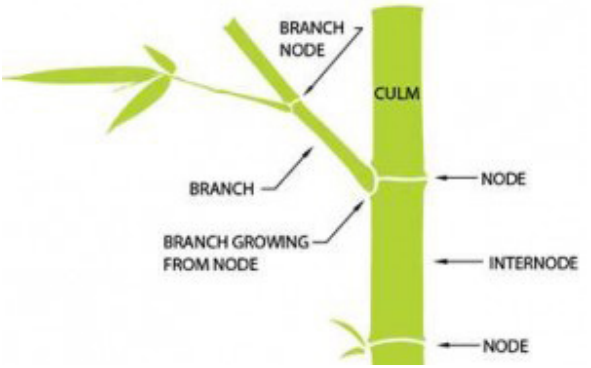
INTRODUCTION

Bamboo is the tallest perennial grass belonging to the Graminae family. Due to the long cylindrical woody stem strength and ease of workability, bamboo is a versatile material for a variety of economic uses: handicraft and furniture; farm implements; fishpen, fishcages and other fishing gears; banana props; musical instruments; pulp and paper; and, house construction. Aside from these, young shoots of some species are edible. There are 60 known bamboo species in the Philippines and their number is increasing because of the newly-introduced species by plant collectors and bamboo enthusiasts.

Demand for bamboo in the Philippines is steadily increasing. However, the demand is not currently met. Bamboo production is, therefore, a potential source of income for agroforestry farmers. Bamboo also has ecological benefits as it minimizes soil erosion and stabilizes river banks. Bamboo thrives in a wide range of site conditions making it a suitable reforestation species for environmental protection. Bamboo has notable economic and cultural significance in Southeast Asia, being used for building materials, as a food source, and a versatile raw product. Certain species of bamboo can grow 36 inches within a 24-hour period, at a rate of 1.6 inches an hour.

(Source: PCARRD's The Philippines Recommends for Bamboo).

Parts of the Bamboo



RHIZOMES

(Source: Bamboo Botanicals)

BAMBOO SPECIES

These are the economically important species of bamboo.

1. Bambusa blumeana Schultes f (Kauayan-tinik).

It is erect, clump-forming species, reaching a height of 10-25 m, a diameter of 10-20 cm, and hollow internode of 40-60 cm long. It can be easily distinguished by its large clumps and dense thicket of spiny branches surrounding its basal portion.

Kauayan-tinik is the most extensively distributed species. It can be found almost everywhere in the country, except in areas of high elevation. Its superior strength, durability and culm size make this species the most useful and valuable among all species.

2. Bambusa vulgaris Schrad. Ex. Wendl. (Kauayan-kiling)

It has an an open or loose clump-forming habit. Culms which reach a height of 10-15 m and a diameter of 6-10 cm are spineless. It has yellow-green internode. Culm sheaths are deciduous, brittle, straw-colored and the outer surface is pubescent.

It is claimed to have been introduced into the country during prehistoric times. It is now thinly distributed in areas at low and medium altitudes. It has been observed often that a clump of this species grows singly. Although it does not occur in abundance in any particular province, it is found in backyard along the periphery of cultivated lands, creeks and at the foot of hills.

3. Dendrocalamous asper (Schultes f.) Backer ex Heyne (Giant bamboo)

It grows up to 20m in height. The culms are erect and spineless. The internodes are 12-40 cm long and 12-19 cm diameter. The internode of young culm is covered with brown hair. The culm sheaths become deciduous when it matures. The nodes are slightly raised and the lower ones start to develop roots. There are several branches at each node and one is larger than the rest with basal bracts.

Giant bamboos are found in Bukidnon and South Cotabato. Cultivated clumps can be found in Laguna, Baguio City, Samar and Leyte.

4. Dendrocolomus merrf llfanus (Elm.) Elm. (Bayog)

It is clump-forming, erect, and attains 10-15 m in height. It has green, smooth intermodes, 15-30 cm long, 8-12 cm diameter with thick walls. Bayog is widely distributed in the provinces of Ilocos Sur, Nueva Ecija (Fig. 3), Rizal, Zambales, Pangasinan and Bulacan in Luzon; Cebu and Bohol in the Visayas; and in Lanao in Mindanao.

5. Glgantochloa otter (Hassk.) Kurz (Kayall)

Clumps are densely tufted, irregularly raised above the ground with aerial roots on their lower portions. Young shoots are slender green to dark green with appressed black hairs. In old clumps, culms grow up to 22 m in height 6-10 cm in diameter. The longest internode measures 40-50 cm. Dark brown hairs are appressed on the upper part of the internode. The color is light green with distinct pale rings on the nodes. Culm sheaths have black hairs, sometimes deciduous on the lower portion, long, persistent, narrowly triangular with truncate apex; rounded auricle to slightly curved with 4-6 mm long bristle, ligules 3-6 mm high, irregularly rooted; deciduous blades and reflexed.

This species is found in natural stands and in cultivation in the provinces of Davao, Surigao, Bukidnon, Samat and Layte.

6. Gigantochloa levis (Blanco) Merr. (Bolo)

The species grows erect, spineless, reaching a height of 20 m. its internode reaches 14-40 cm long, 8-10 cm diameter with hollow walls. The nodes are not prominent and the lowest node is root-baring. Spikelets are in groups at the node of leafless branches.

This species is abundant in Laguna, Quezon, Albay, Iloilo, Leyte, Aklan, and Capiz. It is also found in Davao, Mindanao.

7. Schizostachyum lumampao (Blanco) Merr. (Buho)

The culms are strictly erected and attain 10-12 m in height. The internodes are green, 20-50 cm long, 4-6 cm in diameter with thin walls. The culm sheaths are persistent. The outer surface is shiny and glabrous. The auricles are not distinct and the blades are reflexed.

Buho can be found in Laguna, Batangas, Mindoro, Palawan, Panay, Leyte, and Basilan. It is endemic to the Philippines.

8. Schizostachyum lima (Blanco) Merr. (Anos)

The culms are erect. The slender tips droop at 6-8 m in height. The internodes are 12-60 cm long and 2-4 cm in diameter. Leafy branches are numerous at the upper nodes. The culm sheaths are 18 cm long and the base is 8 cm wide. The blades are reflexed.

Anos is endemic to the Philippines. It occurs where S. lumampao exists. Clumps of anos can be found in Agusan, Minndoro, Rizal, Central and Northern Luzon. Those in Laguna and Quezon are widely scattered.

9. Sphaerobambos philippinensis (Gamble) Dransfield (Laak)

The culms reach 4-6 m in height, 5 cm in diameter. The internodes are 60-70 cm long, thin-walled and smooth. Young shoots are glabrous. Culm sheaths are 9 cm long, glabrous and smooth. The blades are erect, ovate-lanceolate and tapered measuring 6-16 cm long, 26 mm wide at the base, glabrous or abaxially; ligule is short but with long bristles auricles measure 2 mm long with long bristles.

Laak plantations are found in commercial scale in Davao del Norte.

Characteristics of Selected Bamboo Species

Common Name (*scientific name*)	Culm Characteristics	Diameter	Length of Intermode	Distribution
	(m)	**(cm)**	**(cm)**	
1. Kauyan tinik (Bambusa blumeana)	10-25	10-20	40-60	Widely distributed.
2. Kauayan kiling (Bambusa vulgaria)	10-15	6-10	30-50	Low and medium altitudes. found in backyard along the periphery of cultivated lands, creeks and foothills..
3. Giant bamboo (Dendrocalamus asper)	20	10-20	12-40	Natural groves locally distributed in Bukidnon and South Cotabato. Cultivated lumps in Laguna, Samar and Leyte
4. Bayog (Dendrocalamus)	10-15	8-12	15-30	Widely distributed in Ilocos Sur, Nueva Ecija, Rizal, Zambales, Pangasinan, Bulacan, Cebu, Bohol and Lanao.
5. Kaychi (Gigantochloa atter	22	6-10	40-50	Natural groves locally distributed in Bukidnon and South Cotabato. Cultivated lumps in Laguna, Samar and Leyte.
6. Bolo (Gigantochloa levis)	10-12	4-6	20-50	Growing in Laguna, Batangas, Mindoro,
7. Buho (Schizostachyum lumampao)	10-12	4-6	20-50	Growing in Laguna, Batangas, Mindoro, Palawan, Panay, Leyte, Basilan.
8. Anos (Schizostachyum lima	6-8	2-4	12-60	Occurring in Agusan, Mindoro, Rizal, Central and Northern Luzon.
9. Laak Sphaerobambos Philippinensis	4-6	5	60-70	Cultivated in Davao del Norte on commercial scale.

PROPAGATION OF BAMBOO

Knowledge on the different methods of bamboo propagation is vital in determining the appropriate method to be used for each particular condition.

Presently, propagation methods, either reproductive (sexual) or vegetative (asexual), are focused on economically important bamboo species. To attain successful establishment and growth, propagules must have well developed root systems and shoots arising from rhizomes.

Reproductive Method

This type of propagation involves the production of new bamboo plants through seeds. One disadvantage of this method is the infrequent to rare flowering of most bamboo species and the production of infertile seeds by most species (Fig. 6). Moreover, most bamboo species generally die soon or a year after flowering. On the other hand the vegetative growth of some species that survive slackens during flowering.

In the Philippines, the study on the flowering of bamboo has been initiated. Only few species have developed viable seeds. However, if wildlings or naturally growing bamboo seedlings in the forest are available, these can be collected and use as planting materials.

Vegetative Method

The methods for vegetative propagation are: (1) offset, (2) culm cutting, (3) branch cutting, and (4) tissue culture.

1. Offset

The method makes use of the rhizome and the portion of the culms. It is commonly used in monopodial or non-clump forming bamboos. It can be applied to some sympodial bamboo species with loose clumps such as anos: (Schizostachyum lima) and buho (Schizostachyum lumampao) because these are difficult to propagate by either culm or branch cuttings.

This method is not recommended to many tropical sympodial bamboos because of the short neck of the rhizome and too dense culms of these bamboos. Collection is difficult and may damage the culm and

the propagules. Few materials can be collected. These bamboos are inconvenient to transport, hence too expensive to use for any large scale reforestation and plantation development.

2. Culm cutting

This method uses segments of culm (cuttings) bearing buds or fascicles of branches. Cuttings are extensively used to propagate most of the sympodial bamboos of the genera Bambusa, Dendrocalamus, and Gigantochloa. Traditionally, these species are directly planted in the field particularly if the source is near the planting area. However this is practical in propagating limited number of clumps. For large scale plantation, raising these species in the nursery is necessary.

Nursery grown culm cuttings have better survival, growth and development in the field than directly planted cuttings because the former receive better care and maintenance and proper grading or selection during outplanting. Culm cuttings are most preferred over larger propagules because of ease of preparation and transport, availability of materials at the right age, besides being cheaper.

Culm cutting (1 -node)

From June to October, the selected one-year old culm is cut 8 ft. above the ground. Then the branches are pruned. The culm is then sawn into one-node pieces. Each one-node culm-cutting is planted in a pot. Note the inclined position of propagule so that the emerging shoot will grow vertically. If the shoot grows sideways, it gets entangled with neighboring shoots which separation difficult.

Tests have shown that the optimum length of the branch to be left attached to the culm is a stub with a remaining branch node. Kauayan-tinik cutting needs full sunlight. Shading slows the growth and enhances the mortality rate.

Branch-marcott culm cutting

This method is similar to cutting method, however, it induces first the rooting of branches by marcottage, before the culm is cut into one node pieces for planting. This pre-rooting procedure is necessary when propagating from small-diameter culms which cannot be directly propagated by culm cutting.

By propagating from full-sized culms by culm cutting, and then later from the small culms of the young plantings through the branch-marcott culm cutting system, the rate of propagation is accelerated.

The additional labor and materials needed for marcotting are compensated by the higher rate of success, (Fig. 8). The time needed for the roots to form, which is about 15 days, is regained later by faster growth of the marcott.

The steps involved in branch-marcott culm cutting are:

1. The marcott bag is first prepared from an ordinary plastic bag, 3" x 10", and cut with scissors.
2. The second bag is filled with wet sphagnum moss or any similar water-absorbing material.
3. The loaded bag is then tied securely around the culm, with the wet filling pressed against the base of the branch which is not yet pruned.
4. After 15 days of attachment, roots will emanate from the base of the branch. At this stage, marcotting is successful and the culm can be cut, the branches can be trimmed and planting in pots can be followed in exactly the same manner as in the first method.

Branch-cutting

Branch cutting is an alternative method of propagating rhizomatous branch-producing bamboos like kauayan-tinik (Bambusa blumeana), Bayog (Dendrocalamus merrillianus), Kiling (B. vulgaris), striated bamboo (B. vulgaris var. striata) and others. Individual branches that resemble the mother culm in having small basal portion which recapitulats the rhizome are referred as rhizomatous. Such characteristic of the branch coupled with its size (being small), makes the branch a potential material for the production of economical and uniform planting stocks that are easy to handle for outplanting. The method does not require cutting of potentially marketable culms.

Tissue Culture

It is a biotechnology method which involves the development of new plants in an artificial medium under aseptic conditions from plant tissue. Unlike other propagation methods, the relative space and manpower requirement to mass produce bamboos is small. Moreover, the production of plants can be carried out in the laboratory the whole year round.

Plantation Establishment

Site Requirement

Bamboo thrives best in well-drained, sandy-loam to clay loam soil, but avoids swampy or wet-stream beds. A pH of 5.0 to 6.5 is most suitable for bamboo. Saline soils along salty bodies of water are not well suited for bamboo.

Site Selection

Selecting suitable site for many plant species is a primary requisite to any plantation establishment. It is important that the site for planting should match with the requirements of the species. Bamboo can grow in almost any type of soil which is not extremely acidic or alkaline. These thrive best in well-drained sandy loam to clay loam soil in river banks, hillsides, cogonal lands or underlying rocks. Although growth is vigorous in moist soils, some species can thrive in drier sites.

Site Preparation

Depending on vegetative cover and purpose, site can be prepared either by completely clearing the vegetation, by clearing strips of 50 cm to 1-meter wide or spots of 50 cm in diameter. For riverbank and hillside rehabilitation, spot clearing is necessary since it will have the least disturbance to the site.

Holes for planting should be wide and deep enough to accommodate the potted, balled, bareroot or freshly cut planting materials. The holes may vary from 30-50 cm wide and deep, depending on the size of the planting materials.

The soil should be cultivated and the roots and rhizomes of existing vegetation should be removed to ensure survival of the newly planted bamboos. When digging, the soil should be placed at one side of the hole and the subsoil at the other side. Planting holes should be properly staked to make them visible. Spacing varies according to species. For riverbank and hillside rehabilitation, dense and irregular planting is necessary. For reforestation and plantation development, spacing and arrangement may be critical. For Laak (Sphaerobambos Philippinensis), Buho (Schizostachyum lumampao) and Anos (Schizostachyum lima) the spacing may be closer (4 x 5 m or 5 x 5 m).

For species with big diameter culms and with thickets, wider spacing is recommended and may vary from 7 x 7 m to 10 x 1O m.

Transport of planting materials

Bamboo planting materials for field planting should be handled with care. Transplanting of the planting stocks from the nursery to the field can be done manually or through an animal-driven cart, by vehicle depending on the distance and accessibility.

Freshly cut planting materials (culm cuttings, rhizomes and offsets) which are to be planted directly in the field should be properly covered or wrapped in moist sacks when transporting these to the site and should be placed under shade to avoid drying.

Tops of bareroot planting stocks (cuttings and seedlings raised in nursery beds and newly collected wildlings) should be pruned immediately after lifting. The roots should be wrapped with moist gunny sacks or any suitable material before transporting to the field.

Potted planting stocks should be put in suitable containers like wooden boxes, bags made of sacks or pandan, basket or kaing for easy and convenient hauling and transporting to the planting site. These may likewise be tied and hauled with the use of bamboo pole carried by the laborers. Newly hauled planting stocks should be kept from direct exposure to sunlight.

Field Planting

Freshly cut planting materials like culm cuttings, rhizomes and offsets can be directly planted in areas with longer, well distributed rainfall. Planting must be done early in the rainy season. Newly collected culm cuttings from one-to two-year old culms should be immediately planted in horizontal position.

Bareroot planting materials should be planted in the hole, positioned similar when they are still in the beds, however, their roots should not be curled upward.

Keep the ball of earth from breaking when these are removed from the containers. Before planting, the hole may be initially filled with compost, then top soil taken from one side of the hole. The stock should

be set in the hole with the root collar or upper part of the ball level to or slightly deeper than the ground level. Then the soil is pressed firmly around the newly planted bamboo.

During the planting of potted planting materials, fertilizer (e.g. 14-14-14 at rate of 50g per plant) may be applied around the plant 15 cm or more from the base. This will boost the growth and development of the plants. Grass mulch and other litters (preferably dried leaves of bamboo) can be placed around the plants to reduce water loss and avoid hardening or compaction of top layer.

Care and Maintenance

A bamboo plantation requires lesser care and maintenance compared to a tree plantation. During initial phase of the plantation, care and maintenance like regular weeding or brushing of the competing vegetation around the plants particularly during the first two years should be done. Thereafter, cleaning or weeding can be done only when needed. The plantation should be kept free from climbers.

Fertilization

Bamboo may be able to grow and develop even without fertilization. However, since the areas most likely available for bamboo plantation development are less fertile and unproductive, it is necessary to apply fertilizer. Inorganic fertilizers will likely favor rapid vegetative growth. The recommended rate per hectare is 20-30 kg nitrogen, 10-15 kg phosphate, 10-15 kg potassium and 20-30 kg silica. These can be applied one month after planting or soon after when plants have shown signs of recovery. Application can be repeated after four months or even earlier or later depending on the growth of the plants. Due to high cost of organic fertilizer, organic farming using cow dung, carabao and chicken manure compost and other organic fertilizers may suffice to allow good 'growth and development of the plants. To provide the bamboo with its silica requirement decomposed bamboo litter can be applied around the plants.

Protection from fire

Although bamboo can recover and continue shoot growth and development after fire, it is necessary to protect them from burning.

Bamboo litter (dead leaves and small branches on the ground) and dried cogon and other grasses are flammable, hence the bamboo plantation becomes susceptible to fire. Fire can be prevented by establishing firebreaks 10-meter strip along the boundaries and compartments of the plantation. Firebreaks are areas cleared of grasses and other flammable organic materials or thickly planted with fast growing fire resistant species. The latter has more advantage because it can at the same time serve as windbreak which protects the plantation from strong wind. If fire is prevented, this will allow soil build up by the decomposing litter, hence death of developing shoots and destruction of the dumps can be avoided.

Protection from animals

The plantation should be fenced to prevent entry of browsing stray animals like cattle, carabao and goat which may feed on young shoots and leaves of the growing bamboos. These also trample and damage the plants.

Protection from rodents

Rodents feed on emerging shoots and bore holes on the young culms. If these rodents are not controlled, the damage to the plantation becomes serious, thus reducing the production of poles. Rats can be controlled by poison baits with rodenticide, a mixture of which is placed inside a bamboo tube about a meter long and distributed at 30-m interval in the plantation.

Protection from humans

Young and succulent shoots of most bamboo species are delicious and people prefer these as vegetable. To allow faster development of clumps, indiscriminate gathering of shoots should be avoided.

Protection from pest and diseases

The bamboo pests in the Philippines include the cottony cushion mealy bug (Planococcus lilacinus), the bamboo scale (Asterolecantum bambusae), oriental migratory locust (Locusta migratoria manillensis), leaf roller (Pelopidas mathias), tussock moth (Lymatria lurata), aphids

(Astegopteryx bambusae) and mites (Aponychus corpuzae, A vannus and Schizotetranychus floresi). Bamboo diseases, on the other hand, include the physiological diseases and fungal disease (Loculistroma bambusae).

Harvesting and Management for Plantation

Thinning - Rapid and profuse growth of shoots result to tight and close development of culms, making the clump becomes dense. Thus, the shoots which developed inside are crooked and small. Cutting of mature culms inside the clump becomes difficult and wastes so much butt portions of the culms after cutting.

Thinning should, therefore be done to make the clump more open allowing a growing space for better development of quality culms inside the clump. Overcutting, however, is not recommended.

Harvesting of Culms - Generally, bamboo culms mature in three to five years after shoot development. Mature culms are dull green, different from the fresh immature green culms. The same dull green color can be observed in the leaves of mature culms. Moreover, the leaf sheaths are no longer present in mature culms.

Depending on species and site, mature bamboo culms can be harvested from a five-to seven-year old established plantation. Fully mature culms are stronger, denser, more durable and less prone to insect attack when harvested than immature ones.

To sustain the yield/productivity of bamboo, culm selection system of harvesting should be adopted. Over mature, defective and few mature culms should be cut. Results of studies suggest that the most suitable cutting/harvesting regimen is to leave in the clump at least two to three fully grown one-to two-year old culms for every young and developing shoot.

Mature culms should be cut in the dry season when starch content is at its minimum level and no shoot is emerging. This prevents the harvested culms from attack of the powder post beetle. Culms should be cut close to the ground to maximize utilization of quality portions. For spiny species (kuayan-tinik, Bambusa blumeana), cutting can be done 2-3 m above the ground. However, the basal portion which is specifically used for furniture making, should be cut closer to the ground within six months after harvest.

Harvesting and Management for Natural Stands

Old clumps of bamboos of unknown age should be converted into managed stands. Conversion of these old/natural clumps of bamboo requires appropriate harvesting. The technique necessitates the removal of the oldest culms situated in the inner portion of the clumps to decongest and allow the emergence of new shoots.

There are known treatments of decongesting the very dense interior portion. The treatments involve the following thinning principles:

1. Open the clump on the side opposite to where the maximum production of new culms is.
2. Remove all over mature and defective culms in the interior of the clump.
3. From the periphery, cut the old culms but leave some enough to support the younger culms.

The above mentioned treatments can be applied to old stands/ clumps of kauayan -tinik and bayog.

For existing natural stands of buho, Virtucio et al. (1990) prescribed the following steps:

1. Mark all new shoots emerging in three years to establish the exact ages of the culms;
2. On the third year after initial marking of emerging shoots and new culms, cut all old culms with unknown ages;
3. On the fourth year the initial; marking, harvest only three-year old and older culms; and
4. The next harvest of the same age groups as in No. 3 is repeated every after two years.

Sources:

1) Beema Bamboo: Health Enchancer and Clean Energy Producer, AGRIMAG May 15, 2019
2) The Philippines Recommends for Bamboo Production by PCARRD, 1991
3) *forestry.denr.gov.ph*

Raising Branch Cuttings

To raise branch cuttings in the nursery, consider also some of the factors cited for culm cuttings like age of material, the portion where cuttings are taken, size of cuttings, time of collection, rooting techniques and media.

Similarly, the one-to two-year old culms are ideal source of branch cuttings. Those with prominently swollen basal branches located at the butt and middle portions of the culm and preferably with in situ rooting or developed aerial root primordia should be selected and used as propagules. The branch cuttings can be collected using a cross cut saw, bow saw and pruning saw. The swollen part of the branch and the buds should not be damaged during collection. The size may vary from two- to three-node branch cuttings.

The best time to collect branch cuttings is during early part of the rainy season. Branch cuttings can be raised in pots or in nursery beds immediately after collection. For better rooting, sprouting, shoot production or rhizome development, the branch cuttings must be planted in propagating sand bed. If hormone (100 ppm indole acetic acid) is available, the branch cuttings can be treated for better rooting and sprouting. After 20-30 days,the rooted branch cuttings should be transferred into pots of suitable size (6" x 8" polyethylene bags) with ordinary garden soil mixed

Bamboo propagation via branch cuttings
(Source: businessdiary.com.ph)

BEEMA BAMBOO

The High Value Crops Development Program of DA RFO 5 will establish a 20-hectare bamboo technology demonstration sites in Del Gallego, Camarines Sur to showcase Beema bamboo as potential source of livelihood for farmers as Beema is a good raw material for furniture, handicraft and cottage industries, power generation projects, paper industries, and construction.

BEEMA BAMBOO is a tissue cultured variety of the Indian Bambusa balcooa, a higher Biomass yielding Bamboo species. This plant is fast-growing and high yielding. It can grow in the field for more than 100 years without the need for replanting. Unlike common bamboos, Beema bamboo's culm grows nearly solid, without genetic engineering. It maintains a fast growth rate and after every harvest cycle, it regrows and does not require replanting for the next 50 years.

(Source: ecoenergizer.org)

Beema Bamboo Native Bamboo

(Source: /www.growmorebiotech.com)

ECONOMIC BENEFITS OF BEEMA BAMBOO

Beema maintains a fast growth rate, giving the opportunity to constantly yield high and predictable harvest. Nevertheless, it does not grow uncontrolled. It is a non-invasive clumping variety, new culms only grow around the mother shoot. Bambusa balccooa does not affect the natural environment of the plantation as it does not spread autonomously.

It's rhizome and root development provides a strong foundation, making the plant robust against natural forces. Increased resistance against pests due to high internal hardness supports predictable and constant harvest yields. (*http://www.growmorebiotech.com/beema-bamboo.html*)

For high density plantation Beema Bamboo (1000 plants / acre or 2500 plants / Ha) the yield will be 40 tons / acre (100 tons / Ha). It is the best Biomass plant specie with the higher calorific value, with low ash and moisture content than many other Biomass crops.

Beema is a tropical variety, preferring a humid environment. Yet it is able to adapt to various soil and climate conditions. Only moderate biological fertilization is required. After every harvest cycle, it regrows and does not require replanting for decades.

Its certified high energy value (4500 kcal/kg) and low ash content make it an outstanding biomass feedstock for energy generation. ***(http://www.growmorebiotech.com/beema-bamboo.html)***

Bamboo for Bio-Ethanol

The Bamboo under precision farming along with appropriate Agri inputs, provides cellulosic Ethanol yield of 10,000 to 12,000 lit per acre per year.

The present source of Ethanol is from Sugarcane, which is yielding only 500 litre from an acre of sugarcane while cultivated bamboo similar to that of sugarcane would result in 10,000 litres of Ethanol.

The Green house gas emission is 12% lesser when compared to the production and combustion of Regular diesel.

Advantages of Bio-Ethanol:

Bio-Ethanol can be used as a transport fuel to replace gasoline, power generation by thermal conversion, fuel cells for thermo chemical reaction, cogeneration systems, feedstocks in chemical industries. Exhaust gases of ethanol are much cleaner, it burns more clearly. The use of Ethanol blended fuels such as E85(85% ethanol and 15% gasoline) can reduce the net emission of the green house gases.

Ethanol is considered as renewable energy resource because it is primarily the result of conversion of sun's energy into usable energy. Creation of ethanol starts with photosynthesis, which causes feedstock, such as Bamboo to grow. These particular feedstocks are processed into ethanol.

Bamboo for Coal

Bamboo has 50% carbon which lent likely to get biomass converted into charcoal. Bamboo makes excellent charcoal that meets the rural energy needs for heating and cooking has industrial fuel and to make product such as activated carbon.

Bamboo charcoal is developed fast in the recent years, unknown to many. The reason for bamboo is that the forest wood used for production of high-grade charcoal has reduced rapidly.

The harvest cycle of bamboo is short because it grows very fast. Hence, bamboo charcoal doesn't destroy forest.

The Property of bamboo charcoal is like high quality wood charcoal and better than coal. Its calorific value is higher than coal and vey low in ash content. For these reasons bamboo is good opportunity to convert into charcoal and get recovery as much as 35%. Bamboo is heated in brick kilns or mechanical kilns with little air that results in no burning but pyrosis of bamboo resulting to bamboo charcoal.

One acre of cultivated bamboo can produce as much as 14tons of charcoal. But quality of charcoal for making activated carbon can be obtained through the process of gasification and pyrosis which could result in 5-6 tons of high-quality charcoal suitable for making activated

ECOLOGICAL BENEFITS OF BEEMA BAMBOO

One fully-grown Beema bamboo could sequester more than 400 kilograms of carbon dioxide from our surroundings every year for the next 100 years, at least for the next few generations. It absorbs carbon dioxide and releases oxygen into the atmosphere at a rate three to four times higher than any other tree. One bamboo tree generates plenty of natural oxygen sufficient for more than one human being's daily requirements.

A family of four, including a dog or cat, would essentially require 1,100 to 1,250 kilograms of oxygen every year for breathing, which is made available by three bamboo plants organically. In tests conducted in India, patients were made to jog through a lush bamboo farm.After the test, all of the patients recuperated and rehabilitated fully from their illnesses.

When fully grown, bamboo farms could be converted into oxygen parks where people can avail themselves of fresh oxygen produced by the bamboo, and carbon neutral gardens to enhance the health of residents living in the area. ***(Source: Agriculture magazine June 2018 issue).***

Bamboo has several desirable fuel characteristics such as low ash-content and alkali index. The high heat value (HHV) of bamboo is higher than most agriculture residue. Biomass energy includes fuel wood, charcoal and agriculture residues which are renewable in nature and does not contribute to the problem of Global warming.

BEEMA CULTIVATION

Conventional Farming

Beema bamboo requires much sunlight as they are clump forming and are more suitable for cultivation and grows very well in tropical and sub-tropical climatic condition.

Conventionally bamboo plantation in wider spacing of 4-5 m between plants results in 160-200 plants in one acre. This spacing is suitable for most of larger diameter bamboo such as Dendrocalamus giganteus, Dendrocalamus asper, Dendrocalamus hamiltonii, Dendrocalamus brandisii and also medium sized bamboo such as Bambusa balcooa, Bambusa nutans, Bambusa vulgaries, Bambusa tulda, Bambusa cacharensis, Bambusa bambus, Dendrocalamus strictus, Bambusa polymorpha.

Bamboo reaches maturity after 4-5 years under well managed plantation condition. Culms are marked for ages by different colour codes and selective culms are harvested after 4 years of culm growth. The cultivation practises, nutrition requirement, spacing between bamboo plants varies for each site.

High Density Planting

High Density Planting technique is a modern method of cultivation involving planting of plants closely, allowing younger plants with modified canopy for better light interception and distribution and ease of mechanized field operation.

High density plantation provides opportunity for early harvest, higher yields as well as returns per unit area due to effective use of space in the early growth stage of the bamboo.

Higher density of planting is also suitable for smaller sized bamboos, the plantation will not suffer from canopy exposure, loss of soil moisture through evaporation and competition from weeds and other vegetation. High density results in quicker harvest when compared to conventional methods. This generally results in 500-1000 plants in an acre. In rare cases it reaches 1,850 plants per acre, specifically, in species such as Thyrsostachys oliveri.

The planting density will vary based on the bamboo species and the end utilization of the Bamboo. Bamboo from high density plantation is used in the form of Energy as Biomass for Power generation, Bio-Ethanol, Bio-CNG, Hydrogen Handicrafts, Special furniture, Agricultural Implements, Timber market Stacking, Construction, Furniture, Paper pulp, Bamboo lumber and many more.

WORLD BAMBOO DAY

18 SEPTEMBER

In celebration of the 11th World Bamboo Day on September 18, DA Bicol joined the nationwide tree planting activity. In the Philippines, the celebration was led by the Philippine Bamboo Industry Development Council. The theme for the 2020 World Bamboo Day was "*Kawayan Tugon sa Hamon ng Panahon*".

In the Bicol Region, the celebration and ceremonial bamboo planting was led by Regional Executive Director Rodel P. Tornilla, together with RTD Luz R. Marcelino and Dr. Mary Grace DP. Rodriguez, Chief of Field Operations Division.

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