A. Why Choose Bamboo?

Not many people know that bamboo is a giant grass. It is a perennial, woody-stemmed grass known for its rapid growth and variety of uses. It has woody and usually hollow culms with distinct nodes and internodes, rhizomes and branches.

Bamboo has spurred worldwide attention as a versatile plant with multifarious uses. Its uses ranged from subsistence to commercial food (young shoots), to building and furniture. It offers vital economic and ecological benefits to many people in the world.

It is a plant found almost everywhere and is known for its rapid growth. A bamboo culm reaches its full height in about 60-90 days. In three to five years, the culms are already matured and can already be harvested, depending on the intended uses.

Bamboo protects the environment and cleanse the air we breathe. Bamboo stands release 35% more oxygen than equivalent stands of trees. Some bamboo can sequester up to 12 tons of carbon dioxide from the air per hectare. It can also lower light intensity and protects man against ultraviolet rays.

Bamboo is a good soil conservation plant. With its widespread root system, it can provide an effective erosion control. It sustains riverbanks and serves as good windbreaks.

Bamboo is a highly renewable material. There is no need to replant once the clump is already established. It produces new shoots on an annual basis that develop depending on species, into erect culms reaching 30 m tall. In general, bamboo is vegetatively multiplied, using culm and branch sections that are induced to sprout before transplanting to the field or by clump division which readily provide a good starter plant.

Bamboo is a good substitute for wood. A bamboo culm matures and develops strength
properties comparable to most wood species in about three years. Its utility has expanded to include its transformation into various structural floors and panels and engineered bamboo products.

Bamboo shoots are good food source. It is an important vegetable in the daily meals of many people in Asia and is considered a gourmet item in Western countries where they are available only as imports.

Bamboo is an exquisite component of landscape designs. It provides natural look and aesthetic beauty to the landscape. Many species of bamboo are good for landscaping and urban greening.

What Species of Bamboo to Grow?

There are two general types of bamboo based on rhizome construction, namely: (1) sympodial type of bamboo whose rhizomes grow into culms that are grouped close to each other or in clumps and commonly grows in tropical areas, and (2) monopodial type of bamboo whose rhizomes grow horizontally at considerable distance from the original rhizome portion where the older culm has developed. The resulting culms appear as though planted at regular distance from each other. They usually grow in temperate areas.

There are many species of bamboo to consider depending for what end purpose it is for. In the Philippines, there are about 62 species of bamboo to choose from. Of these, only 21 species are endemic or are native to the country. The rest are introduced species.

There are 12 priority species to choose from based on their potentials for development in the Philippines. These are as follows:

1. **Bambusa blumeana** - Kawayan tinik
Growing bamboo is not really that difficult. In fact it is easy, fun and gratifying. Growing bamboo for whatever end product you want it for requires less of your time, money and effort. Although, large scale growing of bamboo is desirable, you can do it also in a small scale and yet become successful too.

In growing bamboo, you would need to consider the following important points which will guide you to a successful bamboo venture.

- Identification, selection and availability of bamboo species most suitable for desired end uses. It is important for you to know what product you would want in the end (i.e. for pole, shoot or ornamental production). There is a bamboo for almost any situation and purpose. From this, you would know what species of bamboo to plant. You must also consider availability of the chosen bamboo species as potential source of planting materials.
- Climatic, soil and environmental factors prevailing in the area.
There must be enough supply and source of water. This is very crucial in the emergence of new shoots and in maintaining the productivity of the bamboo clump. It would be better if there is a uniform distribution of rainfall in the area.

Enough exposure to sunlight. Most bamboos are sun-loving. They would grow well and vigorous in areas where there are full sunlight.

Right temperature for the good growth of the chosen bamboo species. Most clumping type of bamboos grow well in warm areas like the Philippines.

Bamboo grows best in well-drained, moist, fertile soils. However, it will not tolerate continuously swampy or water-logged sites.

- Grove management procedure (planting, maintenance and harvesting). Generally, planting procedure and maintenance of the bamboo grove are almost the same for many species of bamboo.
- Product market. Bamboo should be viewed as a complementary crop that fills a niche market or serves a purpose on the farm, rather than a primary cash crop.

What Are the Potential Uses of Bamboos?

Bamboo is a multipurpose plant with great environmental and economic values. The utility of bamboo has expanded to include many new industries and products.

1. Domestic use. Under this category, bamboo culms may be manufactured into various home, farm or garden items. Numerous techniques in bamboo processing coupled with imagination and creativity could transform a simple round bamboo into various household and decorative craft products.
In many farms or gardens, bamboo poles are used as vegetable stakes, trellis poles, simple and functional fences, and even unique garden accents and accessories.

2. Commercial production for use in construction, food and the arts. Bamboo is a very good substitute for various wood products. There are now many new technologies developed that could transform bamboo poles into strong building and construction materials such as concrete reinforcements, laminated bamboo floor tiles and many more.

Young tender shoots are edible and nutritious. Fresh bamboo shoots are considered a tasty alternative to the usual imported canned bamboo shoots.

Bamboo has been and continues to be widely used in the arts. It is used in creating a wide array of musical instruments like flutes, winds, percussion and strings.

3. Ornamental, landscape and conservation uses. Many species of bamboo are suitable for ornamental purposes. They can be planted as a hedge or single clump for specimen plantings.

Small and medium sized bamboos are very much in use now for landscaping purposes. It is planted as a landscape ornamental and for various conservation purposes too. Bamboo is planted in parks and along walk-ways. It is planted along highways and river banks, both to prevent erosion and to create a pleasant visual effect. Around homestead or farms live bamboo hedges can serve as windbreaks.

What Are The Market Potentials of Bamboo?

Compared to the cost of growing organic vegetables, fruit trees or any industrial trees, growing bamboo is relatively inexpensive. During the first two to three years of growth, while the clumps of bamboo are maturing and culms and shoots are not yet ready for harvesting or for sale, you can raise other crops in the area to recover the starting
capital. In practical terms, for the 1st four years, bamboo should be viewed more as a complementary crop that fills a niche market, rather than a primary cash crop. However, from 5th year onward, profitable sustainable yields are already attainable without additional expenses for replanting. Eventually, it will become a primary yearly cash crop.

Bamboo can be cultivated for the following potential markets with the recommended priority species:

1. Plant Material

You can grow and sell various species of bamboo as planting material for small and large scale commercial farming. The ornamental types could be potted and marketed wholesale to garden centers, nurseries and landscape contractors. These can also be retailed to hobbyist and some people who would be interested to grow bamboo.

Recommended species:

Kawayan tinik (*Bambusa blumeana*)

Giant Bamboo (*Dendrocalamus asper*)

Pole Bamboo (*Thrysostachys siamensis*)

Yellow Buho (*Schizostachyum brachyladum*)

2. Food
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Edible and tasty young bamboo shoots could be sold in domestic and international markets. Restaurants, hotels, health food stores, farmers' markets and ethnic markets are potential marketing avenues.

Recommended species

Kawayan tinik (Bambusa bluemana)

Giant bamboo (Dendrocalamus asper)

Bayog (Bambusa merriliana)

Oldham bamboo (Bambusa oldhamii)

Machiku (Dendrocalamus latiflorus)

3. Construction Material

Bamboo poles are hard and durable, but lightweight, making them viable replacement for wood in construction. These can be directly sold to craftsmen, furniture makers and other end users. There is a big potential also for bamboo based panels to be used as engineered building materials.

Recommended Species:
Kawayan tinik (Bambusa blumeana)

Bayog (Bambusa merrilliana)

Giant Bamboo (Dendrocalamus asper)

Bolo (Gigantochloa levis)

4. Musical Instruments

Bamboo could be transformed into a wide variety of musical instruments such as wind, string or percussion. Creating a niche market would be a potential market for these products.

Recommended Species:

Anos (Schizostachyum lima)

Black bamboo (Gigantochloa atroviolacea)

Kayali (Gigantochloa atter)

Bolo (Gigantochloa levis)
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Giant bamboo (*Dendrocalamus asper*)

5. Furniture and Handicrafts

Locally, the largest demand for bamboo poles is required by the furniture and handicrafts sector. Increasing demand for bamboo furniture is driven by the rising cost of wood furniture and by heightened interest in traditional, rural, or ethnic furnishings.

Recommended Species for Furniture:

Kawayan tinik (*Bambusa blumeana*)

Giant bamboo (*Dendrocalamus asper*)

Black bamboo (*Gigantocloa atroviolacea*)

Bayog (*Bambusa merrilliana*)

Recommended Species for Handicraft:

Long-piped bamboo (*Bambusa atra*)

Kawayan kiling (*Bambusa vulgaris*)
Giant bamboo (Dendrocalamus asper)

Yellow buho (Schizostachyum brachyladum)

Green buho (Schizostachyum lumampao)

B. Propagation of Bamboo

How to Propagate Bamboo?

There are two kinds of plant propagation: (1) asexual or through the use of seeds. and (2) asexual or vegetative propagation. As flowering is rate in bamboo and produces very few viable seeds, the most practical and commonly used method of propagating clumping type of bamboo is through vegetative propagation. This method propagation uses various portions of the bamboo plant as source of planting materials.

1. Clump division. This method is generally applied to symposial or clumping type of small-to medium-sized bamboo species. this is done by carefully taking out a portion of the clump with its rhizome still intact from the mother clump. The portion of the clump removed from the mother clump’s periphery is younger and more suitable for productive propagation and high rate of survival. Clump division must be done before the start of the active bud growth which occurs annually during summer.

2. Offset method. This method is also known as the basal stem division and a variation of clump division. One or two of the 1 to 2 years old culms with its rhizomes are separated from the mother clump. The culms with its rhizomes still intact are cut in a slanting direction. Collected offsets should be kept in the nursery for 2 to 3 months before transplanting.
3. Whole culm method. The 1-2 years old whole culm without roots, with the branches and foliage cut and only two-node branches left, is positioned in the propagation bed with the nodal buds or the cut-side branches parallel to the ground surface. The positioned whole culm is then covered with soil of about 2-inches thick. The whole culm is left buried for two to three months until it produces sprouts or rooted plants. The whole culm with shoot emergence after 2 to 3 months is excavated and segmented into one-rooted nodal sprout ready for potting.

4. Culm-cutting methods. This method consists of 1 node or 2-3 nodes culm cutting. The culm cuttings with healthy and well-developed buds and branches are selected and prepared.

- Two-node culm cuttings. A 1-2 two years old culm is segmented into two-node culm cuttings in which each cutting contains one full internode (with two nodes intact), and an open internode above the second node.

- One-node culm cuttings. A 1-2 years old culm is segmented into one-node culm cuttings in which each cutting contains an equal portion of the lower (below the node) and upper (above the node) internodes of about 4-6 cm. Well-developed branches are pruned leaving only 2-3 node branches.

The prepared one or two node culm cuttings are potted immediately in polybags with 1:1 ratio of loamy garden or forest top soil and sand. These potted culm cuttings are reared for one month in a partially shaded area in the nursery and watered daily. Chemical fertilizer of 15-20 g should be applied to each potted planting material three weeks after potting. After a month, rooted cuttings with sprouts are exposed to full sunlight for growth improvement. In 6-12 months, the potted cuttings would then be ready for outplanting.

5. Branch cutting method. This method is mostly suitable for relatively large-sized bamboo species with dominant nodal branches like giant bamboo (Dendrocalamus asper), kawayan tinik (Bambusa blumeana), Bayog (Dendrocalamus merrillianus). Individual branches that resemble the mother culm in having root bearing small basal portion would be a good propagation material.
Single branch cuttings (2-3 nodes in length) from 1.5 - 2 year-old culms are obtained from root-bearing stout branch originating from the mid-culm nodes. These branches are immediately potted in a 6" x 8" plastic bag that contains 1:1 soil, compost and sand and then placed under partial shade and watered daily. After 3-4 months in the nursery, the rooted plantlets are ready for outplanting. Two weeks before outplanting, potted propagules should be hardened by gradually exposing to sunlight and with reduced watering.

What are the basic requirements for a successful vegetative propagation?

1. High air humidity. In preparing vegetative materials for propagation, it is important to preserve or maintain the moisture within the vegetative materials. This can be done by keeping them moist through misting using manual spray or a misting system. Continuous misting reduces water loss from evaporation and transpiration.

2. Appropriate rooting medium. In constructing a propagation or transplant bed, the location, light requirements and good drainage are important considerations.

The bed should be located on a level ground to maintain the uniform distribution of moisture throughout the bed. A three-layer structure of propagation bed (with each layer measuring 7-10 cm thick) with the following composition is recommended: 1) bottom - gravel and coarse sand; 2) the middle layer - medium-sized sand; and 3) the top layer – fine sand.

3. Moderate to full light intensity. It is important to rear the vegetative materials with a moderate light intensity especially in the morning and moderate light intensity in the mid afternoon. This will keep the rooting vegetative materials from getting stressed from the strong heat of the sun.

4. Protection from pests, diseases, strong winds and water logging. The propagation bed installed with the mist system should be well protected from pests, diseases and strong winds and should have good drainage to prevent water logging.
C. Bamboo Plantation Establishment, Maintenance and Protection

Due to the large number of species of bamboo that can be planted for various uses, this section will concentrate on the establishment of bamboo plantation with the species mostly used for commercial purposes such as Kawayan tinik (*Bambusa blumeana*), Bayog, (*Dendrocalamus merriliamus*), and Giant bamboo (*D. asper*). The principles and procedures however, are generally applicable to most commercially important species of bamboo in the Philippines.

What are the important considerations for a good bamboo plantation?

Bamboo is a plant that requires little and simple care. As a versatile plant it can grow in a wide range of soils and produces high amount of biomass. Environment friendly, it is a reforestation species very useful against soil erosion. What’s more, unknown to many bamboo could generate high income for stand owners and traders.

Considering the above situation, large areas have to be established to supply the increasing demand for poles and shoots. To have a successful plantation, careful selection of sites and preparation of planting materials and the site for planting should be given due consideration.

Field visits are necessary to evaluate carefully where to establish the plantation. There are five major factors to be considered:

(a) Soil condition. Bamboos can grow in various soil types. It grows very well in damp
soil near riverbanks, stream banks, lower portion of mountains, and in between fields or abandoned areas. Well drained such as the sandy loam and clay loam soils with more or less 5-6 soil pH are good sites for planting bamboo.

b) Rainfall. With abundant rain bamboo can grow rapidly in open areas. Bamboo can adapt well in areas with long dry season by shedding its leaves. Areas with more rain favors more shoot production and high annual culm yields.

(c) Temperature. Bamboo can grow in hot or cold areas and in a wide range of temperature from 8.5 0C to 36.0C.

(d) Altitudes. Bamboo loves to grow from low or high elevations or even from the shorelines at sea level to the high mountains. The commercially used genera such as Bambusa Shizostachyum, and Dendrocalamus can grow very well up to 3,000 m asl.

(e) Latitude. Most of the bamboos are found naturally growing in the tropics like the Philippines. Going further south or north within the range of 400 from either side of the equator are still suitable for the establishment of bamboo plantations.

How to Prepare the Planting Sites?

The success of a productive bamboo plantation starts with the preparation of a good planting site. The following steps should be followed:

1. Field layout and sketching. A simple sketch of the planting site can start planning the next steps. The whole site should be assessed as to its accessibility factors such as roads and water source; physiographic conditions such as the exposure whether the slope is facing north, south, east, or west; presence of deep ravines, high slopes, creeks, and gulleys.
2. Staking. Sufficient number of approximately 1 m long stakes must be prepared to mark the direction of rows and the point to where the planting holes are to be made. For Bambusa and Dendrocalamus species, a spacing of 7 m x 7 m is appropriate for poor sites and a wider spacing of up to 10 m for fertile soils. For big-sized bamboos like the giant bamboo (Dendrocalamus asper), a 10m x 10m spacing is recommended.

3. Clearing and cleaning. For sites with low growing vegetation, spots where to plant the bamboo propagules should be cleared. All weeds or vegetation within the diameter of one meter should be removed. In areas with tall vegetation, it is advisable to clear a strip of 1.5m to 2.0m.

4. Digging the planting holes. After clearing the marked area for planting, holes approximately 50 cm x 50cm diameter and a depth of 50 cm should be dug, separating the top soil by placing at one side and the subsoil on the other side.

What are the Proper steps in Handling and Planting the Propagules?

Generally there are two common methods of planting bamboos: (1) direct planting of cuttings and (2) planting of potted rooted propagules.

1. Direct Planting of Cuttings.

It is cheaper to directly plant cuttings in the field if properly and timely done. This method, however, is only applicable in areas where there is sufficient or continuous rainfall. As expected, survival of directly planted cuttings is usually lower than planting of potted propagules.

Direct planting is only done during the rainy season. Spacing for medium-sized bamboos like kawayan tinik is usually 7m x 7m. For big-sized bamboos like giant bamboo, a 10m x 10m spacing is recommended.
Culms should be cut into two-nodes with the cut approximately 4-5 cm below the lower node. The lower node should have well developed and active bud eye.

To start planting, the bottom of the hole should be filled first with top soil up to 20 cm. The cuttings could either be set at the center of the hole horizontally or vertically. The soil around the cutting should be slightly compacted. The hole should be filled up with up to the 5 cm level from the top of the hole. The top layer of the hole should be covered with grass debris as mulch.

2. Planting of potted propagules

Planting of potted propagules require extra care. The propagules should be carefully transported from the nursery to the planting site. As in direct planting, this activity is done during the rainy season in 7m x 7m spacing for medium-sized bamboo and 10m x 10m in big-sized bamboos.

The bottom of the hole should be filled up evenly with top soil up 20 cm.

The plastic bags of the propagules should be carefully removed by cutting it with a sharp knife to avoid damaging the roots and breaking the ball of soil covering the roots.

The propagule should be carefully placed at the center of the hole. The unfilled spaces should be filled with soil and slightly compact the soil to hold firmly the planted propagule. Leave about 5 cm from the top of hole unfilled to hold rainwater and eroded sediments. Put mulch around the base plant to protect the loose soil from strong rain. The mulch also helps conserve moisture, and when decomposed it is added as source of organic matter for the plant.

How to Maintain and Protect the Plantation?
Appropriate maintenance operations to ensure survival, recovery and fast growth of newly planted propagules should be done.

Regular visit to the plantation should be done. After the plants had fully recovered, growth can be improved by applying 200-300 g of complete fertilizer NPK. Fertilizer application can be split into two stages. The first application is done after one month and the other half after two months. At the time of application of inorganic fertilizer there should be enough soil moisture to dissolve the fertilizer so that the plants can absorb the fertilizer elements necessary for growth.

Remove regularly all weeds around the plants. Weeds compete for nutrient and space with the newly planted propagules.

Protect the plants by putting a fence around each plant or the plantation should be fenced if possible to prevent animals from eating the leaves and young shoots of the plants.

Rats and rodents are also considered destructive to newly developed shoots of bamboos. Rodenticides may be applied or baits may work when the population of rat is low.

Firebreaks may be established about 10 meters wide strips along the boundaries or compartments of the plantation to prevent occurrence of fire.

D. Bamboo Plantation Management and Harvesting

As in the previous section, This will concentrate on the management of bamboo plantation applicable to species mostly used for commercial purposes such as Kawayan tinik (Bambusa blumeana), Bayog, (Dendrocalamus merriliamus, and Giant bamboo (D. asper). The principles of bamboo plantation management, however are generally applicable to most of the sympodial species of bamboo.
What are the important considerations for a productive bamboo plantation?

*Understanding better the importance of managing the growth of bamboo clumps*

As a versatile plant, bamboo can grow in a wide range of marginal soils and produce high amount of biomass. As such, bamboo has become the best substitute for wood in the furniture, handicraft, and construction industries. Growing bamboo depends on its intended use.

Large areas of bamboo plantations have to be established considering the increasing demand for quality poles. The quality of the bamboo as to its hardness, size, and other chemical as well as the physical properties of culms and clumps are very important considerations in the management of the plantation.

Growth and productivity of clump-forming bamboos such as kawayan tinik, giant bamboo, bayog and similar species can be improved by following recommended technologies to produce quality poles and shoots. On the average, the number of shoots produced by the above species ranges from 6-9 per clump every year.

To sustain production, appropriate clump management strategies or silvicultural approaches are focused on the ease of harvesting the poles, shoots, and managing the clumps that can affect number of poles to cut or shoots to grow.

Appropriate cutting age varies with the end use of the given species. For example if the desired end product is pole for furniture, the culms should be fully matured. It means, the culm has attained its full strength and density. For most of the commercial species of bamboo, 4-5 years is the culm harvesting age.

*How to Manage the Clumps and Harvest the Poles and Shoots?*
Clump congestion as a result of non-harvesting and improper harvesting are the two major causes or conditions that adversely affect clump yields or productivity.

Clump congestion or pole density refers to uncontrolled number or overcrowding of poles per clump and the arrangement of shoots in the clump intended to grow as poles. This factor affects the ease of harvesting of poles.

Generally uncontrolled number of culms per clump (overcrowding) affects the workability of the clumps, number of new shoots and mortality or survival, and the annual clump growth.

Competition for space and nutrients are the major concerns why there is a need to control clump congestion by regulating the number of growing culms per clump.

Improper harvesting practices include: (a) irregular cutting of poles, (b) high stumps left during harvesting (c) over-cutting, (d) harvesting immature poles (e) uncontrolled shoot harvesting.

The problem of congestion and improper harvesting practices can be addressed properly by simply considering the following:

Most commercially grown species of bamboo attain growth and production stability at clump age 6-9 years depending on the site. To avoid congestion you can control the number of shoots to grow as poles and number of shoots for food. For Kawayan tinik 4 poles per culm age for four years cycle is recommended. All shoots not intended for pole production should be harvested after attaining the right size.

(a) At the start of the application of clump management strategies, remove all dead poles and homogenize the clump by identifying equal number of poles per culm age.
(b) Shoots intended for poles should be marked equally from all locations (center and periphery) in the clump.

(c) Mark the poles according to their respective ages as guide during harvesting.

(d) Every year harvest only the mature ones according to the age of the poles.

Care and maintenance of clumps

Provision of appropriate amount of nutrients when necessary such as application of organic matter and application of inorganic fertilizers is vital step in managing productive clumps. For matured clumps, application of 2.5 kg NPK and irrigation of the clumps will improve growth of the poles.

Regular cleaning of the clumps by removing thickets from the base up to two meters ease the harvesting of poles as well as driving away the rats that may establish their nest in the clump.

Leave branchlets above two meters from the ground to support the poles in the clump from falling or lodging.

Harvesting of Poles and Shoots

Harvesting bamboo poles and shoots in managed bamboo clumps is technically easy. Harvest only matured poles at the appropriate age (usually 4 to 5 years). Shoots intended for food should be harvested when the height of the shoot is double the diameter of the base of the shoot.
The best time for harvesting is when the starch content of the poles is low. In the Philippines, it is just after the rainy season or just at the end of summer.

When harvesting do not leave high stumps in the clumps. As much as possible, cut close to the ground, approximately at the second node from the base.

During rainy season poles may be harvested by following these suggestions. Cut the selected pole but do not remove the pole immediately from the clump. Separate the pole from the stump and set a stone bigger than the pole diameter at the base. Allow the pole to stay for one week or until all leaves have fallen. This procedure allows the plant to consume or reduce the starch content of the pole before drying and transporting.

Immediately after harvesting the poles from the clumps, transport them to the processing centers or drying areas to avoid the attack of fungi or cracking and splitting of the poles.

How much can be earned from these bamboo clumps?

Approximately, from a total of 204 clumps per hectare, about 816 poles and 416 shoots per hectare will be available for sale in the market.

Income can be computed by using existing prices for the poles and shoots in your locality.

References:

