

## Study on Ornamental Characteristics and Propagation Technology of *Bambusa Multiplex*

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**Abstract:** To study the propagation technology of *Bambusa multiplex*. Comparison of rooting effect of *Bambusa multiplex* in different hormone concentration, different matrix formula, different planting season, and different planting season. The results showed that the best selection for propagation of *Bambusa multiplex* in spring was to adopt double-stage flat burying, soak in ABT1# rooting powder at 200 ppm concentration for 2 hours, and the substrate was perlite, vermiculite, sandy soil and nutrient soil (1: 1: 1: 1), the rooting rate could reach 50.00%.

**Keywords:** *Bambusa multiplex*, Ornamental characteristics, Burial propagation, Study

### 1. INTRODUCTION

*Bambusa multiplex* belongs to the genus *Phyllostachys* in Gramineae, and is a cluster bamboo. Stem height 3-6m, diameter 0.5-1cm, tip slightly curved, internode hollow, length 16-20cm, leaf 9-13, leaf length 3.3-6.5cm, width 4-7mm. Culm dark green, culm ring inconspicuous, culm ring with wooden peg ring and prominent uplift or turn down, branches mostly. The shoot period is longer, from April to October germination of new shoots, shoots can last for 3-6 months<sup>[1-2]</sup>. Slender branches and leaves, stems slightly bent down, like a phoenix tail, natural and unrestrained, elegant appearance beautiful and elegant, can give a person with a fresh and refreshing feeling, high ornamental value, suitable for planting in the courtyard in the corner, corner, door, and rockery, stacked stone, elegant chic. This can also be used as bonsai plants, with rocks, ornaments. Bamboo leaves slender and soft, natural and unrestrained charm, yin-resistant, so it is in-door and outdoor good foliage, shape plants.

*Bambusa multiplex* originated in the south of the Yangtze river basin in China, commonly used branch breeding, but because of its clustered bamboo each section of the cluster of branches, main branches and side branches have hidden buds, under certain conditions also have adventitious roots, so it can also be used to reproduce, and this method does not destroy the underground part of the bamboo cluster, can be combined with pruning, with cutting and cutting, material is convenient, but at present, few people do related research, Zheng Wei<sup>[3]</sup> has used section cutting propagation.

The test site is in the greenhouse of Jiangsu agriculture and animal husbandry science and technology vocational college, hailing district, Taizhou city, Jiangsu province. The geographical coordinates are 32° 01' 57" north latitude and 119° 38' 24" east longitudes. The regional seasonal distribution is obvious, the general summer heat, rainfall is large, less rainfall in winter. The annual average temperature is between 14.4 °C and 15.1 °C<sup>[4]</sup>.

### 2. MATERIALS AND METHODS

#### 2.1. Material Selection and Fabrication

The tested bamboo species is *Bambusa multiplex* in the high-quality bamboo garden of the campus base. 2-3-year-old bamboo rods with robust growth, full stalk buds, no disease and insect pests and strong germination ability are selected, and the middle and lower parts of the bamboo crown with green branches or light-yellow branches are sufficiently exposed to light, and the tops are cut off, and the middle and upper parts are reserved<sup>[5]</sup>. According to the experimental design requirements were cut into single-segment and double - segment, upper incision flat shear, remove redundant parts and branches and leaves, internode properly keep some branches and leaves, to facilitate photosynthesis.

## 2.2. Experiment Design

### 2.2.1. Comparison of Different Hormone Concentration

The single-section flat burying method is adopted. The matrix is composed of perlite, vermiculite, sandy soil and nutrient soil (1:1:1:1). Hormone with ABT1<sup>#</sup> rooting powder and NAA, set different gradients, such as clear water as the control, using random group arrangement of 3 repeats, each treatment 30 knots. See table 1 below for specific concentration and soaking time:

**Table1.** *Different Hormone Concentrations and Treatment Schedule*

Different hormones	Root powder concentration and treatment time
Pure water (CK)	immersion in Clear water
ABT <sup>1#</sup>	200ppm(2h)
	400ppm(2h)
	800ppm(1h)
	1000ppm(15s)
	1500ppm(15s)
NAA	200ppm(2h)
	400ppm(2h)
	800ppm(1h)
	1000ppm(15s)
	1500ppm(15s)

Increasing the concentration in a certain concentration range has the effect of increasing the rooting rate, but to a certain extent, increasing the negative impact, so there is the concept of optimal concentration.

### 2.2.2. Different Matrix Ratio

Five kinds of substrates with different formulations were used to test the rooting of *Bambusa multiplex*. The segments of *Bambusa multiplex* were soaked with abt1 # 200 ppm for 2 hours, and the effects of different substrate formulations on the rooting of *Bambusa multiplex* were compared. Three repetitions were arranged using a random block group, each processing 30 sections.

**Table2.** *Comparison of Different Matrices*

Number	Matrix Ratio
1	Perlite, vermiculite, sandy soil, nutrient soil (1:1:1:1)
2	Nutrient soil + perlite (1:1)
3	Sand
4	Coconut bran
5	Sand + garden soil (1:1)

### 2.2.3. Time Comparison of Different Buried Joints

In order to summarize the seasonal effects, the single-section flat burying method was used to select the formula perlite, vermiculite, sandy soil and nutrient soil(1:1:1:1:1) as the substrate, and the experiment was conducted in spring of 2015 and autumn of September of 2015 by ABT1 # 200 ppm (2h) concentration treatment.

### 2.2.4. Comparison of Different Section Lengths and Buried Sections

The length of cuttings and the way of burying joints may influence rooting. In this experiment, the formula 1: perlite, vermiculite, sandy soil and nutrient soil (1:1:1:1) were used as the matrix, and ABT1 # 200 ppm was used to soak for 2 hours (double bamboo joints were drilled in the middle of bamboo joints), and the rooting effect was compared. Three repetitions were arranged using a random block group, each processing 30 sections.

**Table3.** *Comparison of Different Buried Joints*

Number	Buried joint mode
1	Single section flat burying
2	Single section inclined buried ( 45 °C )

3	Double - section flat burying
4	Double inclined buried ( 45 °C )

### 2.3. Test Management

The test was conducted on April 14, 2015 (The season test begins in September 5th), and the substrate used in the test was sterilized with 0.5% aqueous potassium permanganate. Because the local temperature is still low in April, to guarantee the effect of rooting after cutting, put it into the greenhouse for daily maintenance and management, according to the greenhouse air humidity, flexible control of water spray management, maintain a reasonable air humidity, and keep the greenhouse air fresh circulation situation, in case of high temperature and humidity caused by disease and insect damage, and observe the germination and rooting.

### 2.4. Results Statistics

Each experiment was conducted at the end of May (season test including the end of October) to investigate the rooting rate of cuttings, calculate the survival rate, and fill in the record form carefully. After data acquisition, single factor analysis of variance was carried out by excel and related statistical analysis tools, and the results were obtained by using the new complex polar difference method.

## 3. RESULTS AND ANALYSIS

### 3.1. Effects of Different Hormone and Concentration Treatment on Rooting of *Bambusa Multiplex*

**Table4.** Effects of Different Hormone Treatments on Rooting of *Bambusa Multiplex*

Different hormones	Root powder concentration and treatment time	Repeat 1	Repeat2	Repeat 3	Average rooting rate
Pure water (CK)	Soaked in water	3.33	6.67	0.00	3.33dC
ABT <sup>1#</sup>	200ppm(2h)	36.67	33.33	43.33	37.78aA
	400ppm(2h)	26.67	33.33	20.00	26.67bB
	800ppm(1h)	10.00	3.33	0.00	4.44dC
	1000ppm(15s)	3.33	0.00	0.00	1.11dC
	1500ppm(15s)	0.00	0.00	3.33	1.11dC
NAA	200ppm(2h)	23.33	16.67	30.00	23.33bcB
	400ppm(2h)	16.67	20.00	16.67	17.78cB
	800ppm(1h)	6.67	6.67	0.00	4.45dC
	1000ppm(15s)	0.00	6.67	0.00	2.22dC
	1500ppm(15s)	0.00	0.00	0.00	0.00dC

The results of rooting treatment of *Bambusa multiplex* with different hormones and concentrations (table 4) showed that plant growth regulator had a significant effect on rooting, and the rooting rate of *Bambusa multiplex* was significantly higher than that of control after treatment with ABT<sup>1#</sup>, NAA. ABT<sup>1#</sup> rooting powder was soaked at 200 ppm for 2h, the rooting rate of phoenix tail bamboo was 37.78% and 400 ppm for 2h, the rooting rate was 26.67%. When the NAA concentration was 200 ppm for 2h, the rooting rate was 23.33% of the control, the difference was significant at 0.01 levels and 0.05 levels. Compared with 3.33% of the control, the difference was significant at 0.01 levels and 0.05 levels. Compared with NAA, ABT<sup>1#</sup> rooting powder was more favorable to the rooting of *Bambusa multiplex*

The data in the table also show that the growth regulator concentration has a great effect on rooting, ABT<sup>1#</sup> rooting powder mass concentration of 800 ppm for 1h, the rooting rates only 4.44% and 1000 ppm, 1500 ppm dip treatment after the rooting rate is lower, only 1.11 %; The rooting rate of NAA was only 4.45 % at 800 ppm and 2.22 % at 1000 ppm and 0.00 % at 1500 ppm, respectively the results are consistent with those of Sun Zhong yuan et al<sup>[6]</sup>.

### 3.2. Effects of Different Matrix Ratios on Rooting of *Bambusa Multiplex*

As can be seen from the data in table 5, different matrix formulations have a significant effect on the rooting of *Bambusa multiplex*. The results showed that the final rooting rate was 37.78 % for perlite, vermiculite, sandy soil and nutrient soil (1: 1: 1: 1), but only 3.33% for pure coconut bran in formula 4. The rooting rate of pure coconut bran in several formulas was significantly different. Analysis of

the reasons, formula 1 contains perlite, vermiculite, sandy soil, nutrient soil and other mixed matrix, not only can ensure the loose ventilation, good moisturizing effect, but also have sufficient nutrients, strong matrix fixation ability, fully fit with the phoenix tail bamboo section, bamboo section to ensure moisture, so as to facilitate rooting; Although the sand in formula 3 has strong permeability, the water and fertilizer retention capacity is poor, the water is easy to lose, the heat preservation effect is poor, the rooting rate is slightly lower, only 13.34 %, the moisture must be fully guaranteed during the curing period, and the fertilizer application should be paid attention to in the later period to ensure the nutrient supply; Formula 4 coconut bran has the lowest rooting rate, only 3.33 %, although coconut bran has good pore structure and strong water retention capacity, but the texture is lighter, bamboo is different from other plants, in the propagation of buried joint with bamboo segment adhesion is not strong, adhesion is not high, but make the joint with soil closely affect the rooting effect.

**Table5.** Effects of Different Matrix Ratios on Rooting of *Bambusa Multiplex*

Different matrix ratio		Repeat 1	Repeat 2	Repeat 3	Average rooting rate
Process 1	Perlite, vermiculite, sandy soil, nutrient soil (1: 1: 1: 1)	36.67	33.33	43.33	37.78aA
Process 2	Nutrient soil + perlite (1: 1)	30.00	20.00	16.67	22.22bB
Process 3	Sand	6.67	16.67	16.67	13.34bcBC
Process 4	Coconut bran	6.67	3.33	0.00	3.33cC
Process 5	Sand + garden soil (1: 1)	20.00	23.33	16.67	20.00bB

### 3.3. Effects of Different Burying Methods on Rooting of *Bambusa Multiplex*

The data in table 6 show that different burying modes have little effect on rooting effect and no significant difference, but the rooting rate is relatively higher than that of the inclined burying, and the bamboo segments may be fully contacted with the substrate during the horizontal burying, and the moisturizing effect is better to facilitate rooting. The rooting rates of single-section flat burying and inclined burying were 37.78 % and 32.22 %, respectively. The rooting rates of double-section flat burying and inclined burying were 50.00 % and 45.55 %, respectively. The difference reached a significant level. These data indicated that the effect of double-section flat burying was better than that of single-section bamboo planting. Buried - node seedling raising is to use the full dormant buds on the stem nodes as the root base, and the nutrients of the bamboo nodes themselves as the energy source before rooting, the rooting process needs to consume a large amount of nutrients and capacity, the storage of carbohydrates in the bamboo nodes have an important effect on rooting, the higher the ratio, the higher the rooting rate <sup>[7-9]</sup>.

**Table6.** Effects of different burying methods on rooting of *Bambusa multiplex*

	Different buried joint modes	Repeat 1	Repeat 2	Repeat 3	Average rooting rate
Process 1	Single section flat burying	36.67	33.33	43.33	37.78bcA
Process 2	Single section inclined buried ( 45 °C )	30.00	26.67	40.00	32.22cA
Process 3	Double - section flat burying	43.33	50.00	56.67	50.00aA
Process 4	Double inclined buried ( 45 °C )	53.33	40.00	43.33	45.55abA

### 3.4. Effects of different burying seasons on rooting

The effects of spring and autumn on rooting of buried season were compared. The results (table 7) showed that the rooting rate in spring (37.78 %) was higher than that in autumn (15.56 %), although the difference was not significant, it had a certain improvement effect. The reason is that the shoot period of *Bambusa multiplex* is longer, and new shoots are germinated continuously from April to October. In April, the number of shoots is smaller; the nutrient loss of parent plant is lower. By September, the end of shoots is basically reached, the nutrient loss is too much, and the nutrient substances in parent plant are relatively less. Therefore, the planting season is not conducive to its rooting, and the planting season is the best in April to May.

**Table7.** Effects of Different Treatment Time on Rooting of *Bambusa Multiplex*

Different buried seasons		Repeat 1	Repeat 2	Repeat 3	Average rooting rate
Process 1	Spring (April)	36.67	33.33	43.33	37.78aA
Process 2	Autumn (September)	13.33	26.67	6.67	15.56aA

#### 4. DISCUSSION

Hormone had a great effect on the propagation of *Bambusa multiplex*. The rooting rate was only 3.33 % after soaking in clear water. The effect of ABT<sup>1#</sup> was better than NAA. Both ABT<sup>1#</sup> rooting powder and NAA mass concentration were 200 ppm soaked for 2 h, and the rooting rate was 37.78% and 23.33% respectively. The difference was significant, and high concentration was not conducive to rooting. But this experiment only uses abt1 # rooting powder and NAA two hormones, for the effect of other rooting hormone and how to use together to play a better effect, and so on, including whether lower concentrations such as 50 - 100 ppm is more conducive to the rooting of the phoenix tail bamboo segments also need to be further verified.

There were significant differences in rooting rate of *Bambusa multiplex* in different matrix proportions. formula 1: perlite, vermiculite, sandy soil and nutrient soil (1: 1: 1: 1) had the best effect, the rooting rate reached 37.78 %, which may be related to the water retention, air permeability and heat preservation properties of the matrix itself. But also pay attention to the degree of close adhesion between the matrix and the phoenix tail bamboo section, like the coconut bran in formula 4 although there is strong permeability and sufficient fertility, but the matrix is too soft, but make the bamboo section and soil joint is not close enough to affect the rooting effect.

The rooting effect of *Bambusa multiplex* was not affected by the mode of burying joints, but the rooting rate of *Bambusa multiplex* was higher than that of oblique burying. The rooting rates of single and double segments were 37.78 % and 50.00 % respectively, while those of single and double segments were 32.22 % and 45.55 % respectively, which indicated that double segments were more favorable for rooting and nutrient accumulation in double bamboo segments was more helpful for rooting and increased rooting rate.

Different cutting seasons influence the rooting rate of *Bambusa multiplex* in the buried season, generally spring is good, the rooting rate can reach 37.78 %, which may be related to the spring air humidity, moisture content and nutritional status is higher than the autumn, *Bambusa multiplex* shoots from April to October, until September has reached the end of the shoot, the mother plant nutrient loss is too much, which influences rooting. The experiment design only compares the spring and autumn cottage, but the effect of summer and winter on rooting rate is not studied.

#### 5. CONCLUSION

Comprehensive comparison, the best choice for propagation of *Bambusa multiplex* is to adapt to double stage flat burying in spring, soak in ABT<sup>1#</sup> rooting powder with 200 ppm concentration for 2 hours and the highest rooting rate can reach 50.00 % by using perlite, vermiculite, sandy soil and nutrient soil ( 1: 1: 1: 1 ). In the experiment, management methods such as water, humidity, temperature and so on may have certain influence on rooting rate, which needs further study.

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