Leaf and Stem Production of *Angelica acutiloba* by Activated Carbon in Green House

Seong-Kyu Choi* and Young-Tae Park[1)]
Department of Oriental Medicine Resources, College of Nature Science,
Sunchon National University, Suncheon, 540-742, Korea
[1)]Dong Yang Carbon Co., LTD. Chonan, 330-881, Korea

ABSTRACT

Activated carbon(AC) can be utilized as a soil conditioner in agricultural crop areas. This study was conducted to investigate the effect of AC on Leaf and Stem Production of *Angelica acutiloba* as affected by different amounts of AC.

The results obtained are summarized as follows. Growth characteristics including plant height and leaf length were the highest when activated carbon added with 10, suggesting that optimum amount of activated carbon was ranged from 10 to 20%. Growth and enlargement of the root were improved by 10% AC.

Kew words **:** leaf, stem, production, *Angelica acutiloba*, green house, Activated carbon

INTRODUCTION

Angelica acutiloba has reddish purple stems and alternate leaves, and blooms white flowers. It is in flower from June to July. The flowers are hermaphrodite (have both male and female organs) and are pollinated by Insects. Perennial growing to 1m. The seeds ripen from August to September and produce seeds with 1.8 g in 1000-seed weight. The essential oils obtained from the seeds and roots by steam distillation are known to contain d-phellandrene, -pinene, osthenole, osthole, angelicin, -thujene, camphene, and numerous other compounds.

The fruits of angelica contain a higher percentage of oil and are rich in coumarins. Root oil is considered superior to the oils obtained from other parts of the plant. Leaves of the plant contain 0.2-0.6% essential oil and vitamins B_{12} and E. Main composition of essential oil is n-butylidenephthalide($C_{12}H_2O_2$), n-valerophonone-o-carboxylic acid ($C_{12}H_{14}O_3$), and bergaptem, ligustilide (James 1995). The essential oil of angelica is used in perfumes, soaps, salves, oils, shampoos, and cigarettes.

Korean angelica utilized as a herbal medicine material is one of perennial Umbelliferae plant and has three varieties such as *Angelica gigas* Nakai, *Angelica acutiloba* Kitagawa, and *Angelica sinensis* Diels. Physical characteristic of *Angelica acutiloba* utilized as a herbal medicine material is one of perennial Umbelliferae plants (Choi et al. 2003). Efficacy of oriental medicine was follows.

The root is emmenagogue, oxytocic, sedative and tonic. It is used in the treatment of women's complaints

*Corresponding author : **Seong-Kyu Choi,** E-mail: skchoi@sunchon.ac.kr

and also eases dizziness. *Angelica acutiloba* also can be utilized as a medicinal plant for vegetables because several ingredients in leaves of *Angelica acutiloba* have specific fragrance (Louis 2000).

Many studies on the soil conditioner have conducted to enhance yield and quality of agricultural crops, especially in Japan. In Korea, researches on the soil modifier for improving productivity in crops are a increasing field in organic agriculture and soil science(Park, 1996)

The utility of activated carbon varies for multi-purposes in environmental and agricultural areas. Especially, it will be utilized as a multi-pore carbon absorbant for protecting environmental contamination and as a soil modifying material for improving soil physical property and sustainable nutrient sources, through mixing with it into soil (Park, 1996).

Recently, in Korea, 45,000 tons of activated carbon a year is required for protecting environmental contamination and cleaning up water and air. However, the waste of activated carbon as a industrial abandon after using is increased every year (Park, 1996).

Therefore, this study was conducted to determine feasibility of production system of *Angelica acutiloba* leaf-stem using activated carbon in greenhouse. Also this study was conducted to develop recycling methods of the wasteful activated carbon for agricultural cropping system and industrial areas. It would be very useful as a soil-modifying material for enhancing crop productivity

MATERIALS AND METHODS

Seeds of *Angelica acutiloba* as a native variety were harvested at the medicinal plant garden of Sunchon National University in June to July, 2004.

After collection, the seeds were stored in a refrigerator at 4℃ for two weeks. The seeds were planted in pot(ϕ 20㎝) in greenhouse of Missouri University Agronomy on 15th of August, 2004.

The pots was filled with activated carbon of 0, 10, 30, 50 and 70%. Stand soil mixtures of Sta-Green and Peat Moss mixed with 50:50 ratio. The soil Sta-Green includes N-P_2O_5-K_2O=0.05-0.03-0.03.

Five seeds per pot, collected in 2004, were planted onto pots, and three seedlings per pot were finally selected for the experiment. Harvest was made when the plant height reached 8∽12 cm high. The shoot and root fresh weight of whole plants were measured.

All treatments were replicated five times using a randomized complete block design.

General cultural procedure and management such as weed control followed conventional culture methods for medicinal plants (Rural Development Administration (RDA, 1995).

All measurements for plant growth and yield were referred to standard measurement of RDA, Korea (RDA, 1989).

RESULTS AND DISCUSSION

Germination rate by activated carbon

Table 1. Effect of activated carbon on the seed germination of *Angelica acutiloba*

Treatment	Germination		
	first day	date	rate(%)
Control	Aug. 25	Aug. 27	90
Activated Carbon 10%	Aug. 22	Aug. 25	92
Activated Carbon 30%	Aug. 21	Aug. 24	91
Activated Carbon 50%	Aug. 23	Aug. 25	90
Activated Carbon 70%	Aug. 23	Aug. 25	91

Germination time and rate of *Angelica acutiloba* seeds by activated carbon are shown in Table 1.

Germination of *Angelica acutiloba* was made on Aug.25(12 days after sowing), showing 90~92% in germination rate. It is generally accepted that *Angelica acutiloba* are higher germination rate and short germination period when faced with high soil temperature (Choi et al. 2004).

Growth and yield of Leaves-stems by activated carbon

Growth of *Angelica acutiloba* : The result on growth of *Angelica acutiloba* as affected by different activated carbon is shown Table 2.

Plant height, number of leaves per plant, and fresh weight of *Angelica acutiloba* grown in control were 7.0 cm, 4.8 and 13.1 g, respectively.

In different activated carbon, plant height, number of leaves per plant, and fresh weight of *Angelica acutiloba* were 7.9~ 9.7cm, 4.9~ 6.0 and 13.4~ 19.5g, respectively. However, when the plants were grown in Activated carbon 10% and the bigger one.

The results show that Activated carbon produce more growth of *Angelica acutiloba*.

Taking together, the results are supported by the report of Park (1996) who reported that optimized amount of AC stimulate crop growth by improving soil physical characteristics. Choi et al(2002), in another study, reported that treatment of AC around 20% improved the growth of medicinal plants, and exhibited differently depending on crop species.

Leaf-stem Yield of *Angelica acutiloba* : The result on leaf and stem production of *Angelica acutiloba* as affected by Activated carbon treatment is shown Fig. 1.

Leaf and stem fresh weight of *Angelica acutiloba* was very low in 70% treatment of Activated carbon. And fresh weight of *Angelica acutiloba* was higher in 10% treatment of Activated carbon.

Growth characteristics including plant height and leaf length were the highest when activated carbon added with 10%, suggesting that optimum amount of activated charcoal was ranged from 10 to 20%. Growth and enlargement of the root were improved by 10% AC. This result supports the report that AC treated with optimum amount significantly can stimulate crop growth (Park, 1996).

These results indicate that leaf and stem production of Angelica acutiloba can be improved by using Activated carbon. These results require further more detail studies on effects of treatment methods on growth responses of *Angelica acutiloba* as affected by different Activated carbon.

ACKNOWLEDGEMENT

This paper was supported by NON DIRECTED RESEARCH FUND, Sunchon National University

Table 2. Effect of activated carbon on the growth of *Angelica acutiloba*

Treatment	Plant height(cm)	Number of leaf	Weight(g)
Control	7.0b*	4.8b	13.1b
Activated Carbon 10%	9.7a	6.0a	19.5a
Activated Carbon 30%	8.7a	5.8a	17.9ab
Activated Carbon 50%	8.2a	5.1ab	14.4b
Activated Carbon 70%	7.9ab	4.9b	13.4b

*Mean separation within column by Duncan's multiple range test, 5% level of significance.

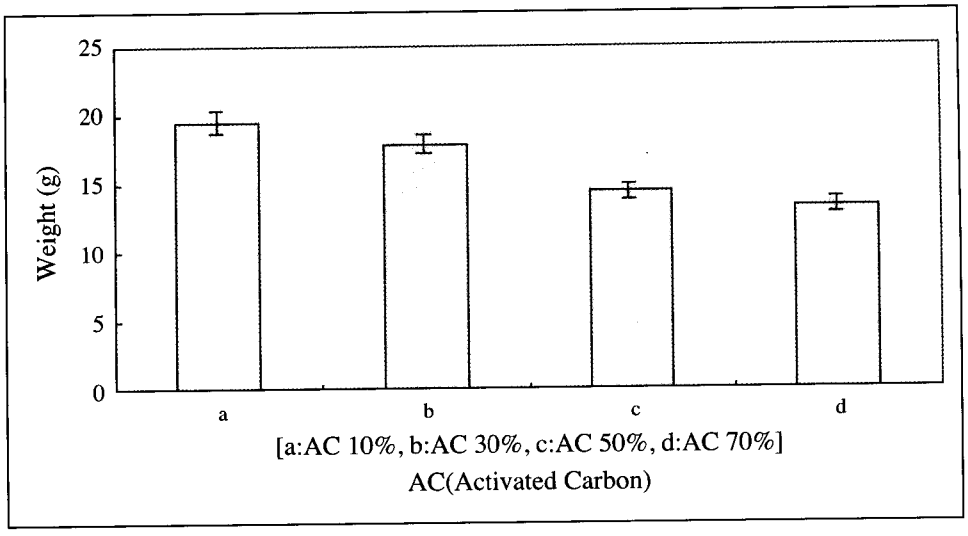

Fig 1. Comparison in effects of Activated Carbon treatment on the yield of leaf and stem in *Angelica acutiloba* Kitagawa.

LITERATURE CITED

Choi S. K., Park Y.T and Yun K.W. 2002. The effect of activated charcoal on growth and yield of medicinal plants. Kor. J. Plant. Res 15(1) : 57-61.

Choi Seong-Kyu. 2003. The Effect of Activated Charcoal on Growth and Yield in *Bupleurum falcatum* Linne. Kor. J. Plant. Res. 16(2) : 130-133.

Choi Seong-kyu, Yun Kyeong-Won, Sang-Uk Chon. 2003. Effect of Activated Charcoal on Growth and Yield of *Curcuma longa* Linne. Kor. J. Plant. Res. 6(3) : 175-177.

Choi, S.K., Kyeong-Won Yun,Snag-Uk Chon. 2003. Study on Leaf Production of *Angelica acutiloba* by Mulching with Polyethylene Film. Korean J. Plant Res. 6(3) : 211~214.

Choi, S.K., Kyeong-Won Yun, Snag-Uk Chon, Jong-Ill Lee, Young-Nam Seo and Kyoung-Sun Seo. 2004. A Basic Study on Leaf and Stem Production of *Angelica acutiloba*. Korean J. Plant Res. 7(3) : 233~237

James W. Perry. 1995. Biology, Seed Plants. Laboratory Manual. pp. 257~269.

Louis N. Flawn. 2000. Vegetable Growing for Health and Flavor. Herbs. Grown Publishers, Inc. U.S.A. pp. 99~101.

Lee J. I., Choi S.K. and Yun K.W. 2001. The effect of activated charcoal on growth and yield in *Scutellaria baicalensis* Kor. J. Plant Res 14(3). 147-151.

Park Yeongtyae. 1996. Active Carbons. Dong Hwa Technology Publishing Co. p. 371

R. D. A.(Rual Development Administration). 1989. Research investigation standard of agriculture(medicinal crop). pp5~8.

R. D. A.(Rual Development Administration). 1995. Research investigation standard of agriculture. pp. 583~585

(Received Jul. 14, 2004)
(Accepted Sep. 18, 2004)