

Growing Characteristics and Component Content of *Angelica gigas* During Spring Harvest According to Facility Type

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Background

Angelica gigas is a crop that can be used as a food ingredient, including its leaves, stems, and roots. However, the majority of farmers primarily cultivate it in open fields with the aim of producing medicinal roots. Typically, when *Angelica gigas* is transplanted and cultivated in the main field after seedling growth, it is harvested in the same year's fall (after mid to late October). This is because if harvested in the following spring, most of the plants would produce flower stalks, rendering the roots unsuitable for medicinal use. Therefore, this study was conducted to determine the optimal timing for spring harvest and identify suitable cultivation methods to ensure stable production of *Angelica gigas* for both food and medicinal purposes.

Materials & Methods

This study was conducted over a two-year period from 2022 to 2023 in Jinbu-myeon, Pyeongchang-gun, Gangwon Province, South Korea. *Angelica gigas* cultivation was carried out in three different facility types, including open-field cultivation as a control, and 35% shading house and rain shelter+35% shading house. The experimental material used for analysis was *Angelica gigas* that had been sown in late February 2022 and grown as seedlings for approximately 70 days before being transplanted to the main field on May 13, 2022. Growth characteristics and component content analyses were conducted twice, in mid-April (340 days after transplantation) and early May (361 days after transplantation), just before the above-ground parts bolted.

Results

The results of the growth characteristics assessment revealed a significant increase in above-ground growth when harvested in early May compared to mid-April, while underground growth showed little difference. In open-field cultivation, the weight of fresh and dry roots increased as the harvesting time was delayed, but in facility cultivation, such as 35% shading, there was a tendency for a decrease. The above-ground weight per plant by facility type showed the trend: rain shelter+35% shading > 35% shading > open-field cultivation, while the underground weight per plant showed the trend: open-field > 35% shading > rain shelter+35% shading. The root/shoot ratio indicated that by early May, the weights of both above-ground and underground parts were becoming more similar, ranging from 50.9% to 67.3% compared to mid-April. By facility type, in mid-April, the root/shoot ratio was open-field > 35% shading > rain shelter+35%, while in early May, it was open-field > rain shelter+35% > 35% shading. Analyzing the content of marker compounds such as Nodakenin, Decursin, and Decursinol angelate in different facility types and harvest times, it was observed that the total content of marker compounds in both above-ground and underground parts decreased slightly when harvested in early May compared to mid-April. However, regardless of the harvest time, the total content of marker compounds in the underground parts exceeded 6.0%, the standard set by the Korean Pharmacopoeia, ranging from approximately 7.2% to 8.5%. Facility-wise, the content of marker compounds in the above-ground parts decreased significantly in the 35% shading house cultivation, while the underground parts showed relatively higher levels.

Table 1. Comparison of Growth Characteristics of *Angelica gigas* Based on Facility Type and Harvest Time

Facility Type	Harvest date (mm/dd)	Above-ground weight(g/plant)			Underground weight(g/plant)			Root/Shoot Ratio (%)
		Fresh	Dry	percentage of dry matter(%)	Fresh	Dry	percentage of dry matter(%)	
Open Field	4/18 ¹	224.7	26.1	11.6	405.3	71.9	17.8	182.7
	5/9	776.4	149.9	20.5	514.4	88.1	18.6	67.3
35% Shading	4/18	262.1	27.3	10.5	447.3	79.7	17.8	171.9
	5/9	797.4	154.4	20.7	402.7	73.0	21.1	50.9
Rain shelter+ 35% Shading	4/18	353.9	38.9	16.8	350.0	62.7	17.8	146.7
	5/9	839.7	174.1	31.4	336.9	60.5	18.5	61.3

¹ Harvest Dates: 4/18 (340 days after transplantation), 5/9 (361 days after transplantation)

Table 2. Comparison of Marker Compound Contents in *Angelica gigas* by Facility Type

Category	Facility Type	Days after transplantation	Nodakenin (%)	Decursin (%)	Decursinol Angelate (%)	Total ¹ (%)
Above-Ground Parts	Open Field	340 days	0.205	1.766	1.766	3.737
		361 days	0.220	1.876	1.193	3.288
	35% Shading	340 days	0.213	2.010	2.010	4.234
		361 days	0.233	1.528	1.163	2.924
	Rain shelter+ 35% Shading	340 days	0.208	1.446	1.446	3.099
		361 days	0.186	1.452	1.135	2.773
Underground Parts	Open Field	340 days	1.029	3.842	3.027	7.899
		361 days	1.237	3.467	2.512	7.216
	35% Shading	340 days	1.002	3.912	3.191	8.105
		361 days	1.199	3.723	3.222	8.144
	Rain shelter+ 35% Shading	340 days	1.054	4.270	3.225	8.549
		361 days	1.186	3.960	2.903	8.049

¹ Korean Pharmacopoeia Standard: Total Content of Marker Compounds 6.0% (*Angelica Root*)



Figure 1. Growth Status by Harvest Time and Facility Type
(From left to right: Open field, 35% shading, Rain shelter + 35% shading)

Conclusions

Considering these results comprehensively, when harvesting *Angelica gigas* in spring, it is deemed most suitable to harvest in early May, taking into account both the above-ground and underground parts' yield. However, if the underground parts are intended for medicinal use, harvesting in mid-April is considered more appropriate. Regarding facility types, it is advantageous in terms of quality stability to cultivate in a 35% shading house.

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** (Acknowledgement) 본 연구는 강원우위 약용작물 참당귀 산업기반 구축 및 실용화 사업(사업번호 PJ016987)의 지원에 의해 이루어진 결과로 이에 감사 드립니다.