

Determination of Optimal Conditions for Forest Cultivation of Medicinal Plant, *Asparagus cochinchinensis* (Lour.) Merr. using Growbag

Seong Hyeon Yong^{1,2}, DoHyeon Kim¹, Kwan Been Park¹, Sun Jeong Shim², Myung Suk Choi^{1,2}

¹Department of forest resources, Gyeongsang National University, ²Forest Research Department, Gyeongsangnam-do Forest Environment Research Institute,

ABSTRACT

Forest cultivation has the advantages of clean forest product harvest, long-term harvest, excellent texture, good taste and aroma, and high content of functional substances, but it is difficult to select a suitable cultivation site. Growbag is very advantageous for weed management, and has the advantage of minimizing forest damage and having almost no site restrictions, but there are no studies applied to forest cultivation yet. *Asparagus cochinchinensis* is a plant belonging to the Liliaceae family and has effects on cough relief, detoxification, and recovery from fatigue. In this study, the optimal conditions for forest cultivation in *Asparagus cochinchinensis* using Growbag were investigated. One-year-old *A. cochinchinensis* was used for the experiment. When the growth of *A. cochinchinensis* according to the size of the Growbag was compared, the growth of the above-ground part showed a tendency to increase as the size of the grow-bag was increased, and the root length, root area, diameter and fresh weight of the underground part also increased. In the case of planting density, if the planting density was too dense or overcrowded, the growth rate of plants decreased. In particular, there was a significant difference in root length and fresh weight. As a result of investigating the effect on the slope, the growth rate of the northern slope was nearly twice as high. As a result of comparison of growth according to clinical practice, when cultivated in a coniferous forest, the root length was 87.99 mm, which was longer than that of a broad-leaved forest (49.33 mm), and there was a significant difference in root diameter and fresh weight.

INTRODUCTION

Bio companies rely on foreign imports for more than 70% of their biological resources, and medicinal plants that are not grown in Korea are being grown in large quantities in China.

Most of these biomaterials have high production potential in forests, but the system for discovering and producing promising tree species is not well established.

Growbag is lighter and cheaper than general plastic products, has excellent flame resistance, durability, insulation, breathability, and drainage, and has a durability of more than 7 to 10 years. Growbag is very advantageous for the production of high-quality wild herbs, eco-friendly cultivation, and weed management, and has the advantage of minimizing forest damage and having almost no location restrictions. *A. cochinchinensis* belongs to the Liliaceae family, and uses tubers and young shoots, and has antibacterial, antitumor, and good lung properties. However, there is no research on forest cultivation for this plant.

This study was conducted to find out the optimal conditions for forest cultivation using the growbag of *A. cochinchinensis*.

MATERIALS AND METHODS

1. Research site

-Location: Gajwa Academic Lim, Gyeongsang National University, 1056-1 Gajwa-dong, Jinju-si, Gyeongsangnam-do (GPS: 35° 8'52.55"N / 128° 5'55.21"E)

-Area: 7ha (Gajwa-dong, Jinju-si, Gyeongsangnam-do)

-Southeast-facing slope, slope: 8°

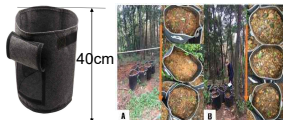
-Forest floor: Mixed coniferous hardwood forest



Research site

Table 1. Research site environment

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
평균기온(°C)	8.7	5.9	8.2	13.1	18.9	21.4	24.5	23.7	20.9	14.8	8.6	1.5
최저기온(°C)	-4.3	-2.8	2.1	6.2	11.2	17.2	20.9	20.9	18.0	8.1	0.9	-3.7
최고기온(°C)	8.9	10.0	14.5	20.8	25.5	26.6	29.0	27.7	26.8	21.8	15.7	7.2
평균강수량(mm)	7.1	18.2	113.5	123.2	91.2	143.8	198.3	560.8	129.3	184.5	78.1	2.3
평균습도(%)	1.0	1.3	1.3	1.0	1.3	1.1	1.1	1.2	0.9	1.0	0.8	1.7
평균일조시간(h)	52.8	56.9	61.2	58.4	59.7	74.1	83.7	85.8	76.1	74.9	74.0	57.2
평균강수량(mm)	228.1	154.8	218.2	269.5	293.4	198.4	199.5	116.7	209.3	229.4	194.4	107.7
평균강수량(mm)	2.2	5.4	4.5	4.5	3.4	7.0	7.0	8.1	5.4	3.4	4.1	3.8



Large size, 30cm planted growbag

2. Investigation items

-Growth characteristics of root and shoot according to growbag size(large 40x30cm, middle 25x22cm, small 14x12cm), planting density, slope, Forest floor

-Length, area, diameter and fresh weight of above-ground and underground parts(WinRHIZO Root Scanner)

3. Determination of extract contents

-Analyte: Dioscin

-Content analysis: Gravimetric method: MeOH extraction, fractionation of MeOH extract with CH₂Cl₂ layer

-TLC analysis method: TLC Silca gel 60 F254, Merck. Color reagent: 10% H₂SO₄

-Developing solvent: Acetonitrile:water (40:60, v:v)

RESULTS AND DISCUSSION

1. Root growth according to grow bag size

Table 2. *A. cochinchinensis* root growth according to grow bag size

Bag size	Root length(cm)	Root surface area(cm ²)	Root volume (cm ³)	Root diameter (mm)	Fresh weight(g)	Dry weight(g)
Large	88.5186	9.1772	0.690667	1.373333	2.084267	0.988267
Medium	38.6488	8.05265	0.4545	1.79	1.43625	0.72645
Small	30.18905	7.91705	0.278	1.76	0.7622	0.37985

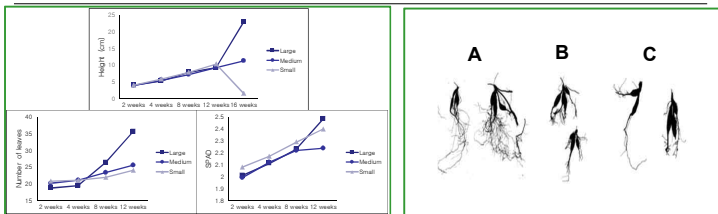


Fig. 1. Growth of the above-ground part along the slope

Fig. 2. Appearance of the roots (A: large, B:medium, and C:small from)

2. Root growth according to plating density

Table 3. Root growth characteristics according to planting density

Planting density	Root length(cm)	Root surface area(cm ²)	Root volume (cm ³)	Root diameter (mm)	Fresh weight(g)	Dry weight(g)
Dense	52.9142	8.6121	0.369333	0.486667	1.007667	0.508033
Medium	62.41573333	8.0131	0.606	0.213333	1.782	0.853933
Loose	58.9634	8.419966667	0.425	0.806667	1.071867	0.380833

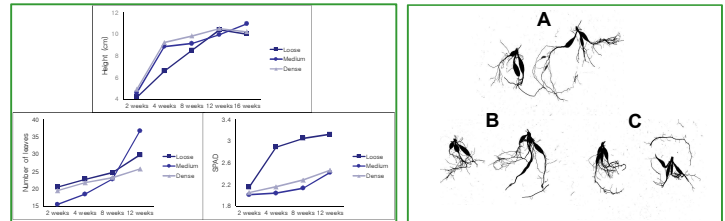


Fig. 3. Growth of the above-ground part according to plating density

Fig. 4. Appearance of the roots (A: dense, B:medium, and C:loose)

3. Root growth according to slope

Table 4. Growth of *A. cochinchinensis* root according to slope

Slope	Root length(cm)	Root surface area(cm ²)	Root volume (cm ³)	Root diameter (mm)	Fresh weight(g)	Dry weight(g)
North slope	92.3566	9.59535	0.718	4.22	2.02475	0.8584
South slope	59.30523333	10.4091	0.5405	3.08	1.52195	0.6385

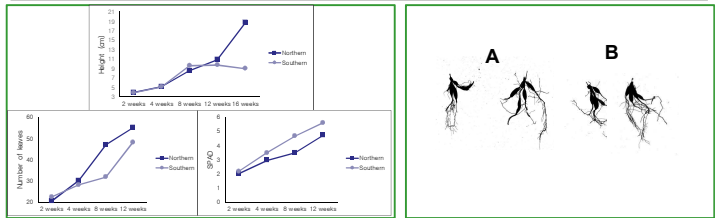


Fig. 5. Growth of the above-ground part of *A. cochinchinensis* along the slope

Fig. 6. Appearance of the roots (A:north, B:south)

4. Growth test according to the forest floor

Table 5. Growth of roots of *A. cochinchinensis* along the forest floor

Forest floor	Root length(cm)	Root surface area(cm ²)	Root volume (cm ³)	Root diameter (mm)	Fresh weight(g)	Dry weight(g)
Coniferous forest	87.9962	9.5954	0.7905	2.815	2.05275	0.829
Broad-leaved forest	49.32825	9.84965	0.247	1.57	0.7256	0.3279

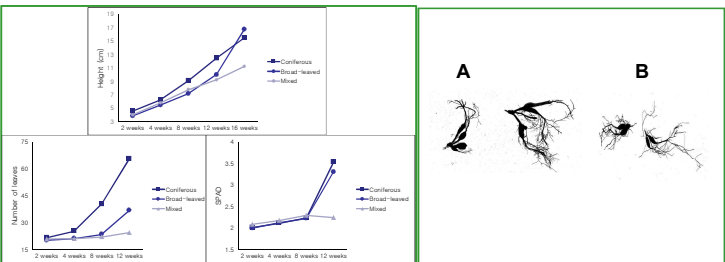


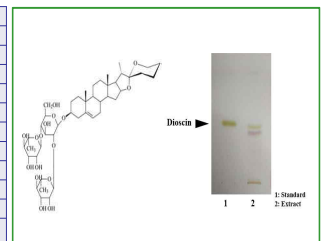
Fig. 7. Growth of the above-ground part of *A. cochinchinensis* along the forest floor

Fig. 8. Appearance of the roots (A:coniferous B:broadleaved forests)

5. Extract content according to the cultivation methods

Table 6. Changes in total extract content according to growbag cultivation method

Cultivation	Extract(%)	
Field cultivation	9.95%	
Growbag size	Large	10.17%
	Medium	10.16%
	Small	10.17%
Planting density	Loose	10.14%
	Medium	10.16%
	Dense	10.37%
Slope	North	10.22%
	South	10.14%
Forest floor	Coniferous forests	10.14%
	Broadleaved forests	10.12%



The cultivation of *A. cochinchinensis* in the forest should be cultivated in the coniferous forest of the northern slopes after maintaining an appropriate density in the large growth pouch. The above results are expected to contribute to the mass production of *A. cochinchinensis*, a useful medicinal crop, through forest cultivation.