

A Basic Study on Storage of Leaf, Stem and Root in *Angelica acutiloba* Kitag

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Abstract - This study was carried out to obtain basic information for optimum storage method of leaf, stem and root of *Angelica acutiloba* Radix, which is being utilized as major cultivated herbal medicine materials, root of *Angelica acutiloba* was stored for 3 months in different packing materials and sealing methods, such as punched packing, sealing and vacuum packing. The results are summarized as follows. The loss in weight as influenced by packing materials and sealing degree was the lowest at vacuum packing and complete sealing condition with transparent polyethylene film. The ratio of root rot during the storage period was not significantly different between polyethylene films, but it was significantly different between sealing conditions. Therefore, vacuum packing and complete sealing with polyethylene film are desirable storage condition for *Angelica acutiloba* Radix.

Key words - *Angelica acutiloba* Radix, Storage, Packing materials, Polyethylene film

Introduction

In folklore, *Angelica* was associated with the archangels Michael and Gabriel. It has been revered since ancient times as an anti-infectious and blood-purifying herb. It is used in traditional herbal medicine as a cleansing and detoxifying remedy (Jennie, 2005).

Korean *angelica* has three varieties such as *Angelica gigas* Nakai, *Angelica acutiloba* Kitagawa, and *Angelica sinensis* Diels. Korean *angelica* utilized as a herbal medicine material, is one of perennial Umbelliferae plant. *Angelica acutiloba*, a perennial herbal medicinal plant, has been grown through all the Korean Peninsula. *Angelica acutiloba*, remains one of the most popular plants in Korean medicine, and it used primarily for health conditions in women. Dong quai has been called "female ginseng," based on its use for gynecologic disorders such as painful menstruation (dysmenorrhea) or pelvic pain, recovery from childbirth or illness and fatigue/low vitality. It is also given for strengthening *xue* (loosely translated as "the blood"), for cardiovascular conditions/high blood pressure, inflammation, headache, infections and neuropathic (nerve) pain (Louis, 2000).

The plant starts to sprout early in April and bloom on July. *Angelica acutiloba* is being cultivated at the middle southern area of Korea, it needs to have long growing period (Kim *et al*, 1997). *Angelica acutiloba* harvested on the middle of November. After harvest, tertiary roots and shoot parts of the plant are removed by cutting and washed with fresh tap water. The root parts were dried by natural sunshine, which usually used in farmer household. In case of drying

by sunshine, even though there is a little difference according to weather, it takes 15 to 20 days to dry. After drying the materials were wrapped with polyethylene films, stored at well-ventilated place and finally shipped as major cultural herbal medicine materials.

Herbal medicine materials are generally stored until they were sold or used for medicine. During storage, temperature, humidity, and ventilation of room were very important factors to keep good quality of plants even they well dried and cleaned. The factors can influence damage in quality as well as aberration in the efficacy of chemicals (Choi, 1994). Several points must be considered during storage. It should be ventilated to lessen humidity, stored at cooling room, prevented from insects, and stored at airtight container. Choi *et al* (2002) reported in a previous study that herbal medicinal materials should be stored at the place where are well ventilated with low temperature, dry and prevented from insects. Leaf, stem and roots of *Angelica acutiloba* Radix have to be completely dried to prevent from decaying. Especially quality of goods might be lowered by fungus.

This study was conducted to determine causes and their solution of loss in quantity as well as in quality during storage leaf, stem and roots of *Angelica acutiloba* Radix. Amount loss and rotting rate at different harvest time were examined according to storage of different packing materials and sealing conditions.

Materials and Methods

Seeds of *Angelica acutiloba* were harvested at the medicinal plant

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garden of Sunchon National University in June to July, 2004. *Angelica acutiloba* was planted at Sanborn field of Agronomy in University of Missouri-Columbia on 18th of April 2005 (Fig.1.).

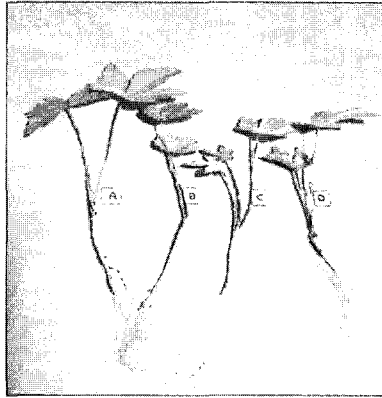


Fig. 1. Planted *Angelica acutiloba*.

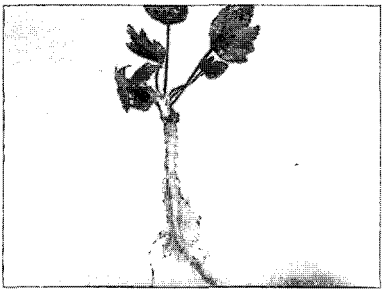


Fig. 2. Harvested *Angelica acutiloba*.

One hundred plants were carefully sampled without damage by using agricultural spades at 30cm high from soil surface in November, 2005. Leaves, stems and root of *Angelica acutiloba* were harvested at vegetative stage (Choi *et al.*, 2004; Choi 2005) Fig 2.

The plants were washed with tap water, dried under natural sunshine for 24 hours, and dried again with cold wind at 40°C for 7 days. After drying the roots were chopped into 5cm in length of main root. Mean root weight a plant was about 10 grams.

The collected leaves, stems and roots of *Angelica acutiloba* were separately wrapped in polyethylene film envelops (10cm×20cm ×0.05mm) with transparent, black, and green color. The polyethylene film envelops containing samples were treated with vacuum packing, complete sealing, and punching method. Vacuum packing of transparent polyethylene film was using Vacuum Packer (JW-500XL). Punching on polyethylene film was made into 1mm in diameter and 10 punches an envelop were evenly given.

After packing the envelops were dried and stored at cooling room until investigated. Loss in weight and rotten rate after storage were measured 6 times at 15 days-intervals from December 1, 2005 to February 15, 2006.

General cultural procedure and management such as weed control followed conventional culture methods for medicinal plants (RDA: Rural Development Administration, 1995). All assessment was made according to RDA Standard Methods for Field Experiment (Rural Development Administration, 1989).

Results and Discussion

Dry Weight of *Angelica acutiloba*

Dry weight of *Angelica acutiloba* as affected by different packing materials and sealing methods was determined 6 times at 15 days-intervals in 2005 and 2006.

No difference in dry weight among storage durations was ob-

Table 1. Comparison of loss in weight as influenced by packing materials and sealing methods in storage of *Angelica acutiloba* Radix

Packing materials	Sealing degree	Investigating time					
		2005		2006			
		Dec. 1	Dec. 15	Jan. 1	Jan. 15	Feb. 1	Feb. 15
T. P. E ¹⁾	C.sealing ⁴⁾	100(g)	88.4(g)b ^{x)}	87.7(g)b	87.2(g)b	86.5(g)b	86.1(g)b
	Punch ⁵⁾	100	85.2b	84.5b	84.1b	83.0b	82.7c
B. P. E ²⁾	C.sealing	100	88.3b	87.8b	87.5b	86.8b	86.1b
	Punch	100	85.7b	84.7b	84.2b	83.7b	82.4c
G. P. E ³⁾	C.sealing	100	88.4b	87.4b	87.5b	86.6b	86.0b
	Punch	100	85.8b	84.6b	84.0b	83.2b	82.8c
T. P. E	V. P. ⁶⁾	100	96.1a	95.4a	94.3a	93.9a	93.1a

^{x)} Mean separation within column by Duncan's multiple range test, 5% level of significance.

¹⁾ T. P. E.: Transparent polyethylene film, ²⁾ B. P. E.: Black color polyethylene film, ³⁾ G. P. E.: Green color polyethylene film, ⁴⁾ C. sealing: Complete sealing, ⁵⁾ Funch: Punch(φ1mm) on polyethylene film, ⁶⁾ V. P.: Vacuum packing.

served, but complete sealing treatment affected dry weight of leaves, stems and roots. Dry weight of *Angelica acutiloba* leaves, stems and roots was gradually reduced with time regardless of packing materials and sealing methods. In sealing treatment, dry weight of root stored with complete sealing with punch were more reduced than with vacuum packing.

It was thought that water from the dried plants could be naturally evaporated through complete sealing or punch with time during storage. Dry weight of leaves, stems and roots in *Angelica acutiloba* sealed by punch was more reduced than complete sealing without punch. In packing materials, the colors of polyethylene film did not affect plants dry weight.

This result showed that storage with complete sealing without punch could be better than storage by sealing with punch for long term storage. Storage with vacuum packing did not affect plants dry weight and was best among treatments. Dry weight of *Angelica acutiloba* root was little bit changed by vacuum packing methods during storage. These results showed that storage methods with complete sealing or with vacuum did not affect dry weight of plants because of restriction of air exchange.



Fig. 3. Storage with vacuum packing could be suitable for *Angelica acutiloba* Radix.

Chung *et al* (1991) reported that complete sealing storage with polyethylene film sustained quality of kiwi-fruits for long term. Therefore, storage with complete sealing or with vacuum packing could be suitable for *Angelica acutiloba* plants, indicating no change in plants weight, humidity, and low infestation of insects and disease.

However, more detail researches were needed for storage of other medicinal plant species.

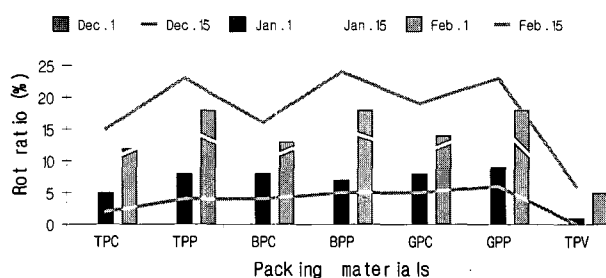
Rotten Rate of *Angelica acutiloba* during Storage

Rotten rate of *Angelica acutiloba* root affected by different pack-

ing materials and sealing methods was examined (Fig. 4).

There was no significance in rotten rates among colors of packing materials, transparent, black, and green polyethylene film. Rotten rate of leaf, stem and roots packed with transparent P.E. film was slightly lower than with black or green P.E. film. Rotten rate of leaf, stem and root was about 10% at 1 month after storage but was 23% at 3 months after storage, increasing with time. At 3 months after storage, rotting rate of leaf, stem and root with vacuum packing was the least (6%) and the highest with punch storage (20~25%).

The results indicates that storage by vacuum packing or by complete sealing appeared low rotting rate of *Angelica acutiloba* root. However, storage with punched polyethylene film allowed diseases and insects to enter into packed or sealed materials through air punches, and increased rotten rates. More researches on kinds of pests and infestation rate were required to better understand rotting mechanism.



T.P.C (Transparent Polyethylene film Complete sealing), T.P.P (Transparent Polyethylene film Punch), B.P.C (Black color Polyethylene film Complete sealing), B.P.E.P (Black color Polyethylene film Punch), G.P.C (Green color Polyethylene film Complete sealing), G.P.E.P (Green color Polyethylene film Punch), T.P.V (Transparent Polyethylene film Vacuum packing).

Fig. 4. The change of rot ratio as influenced by packing materials and sealing methods in plants storage of *Angelica acutiloba*.

Seong *et al* (1996) suggested that dry roots must be fumigated with chloroform and methyl bromide when agricultural products were manufactured and stored to prevent from damage of insects and weevil. The results of present study indicate that fumigates must be applied to control pests before storage with punched P.E. film for long term storage.

Acknowledgements

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