SHORT NOTE Propagation of *Bambusa vulgaris*: a simplified method for use in display glasshouses

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Abstract

Horticulture staff at the Royal Botanic Garden Edinburgh have experimented with the propagation of *Bambusa vulgaris* by planting pieces of stem directly into the bed in which the plant is to grow. The success of the method means that both transportation time and space are saved by removing the stage where these large propagules are in the propagation unit.

Introduction

Bambusa vulgaris (common bamboo) is one of the most impressive plants displayed in the tropical glasshouses at the Royal Botanic Garden Edinburgh (RBGE), due to its size, smooth green culms and silky foliage. Its lower branches arch gently over the path while the upper foliage forms a dense canopy obscuring the glasshouse roof, and the plant contributes to the illusion of being in a tropical forest (Fig. 1). Such an evocative plant is valuable for RBGE's living collection displays.

In 2020, glasshouse renovations required that the single specimen at RBGE be removed and propagated to ensure continuance of the accession. Moving large species like the common bamboo requires several members of staff and is often difficult due to lack of space and the sizes of door openings.

The propagation of large and fast-growing plants presents a challenge to horticulturists because the plants often do not grow well in the restricted space of a pot. They also dislike disturbance caused to roots when repotting and planting when they are mature. For this reason, horticulturists were eager to try out a method that would simplify the process.

Cultivation

Bambusa vulgaris is a widespread species commonly grown in tropical regions for various practical applications from agriculture to construction and furniture manufacture (Poudyal, 2006; Liese & Köhl, 2015). It is easy to cultivate if it is in warm and humid conditions and has free-draining compost and enough space to grow to its full size (Rojo, 2000).

At RBGE the species is grown in the controlled environment of a tropical glasshouse with daytime temperatures of 22–28 °C and night temperatures of 18–24 °C, and humidity levels oscillating around 80–90 per cent. It is fed with fertiliser with an N:P:K ratio of 3:1:1 in spring to promote new growth, and balanced 1:1:1 fertiliser in summer and autumn. From late October until February the plant is not fed as growth is suspended due to the short daylength in Scotland.

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Fig. 1 Mature *Bambusa vulgaris* growing in the Tropical Palm House at the Royal Botanic Garden Edinburgh in 2013. Photo: Robyn Drinkwater.

Propagation

Authors cite several methods of propagation for *Bambusa vulgaris*, including cuttings of culm, branch or rhizome, air-layering (Liese & Köhl, 2015) and clump division (Lawson, 1968). It can also be micropropagated (Poudyal, 2006).

At RBGE a propagation method that requires repotting multiple times over several years has traditionally been used. Cut sections of side branches are placed in water until they form new roots from the internode. This stage takes two to four weeks. Once rooted, the propagules are potted up into a compost mix of pine bark and perlite. They are grown on and repotted regularly until they reach a suitable size for planting out into the tropical display glasshouse.

This method has been used on numerous occasions on various bamboo species, including *Bambusa vulgaris*. The advantages of this method are the high success rate and the value of holding stocks of young offspring in pots. The disadvantages are the time and resources required for repotting numerous times. Repotting causes stress to the plant and prolongs the time taken for it to reach its full size.

Method

Ang Maginoong Waray demonstrates a technique in a YouTube video made on his farm in the Philippines, where he cultivates bamboo (Ang Maginoong Waray, 2020). He does not specify which species he is using for the demonstration.

He chooses a fresh bamboo culm, making sure it has two internodes and three nodes with side branches and foliage. Then he places the cut section on the ground and prepares it for propagation by reducing the amount of foliage. With a sharp machete he makes a small opening in each internode. He pours a glass of water into the empty cavity of each internode and loosely seals up the holes with the plugs of stem. He indicates that the water in the culm cavities is essential to the propagation success.

The bamboo is then ready to be planted directly where it can grow to its full size. He digs a shallow trench and places the culm horizontally with the sealed holes facing up. He covers it with soil so only the small side branches with foliage are visible above the ground. Three weeks later he presents a new plant with fresh foliage.

Ang Maginoong Waray's method seems elegant and very simple, and so RBGE horticultural staff decided to try the method in the Lowland Tropics House. The humidity level in this glasshouse oscillates

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around 80 per cent and the temperature ranges from a night minimum of 20 °C to a day maximum of 28 °C at which point the automatic vents open to lower the temperature.

The bed was prepared prior to inserting the cuttings of *Bambusa vulgaris*. It is standard practice at RBGE to rejuvenate the soil by digging over and incorporating fresh compost before new plantings are made. Over time soil in the glasshouses loses structure and nutrients, becoming heavy and compacted. The following compost mix was made and mixed with the existing soil:

- 200 litres milled pine bark (size 6–20 mm)
- 50 litres leaf compost
- 20 litres perlite (size 3–6 mm)
- 10 litres charcoal (size 8–15 mm)
- 700 mg granulated slow-release fertiliser
- 100 mg dolomitic limestone powder

Several pieces of fresh *Bambusa vulgaris* culms were cut and placed temporarily in the tropical propagation tank and inspected for pests and diseases (Fig. 2). Four culms were selected and prepared for planting (Fig. 3). The propagules were given numbers allocated to their planting sites (Table 1). Nos 1 and 2 were used for culms with three and two nodes respectively and which were planted horizontally. Nos 3A and 3B were assigned to two culms which were planted vertically.

Only one propagule (no. 1) had three nodes and two internodes, exactly as presented by Ang Maginoong Waray. There were two reasons for deviating from the original method. First, we wanted to find out if smaller propagules would root. McClure (1966) states that culm cuttings with only one node are sufficient. Second, space in the glasshouse beds was limited.

Fig. 2 *Bambusa vulgaris* lengths in the warm water propagation tank. Photo: Kate Hughes.

Fig. 3 Culm sections prepared for planting. Photo: Paulina Maciejewska-Daruk.

The amount of foliage on each node was reduced by half and trimmed to 30 cm. The foliage grows in the opposite direction on each consecutive node, so once placed horizontally some of the foliage was buried. This buried foliage was entirely removed to reduce the risk of rotting. Small openings were made with a hand saw in the centre of the intersections (Fig. 4) and a glass of water

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Fig. 4 Openings cut in the culm intersection. Photo: Paulina Maciejewska-Daruk.

Fig. 5 Planting propagule 1, with three nodes and two internodes. Photo: Kate Hughes.

was poured into each opening. The offcut plugs were replaced to cover the holes.

Propagules 1 and 2 were planted following the method described in the video (Figs 5 & 6). Propagules 3A and 3B were planted vertically, so the openings of the cut culms faced upwards like a vase and were not covered with compost. The culm openings for these propagules were filled with water after planting (Fig. 7).

All were generously watered and marked with labels. They were monitored daily for signs of growth or deterioration and were watered in the same way as the rest of the plants in the glasshouse. The watering routine varied according to the daily fluctuations in temperature and humidity.

Results

New shoots were visible on all propagules within a week (Fig. 8). After ten weeks the

Table 1 Location, description and planting position of each propagule.

Propagule number	Location	Location description	Propagule description	Planting position
1	Centre of the glasshouse	Stable humidity but lower temperature	100 cm Three nodes and two internodes, each with an opening filled with water	Horizontal
2	Close to the heating pipes	Very warm but dries out quickly	60 cm Two nodes and one internode, with an opening filled with water	Horizontal
3A & 3B	Close to the path	Stable temperature but very wet compost	Two propagules each 40 cm One node with sections of internodes on each side	Vertical

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Fig. 6 Propagule 2 with two nodes and one internode ready for planting. Photo: Thomas Shriver.

Fig. 7 Propagules 3A and 3B were planted vertically and filled with water. Photo: Paulina Maciejewska-Daruk.

Fig. 8 New growth after one week. Photo: Paulina Maciejewska-Daruk.

propagules were excavated to check for roots. All of them had healthy roots and lush new foliage (Figs 9 & 10).

Only the orientation of the propagules, horizontal or vertical, appeared to have an effect on shoot formation. The bigger, horizontally planted propagules 1 and 2 produced short and dense foliage, while the smaller, vertically planted propagules 3A and 3B produced fewer and more etiolated stems, each reaching over 2 m in height (Fig. 11). Propagules with young shoots present on nodes during planting did not have any advantages. The shoots which were small and thin on insertion were ultimately the most vigorous.

Discussion

The propagation method tested here was successful, with the production of thriving propagules after ten weeks in the tropical glasshouse environment. The difference in

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Fig. 9 Propagule 2 with two nodes and one internode. Ten weeks after planting, it has grown several new stems. Photo: Paulina Maciejewska-Daruk.

Fig. 10 New roots supporting the young stems ten weeks after planting. Photo: Paulina Maciejewska-Daruk.

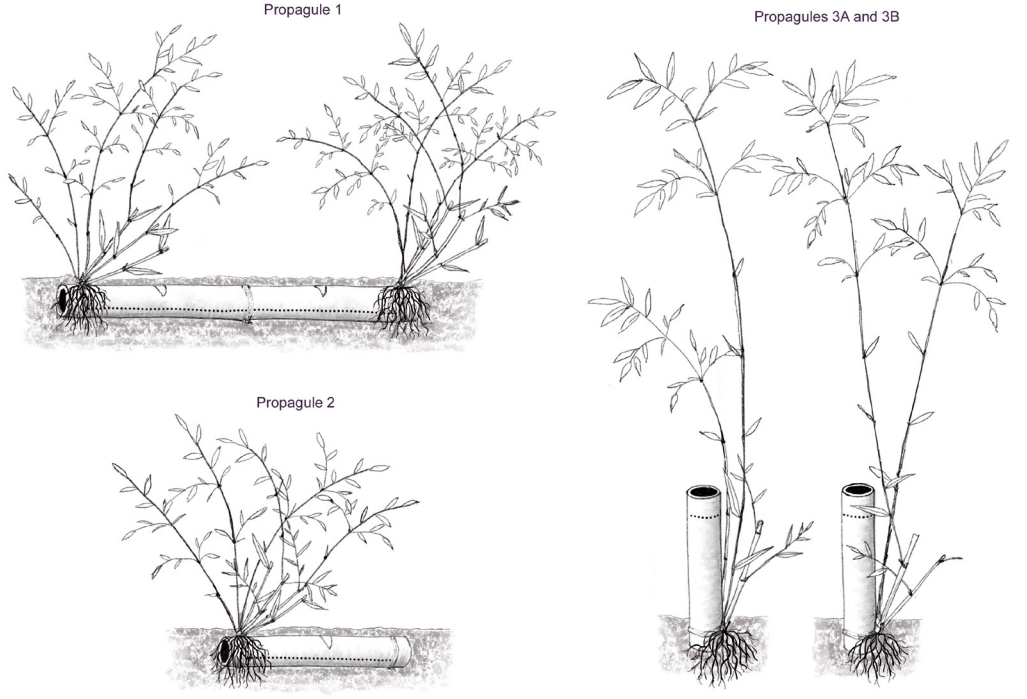

Fig. 11 Schematic illustration comparing the proportions of new growth on the propagules. The dotted line on the culms indicates the water level inside the stems. Illustration: Paulina Maciejewska-Daruk.

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vigour of new growth on the horizontally planted propagules is due to a geotropic reaction related to the culm position. Under the action of gravity, growth hormone (auxin) accumulates on the underside of the horizontally planted culms, stimulating growth in the lower cells rather than the growing tips (Capon, 1990). Vertically planted culms were less disrupted as their orientation remained unchanged and side branch growth continued in the same way as it does on mature plants. A further difference that may have affected shoot vigour was the amount of water poured into the culm cavity. The vertical propagules were almost filled with water, while the horizontal ones were given approximately 500 ml each. Space was not available to test these correlations on this occasion and it would be worthwhile to include such variables in future experiments.

There are a couple of factors to consider when using this propagation method in the context of glasshouses which are open to visitors. First, the advantage of the direct planting method is that space and time required for potting and handling plants can be saved. In addition, propagation is often carried out 'behind the scenes', out of sight of the public. To do it in the display glasshouse enables horticultural techniques to be presented to visitors, creating an opportunity for engagement and education.

There is, however, a disadvantage to the method described here. The newly planted areas do not make a good display early on and it takes several years for the young bamboo to fill out the planting bed. To remedy this, small ground-covering plants could be added around the propagules when they are new. Such carpet-like plants would create an attractive display and help to stabilise the microclimate around the growing bamboo. They could be thinned and eventually removed as the bamboo matures.

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