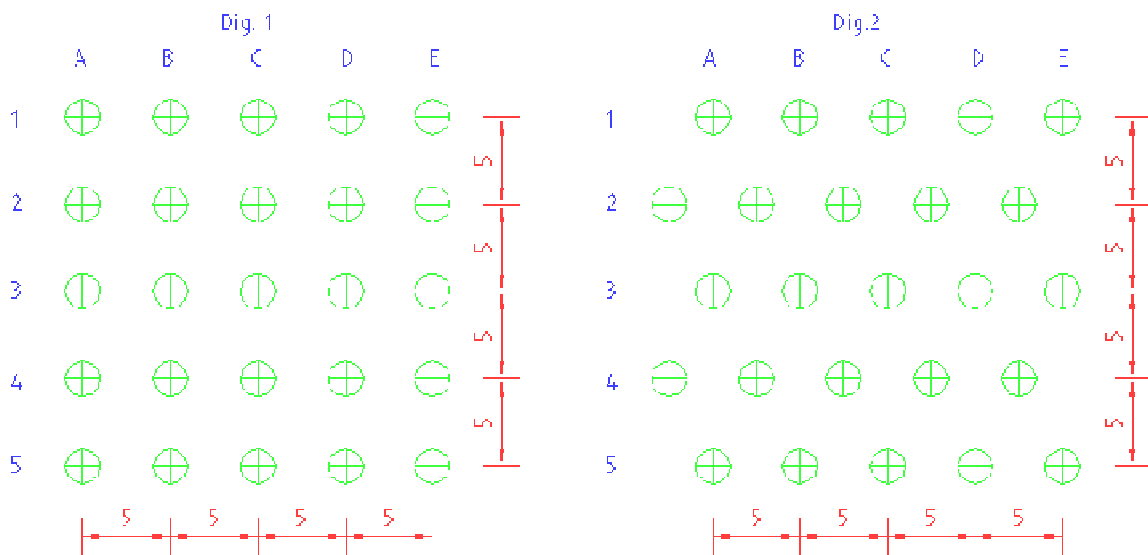


## Plant Spacing

Plant spacing is important for two reasons the first is to ensure access into the plantation for maintenance, harvesting and extraction. The second is to ensure sufficient space between the stands so culms can grow to their full size and achieve optimum yield. If over planted competition for light, nutrients and water will diminish yields and the quality of the culms. The exact spacing of stands depends on the following:-

- The species of bamboo , those with larger culms need to be planted further apart
- Rainfall
- Humidity
- Light
- Vehicular access



In the above diagrams two alternative examples are shown rows (these are merely for illustration and not for a specific species).

**Dig. 1 Shows plants with equidistant spacing and lined up on both the horizontal and vertical: -**

- This allows for access in the plantation by a tractor in both directions.
- Improves ventilation. In areas of excessively high rainfall and humidity this will help reduce fungal infection.
- Irrigation lines can be laid in either direction.

**Dig. 2 Shows plants with equidistant spacing, lined up on both the horizontal but staggered in the vertical rows: -**

- This limits access in the plantation by a tractor in in one direction.
- This limits ventilation and can help to improve humidity in the plantations of low rainfall and humidity by staggering the rows across the line of prevailing wind.
- Irrigation is limited to one direction only
- Plants are optimally spaced reducing competition for light nutrients and water

After considering the above you should look at the species table indicating recommended density per hectare.

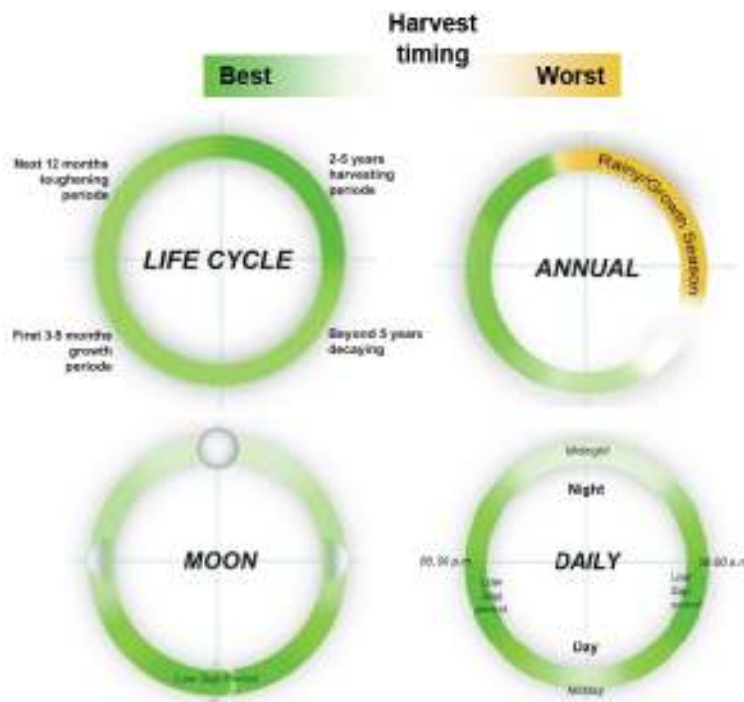
Species	Planting Distance (range)	Plants per Ha	Years from planting to full Harvest
Bambusa balcooa	5-10m X 5-10m	100 - 400	7
Bambusa bambos	5-8m X 5-8m	156 - 400	7
Bambusa hamiltonii	5-7m X 4-6m	238 - 500	7
Bambusa oldhamii	5-7m X 4-6m	238 - 500	6
Bambusa tuldoides	3-5m X 3-5m	400 - 1111	6
Bambus vulgaris	4-6m X 4-6m	278 - 625	6
Bambusa vulgaris 'Vittata'	4-6m X 4-6m	278 - 625	7
Dendrocalamus asper	5-10m X 5-10m	100 - 400	8
Dendrocalamus giganteus	6-10m X 7-10m	100 - 238	7
Dendrocalamus latiflorus	5-8m X 5-8m	156 - 400	7
Dendrocalamus	5-8m X 5-8m	156 - 400	7
Gigantochloa atroviolacea	4-7m X 5-7m	204 - 500	6
Gigantochloa atter	4-7m X 5-7m	204 - 500	6
Gigantochloa apus	4-7m X 5-7m	204 - 500	6
Oxytenanthera abyssinica	4-5m X 5-7m	286 - 500	5
Phyllostachys aurea	2-4m X 2-4m	625 - 2500	5

Once planted the bamboo stands need to be allowed to develop and grow to optimum size before harvesting can begin, this is indicated in the table above. There after all 3 year old culms can be harvested, although bamboo culms reach their full height and girth in a single season of 3 to 4 months they comprise mostly of water and need a further 2 years to become woody and fully mature. This means you will be able to harvest 30% of the culms each year. There are preferable times for harvest, within the life cycle of the bamboo, the annual cycle of growth, the time of the month as well as the time of the day. For example, harvesting during the rainy growth season should be avoided as it will damage newly emerging shoots, reducing overall crop productivity. The guidelines below show how to increase the life expectancy of both the structure and the crop.

#### How to Harvest

1. LIFE CYCLE: Harvest culms no younger than 3 years old and no older than 5 years old.
2. ANNUAL CYCLE: Harvest well outside the growth phase during the rainy season.
3. MONTHLY CYCLE: Consult local knowledge about the best time to harvest by moon cycle.
4. DAILY CYCLE: Harvest preferably at dawn when visibility is sufficient but sap levels are still low.





**Best practice in bamboo harvesting includes:**

- To ensure adequate foliage to feed the developing clump, ideally no more than 33% of a clump should be harvested at any time.
- Harvest culms at 3-5 years old (there is some variation between species).
- Ensure cuts are as neat as possible and clean up waste bamboo to reduce pest infestation and fungal disease.
- Prune the clump to allowing more light in and encourage new shoot growth. Clear out culms that are:
  - too old and have begun to decay.
  - diseased.
  - broken or overly bent.
- Bamboo cells begin to collapse and close within 2-3 days of harvest, after which time they are no longer capable of transporting water. Treatment systems that make use of the plant's vascular system must be undertaken during this period. Storing freshly-cut bamboo under water as is common in sap leaching procedures will increase this interval. A number of bamboo forestry practitioners recommend managing bamboo clumps into a horseshoe, cross or rotating flower configuration. In this practice, new shoots are encouraged to form at the outside of the clump, with a small access corridor maintained to allow access to the centre. The inner section of the clump will contain older culms ready for harvesting while the outer expanding section is only new growth.

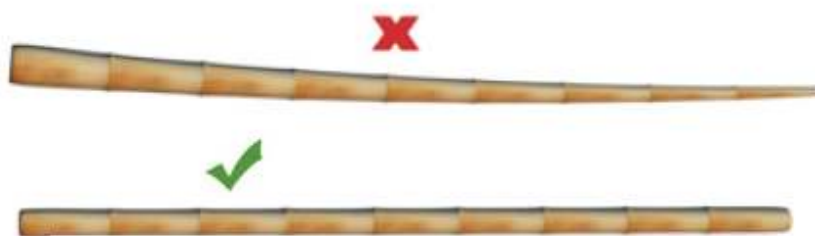
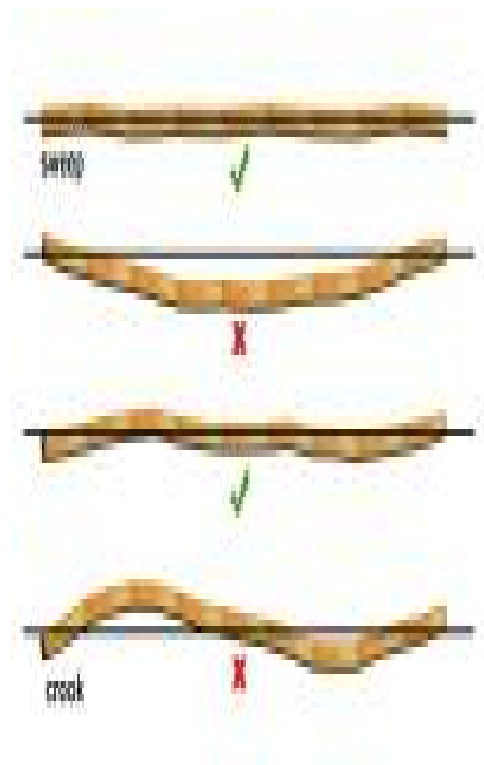


Example of Horseshoe Crop

## Evaluation Criteria

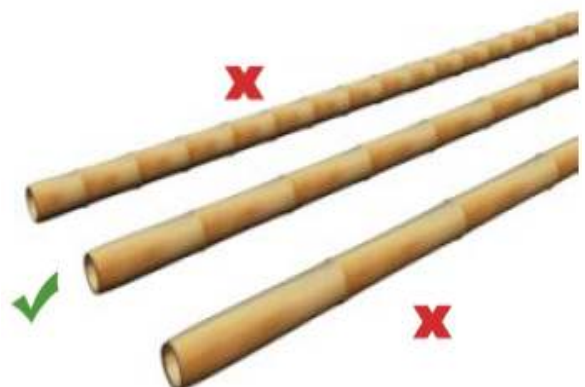
Recent research by the Environmental Bamboo Foundation in Bali has shown that good crop management practices can increase bamboo crop yields by up to 400%. When evaluating the culms the criteria will differ depending on the intended use of the crop. But generally the following factors are important:-

- Weight
  - Wet mass
  - Dry mass
- Length of the Culms
- Diameter of the culm at the base
- Wall thickness of the culm at the base
- Straightness, mildly bent culms may be suitable. Acceptable levels of “sweep” and “crook” may be measured using a string line stretched from the tip to the butt of the culm. No part of the culm should fall outside of the line of the string.
- Taper is important especially if culms are being selected for construction requiring consistency of strength, culms should be selected with a minimal level of taper along the length. A maximum taper of 10mm per 3m is commonly considered acceptable.



Acceptable taper is 10mm per 3m

- Nodes, bamboo is straight between nodes, altering direction slightly at the node. Hence bamboo with tight nodal spacing may make for irregular-shaped culms that are more difficult to build with. Wider nodal spacing (30cm-60cm) makes for straighter bamboo and therefore easier construction. Overly wide spacing limits the horizontal strength of the culm.



Bamboo for construction has an ideal nodal spacing of 30 to 60cm

