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Research Article

Effects of Site Factors on the Clonal Growth of *Phyllostachys bambusoides* f. *shouzhu* Yi

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Abstract

In order to provide theoretical foundation for forestation of *Phyllostachys bambusoides* f. *shouzhu* Yi, the site factors, and the morphological character and biomass of standard bamboo were investigated in 16 sample spots of bamboo forest in Liangping county, Chongqing City, and then the effects of site factors on the clonal growth was discussed. Three site factors as the slope position, altitude, species diversity, had significant effects on the clonal growth of the bamboo. The effects of the gradient, slope aspect, humus thickness, and soil thickness were little, but that of slope aspects was not significant. The altitude of above 800 m, the upper slope, the steep slope and slope, and the thin soil were not suitable for its clonal growth. The results showed that (1) the main site factors affecting the growth of *P. bambusoides* f. *shouzhu* were slope position, soil thickness and humus thickness; (2) The forestation site of *P. bambusoides* f. *shouzhu* should be selected at the flat ground and the gentle slope of the hills below altitude of 800 m, and the slope position of the forestation site should be selected at the mid and lower position of a hill; (3) Soil thickness and humus thickness should be kept at a suitable level; (4) The diversity of plant species in the bamboo forest should be kept at a suitable level for keeping its growth environment.

Introduction

Phyllostachys bambusoides f. *shouzhu* Yi is a bamboo species belonged to Bambusoideae of Gramineae [1,2], and mainly distributed in Sichuan and Chongqing, Southwest China [3]. As its bigger diameter at breast height (DBH)(up to 13cm) and its longer internode (up to 60 cm), the species is planted on a commercial scale for the large culms, and are widely used for building materials, farm tools, and furniture and are also split for weaving various bamboo articles. The shoots are tasty, and the culm sheath is a good material for producing high-grade packaging products. As its better developmental and usage value, this species has received much attention about its forestation and development.

Previous studies have documented how slope and altitude have affected the growth of many bamboos in Japanese [4,5]. In Chinese forests, environmental factors such as slope angle, slope aspect, altitude and soil thickness significantly influenced the growth of some bamboos such as *Bambusa pervariabilis×Dendrocalamopsis daii* [6,7], *Bambusa emeiensis* [8], *Phyllostachys edulis* [9], and *Fargesia nitida* [10]. The morphological features of the bamboo culm are important for judging the clonal growth of bamboos, and biomass is the basis for researching the material circulation and the clonal growth in bamboo forest [11,12]. Knowledge on the morphological features and biomass is necessary for estimating the bamboo productive forces and improving the silvicultural level, and its result may be used in guiding the forestation and usage of bamboos [13]. However, little is known about the site factors influencing the clonal growth of *P.*

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bambusoides f. *shouzhu* [3,14]. In view of the significantly economical and ecological functions of *P. bambusoides* f. *shouzhu*, an explanation of its clonal growth in forest would be helpful in improving the forestation of bamboo forests in the region.

In this study, the effects of several site factors on the clonal growth of *P. bambusoides* f. *shouzhu* was studied, based on the survey of 16 sample plots in the bamboo forests of *P. bambusoides* f. *shouzhu* in Liangping County of Chongqing city, China. The objective of this study was to clarify the main factors underlying the growth of *P. bambusoides* f. *shouzhu* in a bamboo forest, and provide the useful guidelines for the management and forestation of *P. bambusoides* f. *shouzhu* population.

Materials and Methods

Study area

The study site is located in the middle section of the Mingyue Mountain (30°40′25″~30°44′27″N, 107°29′50″~107°35′16″E) near the Zhushan town of Liangping county, Chongqing City, China. The climate is warm, with an annual mean temperature of 14℃, frost-free period of 250 d, and annual mean rainfall of 1200-1400mm. The soil subtrate is mountain yellow soil, with the relative humidity of 85% [3]. The forest on the site is mainly the pure bamboo forest of *P. bambusoides* f. *shouzhu*.

Field data colletion

According to the distribution of the bamboo and the two main factors (including the slope position and slope aspect) in this region, 16 plots (each 10×10 m, 1,600 m^2 in total) were sampled in March 2009 [15]. For each plot, the site factors such as slope angle, slope position, slope aspect, the altitude, soil thickness, humus thickness and species diversity were recorded. Afterwards, the DBH of each bamboo culm was measured, and 3 standard culms were chosen according to the method of Su et al. [15]. For each standard culm, the indexes of clone growth such as the DBH, the clear bold height, culm height, overall height, and culm wall thickness were measured.

For estimating the biomass of the bamboo, the standard bamboo culm was dug up by its stump, and was saved from the culm base. Then, the stump was washed and dried naturally, and the fresh biomass of every bamboo module (including culm, branch, leaf and stump) was weighted respectively according to the methods of Su et al. [15].

Statistical Analysis

Based on the investigation result, the site factors have been divided into different levels according to methods by Gou [7], (Table 1).

The indexes of clonal growth such as culm height, DBH, clear bold height, culm wall thickness, and the biomass of every module among different levels of every site factor were analyzed with one-way ANOVAs followed by Duncan test using the statistic software SPSS 17.0. When analyzing the effect of every factor on the clonal

Table 1: The levels of environmental factors.

Environmental factors	levels			
	1	2	3	4
Slope angle (San)	Flat (<5°)	Gentle slope (5°~15°)	Slope(15°~25°)	steep slope(≧25°)
Slope position (Sp)	Uphill	Mesoslope	Downhill (including ridge)	
Slope aspect (Sas)	Sunny Slope	Cloudy slope		
Altitude (Al)	<600 m	600~700 m	700~800 m	≧800 m
Soil thickness (St)	<30 cm	30~60 cm	≧60 cm	
Humus thickness (Ht)	<2 cm	2~3 cm	3~4 cm	≧4 cm
Species diversity (Sd)	<10	10~20	20~30	≧30

growth of this bamboo, the other factors in the analyzed plots should be in harmony. For evaluating the main factors affecting the clonal growth of *P. bambusoides* f. *shouzhu*, Quantity regression in SPSS software was used [6].

Results

Slope angle

With the increase of slope angle, the DBH, clear bold height, culm height, overall height and culm wall thickness of *P. bambusoides* f. *shouzhu* all decreased (Table 2). The analysis of variance showed that there was no significant difference about the index of clonal growth between flat and the gentle slope. Except for clear bold height and culm wall thickness, there was significant difference about DBH, culm height, and overall height between steep slope and other levels. The result indicates that steep slope was unfavorable to the increase of DBH, culm height and overall height, but the flat and gentle slope were all favorable to the growth of *P. bambusoides* f. *shouzhu*.

With the increase of slope angle, the biomass of every module of *P. bambusoides* f. *shouzhu* gradually decreased on the whole (Table 3), indicating that slope angle had an impact on the module biomass to a certain degree. For the biomass of culm and stump, there was significant difference among different levels of slope angle. For the branches biomass, there was significant difference between flat and slope or steep slope, but no significant difference between slope and gentle slope or steep slope. For the leaves biomass, there was significant difference between flat and other levels, but no significant difference among other levels. The results showed that the flat was more advantageous to the biomass accumulation than other slope angle levels, but the steep slope was most disadvantageous to the biomass accumulation.

Slope position

There was no significant difference of the DBH, clear bold height, culm height, overall height and culm wall thickness of *P. bambusoides* f. *shouzhu* among different slope position levels (Table 4). Except for the culm wall thickness, the mean values of each clonal growth index in the uphill all reached the minimum, suggesting that the uphill was relatively not suitable for the growth of this bamboo species. Therefore, we should choose gentle slope as far as possible for cultivating the bamboo.

Table 2: Effect of the slope on the clonal growth of *P. bambusoides f. shouzhu*.

San level	DBH /cm	Clear bold height/m	Culm height/m	Overall height /m	Culm wall thickness/ mm
1	8.30±0.06a	10.85±0.37a	13.44±0.27a	15.88±0.52a	13.33±0.43a
2	7.83±0.12ab	9.25±0.77ab	12.73±0.38a	15.09±0.50ab	13.13±0.22a
3	7.17±0.16b	7.56±0.26bc	10.99±0.24b	13.05±0.38b	11.85±0.33ab
4	5.48±0.13c	6.09±0.20c	8.65±0.33c	10.47±0.77c	10.37±0.10b

Note: different letters in the same column indicates significant difference among environmental factors. The same as followed.

Table 3: Effect of the slope on the biomass of *P. bambusoides f. shouzhu*

San level	Culms /kg	Branches /g	Leaves /g	Stumps /g
1	20.10±0.23a	2468.00±157.31a	2868.00±353.33a	1063.67±47.46a
2	15.57±1.00b	1941.22±104.20ab	1271.25±287.67b	894.22±18.10b
3	11.62±0.71c	1599.43±164.41bc	1451.92±194.15b	719.43±29.89c
4	5.77±0.64d	1010.00±101.16c	834.14±180.68b	387.33±34.95d

Table 4: Effect of the slope position on the clonal growth of *P. bambusoides f. shouzhu*

Sp level	DBH /cm	Clear bold height/m	Culm height/m	Overall height/m	Culm wall thickness/mm
1	7.12±0.16a	7.86±0.35a	10.93±0.35a	13.40±0.51a	12.66±0.40a
2	7.38±0.27a	8.63±0.55a	11.68±0.49a	13.68±0.63a	12.39±0.39a
3	7.29±0.25a	7.73±0.58a	11.51±0.45a	13.60±0.64a	11.63±0.47a

Similarly, the slope position had no significant impact on the modual biomass accumulation (Table 5). Except for the leaves, the biomasses of other modual in meloslpoe or downhill were all bigger than that in uphill. For the culms, the maxium appeared in the meloslope. For the branches and stumps, the maxium appeared in downhill. The results indicated that the uphill was suitable for the biomass accumulation of leaves, but not for that of other modules.

Slope aspect

Generally, slope aspect would have influenced on the plant growth, because the environmental factors (including light, heat and water) related to plant growth were different with the difference of slope aspect. In this experiment, the mean values of the DBH, clear bold height, culm height, overall height and culm wall thickness in sunny slope were all bigger than that in the cloudy slope (Table 6). However, the analysis of variance showed that slope aspect had no significant effect on the clonal growth of *P. bambusoides* f. *shouzhu* (p>0.05) except for culm wall thickness (F=5.864, p=0.02<0.05).

It can be seen from table 7 that the biomass of total and culm of the bamboo in sunny slope were bigger than that in cloudy slope. In contrast, the biomassof other modules in sunny slope were lower than that in cloudy slope. The analysis of variance showed that there was no significant difference of the biomass between in sunny slope and cloudy slope (p>0.05), indicating that slope aspect had no effect on the biomass accumulation of *P. bambusoides* f. *shouzhu*.

Altitude

Generally, altitude would have an impact on the environmental factors such as temperature and light, and thus affect the plant growth. In *P. bambusoides* f. *shouzhu*, the minimum of the growth indexes all appeared on the altitude above 800m (Table 8). The analysis of variance showed that the DBH, clear bold height, culm height, overall height and culm wall thickness on the altitude above 800m were all significantly different from that on other altitude levels, and there was no significant difference among other altitude levels. The result indicated that the altitude of 800m could be a boundary line for the growth of this species, and the altitude of more than 800m may be unsuitable for its growth.

Table 5: Effect of the slope position on the biomass of *P. bambusoides f. shouzhu*.

Sp level	Culms /kg	Branches /g	Leaves /g	Stumps /g
1	11.36±0.10a	1439.44±228.19a	1642.84±326.39a	725.44±48.03a
2	13.57±1.28a	1672.33±190.30a	1398.22±167.54a	734.60±55.71a
3	13.01±1.38a	1954.42±163.40a	1440.30±350.84a	830.08±55.89a

Table 6: Effect of the slope aspect on the clonal growth of *P. bambusoides f. shouzhu*.

Sas level	DBH/cm	Culm height/m	Clear bold height/m	overall height /m	Culm wall thickness/cm
1	7.03±0.31	10.93±0.52	7.75±0.57	13.29±0.62	11.47±0.39
2	7.41±0.18	11.76±0.34	8.31±0.43	13.83±0.47	12.73±0.33

Table 7: Effect of the slope aspect on the biomass of *P. bambusoides f. shouzhu*.

Sas level	Total/kg	Culms/kg	Branches/g	Leaves/g	Stumps/g
1	16.41±3.81	11.95±2.98	1760.75±313.90	1927.11±420.26	770.17±140.45
2	16.96±1.69	13.27±1.34	1681.83±193.07	1246.42±233.12	757.38±49.56

Table 8: Effect of the altitude on the clonal growth of *P. bambusoides f. shouzhu*.

Al level	DBH /cm	Clear bold height/m	Culm height/m	Overall height/m	Culm wall thickness/ mm
1	7.53±0.23ab	8.10±0.39ab	11.54±0.44a	13.67±0.60a	13.03±0.44a
2	7.02±0.23b	7.40±0.43bc	11.20±0.41a	13.21±0.54a	12.21±0.45a
3	7.83±0.14a	9.41±0.62a	12.28±0.40a	14.66±0.57a	12.04±0.40a
4	5.48±0.15c	6.09±0.20c	8.65±0.33b	10.47±0.77b	10.37±0.10b

The biomass accumulation of module in *P. bambusoides* f. *shouzhu* had the similar character with the growth indexes. The minimum of every module biomass all appeared in the altitude of more than 800m, and there was significant difference between al 4 and other al levels (Table 9). In addition, no significant difference remained among other altitude levels. The results indicated that the altitude had an impact on the biomass accumulation of *P. bambusoides* f. *shouzhu* to a certain degree, and the altitude of more than 800m maybe not suitable for the biomass accumulation.

Soil thickness

With the increase of soil thickness, the DBH, clear bold height, culm height, overall height and culm wall thickness of *P. bambusoides* f. *shouzhu* all increased (Table 10). Except for culm wall thickness, there was a significant difference between st 3 and st 2 or 1. However, no significant difference of the growth indexes was not found between st 1 and 2. The result indicated that the thicker soil layer was advantageous to the growth of *P. bambusoides* f. *shouzhu*.

With the increase of soil thickness, the biomass of every module in *P. bambusoides* f. *shouzhu* all gradually increased except for the stumps (Table 11), indicating that the soil thickness had a certain impact on the biomass of *P. bambusoides* f. *shouzhu*. For the biomass of culms and leaves, there was a significant difference between st 3 and other levels, but no significant difference remained between st 1 and 2. For the biomass of branches, the difference of biomass was not significant between st 3 and st 2, but that was significant between st 1 and other levels. No significant difference of the stumps biomass was found among all the levels.

Humus thickness

Except for culm wall thickness, the mean value of growth indexes gradually increased on the whole with the increase of humus thickness, no significant difference was found among the ht levels (Table 12). Therefore, the thick humus layer had a little impact on the clonal growth of *P. bambusoides* f. *shouzhu*.

Table 9: Effect of the altitude on the biomass of *P. bambusoides f. shouzhu* .

Al level	Culms /kg	Branches /g	Leaves /g	Stumps /g
1	13.40±1.32a	1740.00±296.13ab	1426.98±295.57ab	719.33±41.11a
2	11.59±0.85a	1704.75±157.10ab	1102.35±285.83ab	775.42±42.94a
3	15.41±1.30a	1862.17±192.40a	2039.09±216.04a	880.67±49.86a
4	5.77±0.64b	1010.00±101.16b	834.14±180.68b	387.33±34.95b

Table 10: Effect of the soil thickness on the clonal growth of *P. bambusoides f. shouzhu.*

St level	DBH /cm	Clear bold height/m	Culm height/m	overall height /m	Culm wall thickness/mm
1	7.18±0.16b	7.85±0.40b	11.13±0.30b	13.36±0.46b	11.78±0.29a
2	7.22±0.32b	7.95±0.48b	11.46±0.56b	13.40±0.60b	12.72±0.50a
3	8.30±0.06a	10.85±0.37a	13.44±0.27a	15.88±0.52a	13.13±0.43a

Table 11: Effect of the soil thickness on the biomass of *P. bambusoides f. shouzhu.*

St level	Culms /kg	Branches /g	Leaves /g	Stumps /g
1	12.58±0.65b	559.90±197.81b	1266.06±155.33b	1229.15±164.83a
2	12.98±1.37b	1839.83±203.92a	1494.83±245.67b	699.58±58.84a
3	20.10±0.23a	2468.00±157.31a	2868.00±353.33a	1063.67±47.46a

Table 12: Effect of the humus thickness on the clonal growth of *P. bambusoides f. shouzhu*

Ht level	DBH /cm	Clear bold height/m	Culm height/m	Overall height/m	Culm wall thickness/ mm
1	7.23±0.24a	7.40±0.37a	11.04±0.54a	13.33±0.78a	12.69±0.35ab
2	7.10±0.27a	7.72±0.43a	11.04±0.41a	12.92±0.54a	11.41±0.35b
3	7.58±0.10a	8.87±0.58a	12.36±0.37a	14.36±0.38a	13.67±0.44a
4	7.62±0.29a	9.39±1.06a	12.09±0.71a	15.03±0.79a	12.64±0.35ab

Similarly, the biomass of every module of *P. bambusoides* f. *shouzhu* gradually increased with the increase of humus thickness on the whole except for the stumps (Table 13), but there was no significant difference among ht levels, indicating that the humus thickness had a little impact on the biomass accumulation.

Species diversity

In this experiment, the species numbers in plots were from 17 to 37. With the increase of the species diversity, the mean value of each indexes of *P. bambusoides* f. *shouzhu* increased. The analysis of variance showed that there was a significant difference of the mean of the growth indexes among sd levels except for DBH and culm wall thickness. For DBH and culm wall thickness, there was a significant difference between sd level 4 and 2, but no significant difference was found between sd level 3 and 4 (Table 14). The results suggested that species diversity had a significant impact on the clonal growth of *P. bambusoides* f. *shouzhu*.

For the biomass of *P. bambusoides* f. *shouzhu*, the mean of every module gradually increased with the increase of species diversity (Table 15). For the biomass of culm and stump, there was a significant difference between sd level 4 and 2, but no significant difference between sd level 3 and 4. For the biomass of branches and Leaves, no significant difference was found among different species diversity. The results indicated that species diversity had an impact on the module biomass to a certain degree.

Multiple regression analyisis of influence factors on the clonal growth of *P. bambusoides* f. *shouzhu*

In the light of the principles of synthetic analysis and principal factors, multiple regression analysis of influencing factors on the clonal growth of *P. bambusoides* f. *shouzhu* was used in SPSS software for analyzing the main influencing factors.

It could be seen from table 16 that the multiple correlation coefficient between clonal growth indexes and environmental factors were in 0.684~0.916, and the correlation between clonal growth and environmental factors was significantly high.

The result of partial correlation coefficient showed that the three factors (including soil thickness, humus thickness and species diversity) had significant influences on the clonal growth of *P. bambusoides* f. *shouzhu*. In addition, the effect of slope angle on the biomass of branch and leaves reached marked level ($p<0.05$), and slope aspect had a significant influence on the biomass of leaves and stump. Except for overall height and

Table 13: Effect of the humus thickness on the biomass of *P. bambusoides f. shouzhu.*

Ht level	Culms /kg	Branches /g	Leaves /g	Stumps /g
1	10.98±0.96a	1398.17±298.37a	575.40±167.20b	739.33±65.03ab
2	11.66±1.05a	1721.56±198.04a	1217.72±181.32ab	637.44±41.79b
3	14.62±0.86a	1953.83±133.16a	1953.96±329.62a	808.67±40.89ab
4	14.80±1.99a	1719.00±225.66a	1842.52±322.13a	881.50±51.70a

Table 14: Effect of the species diversity on the clonal growth of *P. bambusoides f. shouzhu.*

Sd level	DBH /cm	Clear bold height/m	Culm height/m	Overall height /m	Culm wall thickness/mm
2	6.21±0.29b	6.33±0.19c	9.72±0.36c	11.41±0.54c	10.22±0.12b
3	7.40±0.19a	7.89±0.32b	11.32±0.35b	13.65±0.45b	12.79±0.36a
4	7.95±0.10a	9.65±0.61a	12.90±0.30a	15.29±0.40a	13.29±0.19a

Table 15: Effect of the species diversity on the biomass of *P. bambusoides f. shouzhu.*

Sd level	Culms /kg	Branches /g	Leaves /g	Stumps /g
2	9.04±1.39b	1361.5±233.84a	1207.71±352.01a	605.83±90.31b
3	12.74±1.8ab	1690±342.18a	1541.44±290.21a	742.5±49.17ab
4	16.7±1.65a	2072.92±132.62a	1670.81±535.72a	936.59±47.28a

Table 16: Multiple regression analysis results of the clonal growth of *P. bambusoides f. shouzhu* to the environmental factors.

Clonal growth index	Partial correlation coefficient							Multiple correlation coefficient
	San	Sp	Sas	Al	St	Ht	Sd	
DBH	-0.052	0.316*	-0.228	-0.505*	0.94**	0.273	0.481*	0.684*
Culm height	-0.137	0.321*	0.076	-0.289	0.94**	0.401*	0.388*	0.702**
Overall height	0.210	-0.362	-0.258	0.483**	0.83**	0.510*	0.348**	0.748**
Culm biomass	0.201	0.654*	0.071	-0.064	0.580*	0.549*	0.641*	0.848**
Branch biomass	0.307*	0.885**	-0.117	-0.162	0.695*	0.549*	0.554*	0.894**
Leaves biomass	-0.452*	-0.084	-0.600*	-0.436*	0.403*	0.667*	-0.235	0.750**
Stump biomass	-0.239	0.757**	-0.642*	-0.393*	-0.281	0.526*	0.713*	0.916**

Note: *means the difference is significant at the 0. 05 level; **means the difference is most significant at the 0.01 level.

leaves biomass, slope position affected significantly on other clonal growth indexes of the bamboo. Besides, the influence of altitude on the DBH, overall height, the biomass of leaves and stump were notable ($p<0.05$) or very notable ($p<0.01$). Synthetically, the factors significantly affecting the clonal growth of *P. bambusoides* f. *shouzhu* were soil thickness, humus thickness, species diversity and slope position. The three factors (including slope angle, slope aspect and altitude) had very little impact on the clonal growth of *P. bambusoides* f. *shouzhu*.

Discussion

In general, slope angle, slope position will cause differences in soil layer and the thickness of humus, which affects the soil moisture, organic matter and other nutrients' reserves and the root distribution [16,17], and then impact the bamboo biomass accumulation. Our study showed that the slope angle, slope position, soil thickness and humus thickness have a certain influence on the biomass, which has the similar results to the study of *Phyllostachys pubescens* [9], *Bambusa pervariabilis×Dendrocalamopsis daii* [6], and *Neosinocalamus affinis* [8]. The result indicated that the demand of the clonal growth of *P. bambusoides* f. *shouzhu* for soil nutrients is higher. Therefore, the soil nutrients including moisture and organic matter is the concerning elements of forestation of *P. bambusoides* f. *shouzhu*.

The environmental factors such as light, heat and moisture are affected by slope aspect, which have an important impact on the growth of plants [18,19]. In general, the light in sunny slope is better than that in cloudy slope, and is more conducive to the photosynthesis and growth of plants [20-22]. In this study, the slope aspect has no significant impact on the *P. bambusoides* f. *shouzhu*. The results showed that this bamboo was not strict with light, similar to the research result in *Bambusa pervariabilis×Dendrocalamopsis daii* [6].

In this paper, the clonal growth of *Phyllostachys bambusoides* f. *shouzhu* was relatively poor in the altitude above 800m, but that was relatively better in the altitude below 800m, which is in agreement with the result from *Bambusa pervariabilis×Dendrocalamopsis daii* [6]. The altitude of 800m was just the boundary of Low and Middle Mountain [23]. In the region with higher altitude above 800m, the temperature was relatively lower, and the cold snap lasted for a long time, which can result in the death of a lot of bamboo shoots and the injury of younger bamboo [9], and then affect the quality of the bamboo and bamboo forest in *P. bambusoides* f. *shouzhu*. The result suggests that *P. bambusoides* f. *shouzhu* maybe adapt to the environment of Low Mountain.

Until recently, the research about species diversity in bamboo forest is limited to the pure forest of *Phyllostachys edulis* or the mixed forest with bamboo and broadleaved trees [24], but little is known about the species diversity of *P. bambusoides* f. *shouzhu* forest. As the undergrowth vegetation in bamboo forest can be competed the soil nutrients such as moisture and organic matter with bamboo, the vegetation under bamboo forest is usually removed by bamboo peasants for improving the productive force of bamboo forest. The result showed that the species numbers in the forest of *P. bambusoides* f. *shouzhu* had significantly positive relation with the bamboo growth [25]. Found that the well-developed vegetation under the *Cunninghamia lanceolata* forest could improve the physical and chemical properties of soil and increased the biological activity of soil, which is favorable to improve the soil fertility. Hence, the more species numbers of undergrowth vegetation in *P. bambusoides* f. *shouzhu* forest meaned the well-developed vegetation, which can be beneficial to the accumulation of soil fertility, and had a positive influence on guarding against any insects and diseases, and soil degradation, and then accelerated the clonal growth of *P. bambusoides* f. *shouzhu* and increased the productive force of the bamboo forest. Thereby, the vegetation including shrub and weeds during the forestation practice of *P. bambusoides* f. *shouzhu* should not be removed frequently for maintaining the better undergrowth vegetation, which can create a favorable environment for the clonal growth of *P. bambusoides* f. *shouzhu*.

The following aspects should be paid more attention in the forestation of *P. bambusoides* f. *shouzhu*: (1) The forestation site of *P. bambusodes* f. *shouzhu* should be selected at the flat ground and the gentle slope of the hills below altitude of 800 m; (2) the slope position of the forestation site should be selected at the mesoslope and downhill. The forestation site in uphill could be improved through the measures of arranging and thickening the soil layer; (3) Soil thickness and humus thickness should be kept at a suitable level in the forestation site; (4) the undergrowth vegetation should not be pulled up frequently, which can maintain the better ecological environment for the clonal growth of *P. bambusodes* f. *shouzhu*.

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