

**PRODUCTION AND USE OF ANGELICA IN MEDICINE AND ENVIRONMENTAL PROTECTION****PÉTER JAKAB<sup>1</sup>, JÚLIA HUPUCZI<sup>1</sup>, YOSHITAKA WACHI<sup>2</sup>, TÍMEA SÜLI-ZAKAR<sup>1</sup>**<sup>1</sup>Institute of Crop Production and Environmental Protection, University of Szeged  
Andrássy út 15, 6800 Hódmezővásárhely, Hungary<sup>2</sup>Nougakuken Center Ltd., Japan

sulizakartimea@mgk.u-szeged.hu; jakabpeter@mgk.u-szeged.hu

**ABSTRACT**

The concentration of greenhouse gases in the atmosphere, especially carbon dioxide is increasing apace on account of population's growing, human and industrial activities. These gases are not only unhealthy but also there has been growing interest in the global temperature of Earth.

The *Ashitaba* (*Angelica*) could be used as strong carbon offsetting and it is used as medicine raw material and the health food supplement. In Scandinavian countries the angelica has been known and used as a medicinal and culinary herb since the 12th century. It has been grown in England since the 16th century. Folk medicine recommends the scalded leaves for colds, and for the illnesses of the stomach, for carminative purposes or for respiratory illnesses. The spasmolytic and anti-inflammatory effects of the plant were confirmed in the *in vitro* experiment. The root furanocoumarins inhibited the growth of certain cancer cells as specified in animal studies. In some *in vivo* studies the anti-ulcer, antioxidant, hepatoprotective, analgesic and sedative effects were demonstrated.

**Keywords:** *Ashitaba* (*Angelica*), carbon dioxide, environmental protection, herbal.

**INTRODUCTION**

In recent years environmental protection has been more and more widespread both in medical treatment and in using natural plant-based materials.

According to customers plant-based medicine (phytopharmakon) has biological and economical advantages. This kind of medicine is suitable to keep health, to prevent illnesses and it can also be used as corroborative material to cure not too serious illnesses' if using of synthetic materials in unsubstantiated 60-70% of the civilization diseases come from psychomatic origin. They can mostly be treated by plant-based materials (GANONG, 1990).

In the atmosphere the concentration of carbon dioxide is higher today than it was any time in the last 650,000 years. More than 80% of the greenhouse gases are carbon dioxide in the industrially developed countries. Plants can bind the carbon dioxide of the atmosphere through photosynthesis.

**MATERIAL AND METHOD**

According to the 8th Hungarian Pharmacopoeia the drugs of angelica are from the root and the *Angelica radix*. The essential oil content minimum is 2.2 ml/kg. Rarely used parts are the leaf and the crop (*Angelica folium et fructus*). The essential oil of angelica root is made of angelica root with steam distillation. The alcoholic extract of angelica (*Angelicae tinctura*) is used also in medicine (BERNÁTH AND NÉMETH, 2007; GOSZTOLA AND LENCHÉS, 2013).

The root of *Angelica* contains 0.2-1.9% essential oil, there is 0.2-0.4%, in the dry leaf, while 0.6-1.5% in the mature crop. The principal component of essential oil are alpha-and

beta-pinen, alpha- and beta-fellandren, mircen, limonen, szabinen, germakren-D, beta-bizabolon, kariofillen. The root contains kumarins, furanokumarins (ex. bergapten, angelicin), and also angelica acid (0.3%), 6% resin, sterols, fenol acids (caffeic acid, chlorogen acid), bitter substances and exchange material. The crop contains 25% fatty oil (TAKÁCSNÉ, 2004, GOSZTOLA, LENCHÉS, 2013).

The *Ashitaba* is dried and it is used for the medicine raw material, the health food supplement, and the juice, tea, pasta, the seasoning, soup, the ice cream, jam, bread, and the cookie, etc. as a powder.

## RESULTS

### Botanical description

The *Angelicae* is a strong growing, biennial, herbaceous plant. In the first year the root is carrot-like, 20-30 cm long, 5-6 cm thick, less branched, while in the second year it develops finger-sized accessory roots. It is also in the second year that it grows a 1.5-2 m high stem. Umbellate florescence is globular; its diameter is 20-30 cm. Its perfect yellow flower comes out in June. The schizocarp crops are light yellowish brown. Its thousand seed weight is 2.5-3 g (GOSZTOLA, LENCHÉS, 2013).

### Environmental needs

It prefers cool climate. It is not sensitive to frost even in the vegetation period. It grows best on lower areas, humid (not aqueous) with fertile layer rich in nutrients, on sandy loam, or adobe-like, medium-cohesive soil. It can be grown successfully under drier conditions as well, when its high water need can be satisfied by irrigation (GOSZTOLA, LENCHÉS, 2013).

### Production

Crop life is 1-4 years, depending on what drug is desired to be produced. We must choose a preceding crop for angelica, which makes it possible that soil tillage can be done in autumn, and sowing in November. After itself or other umbelliferous plants it can be sown again in 3-4 years.

*Angelica* well utilized the organic fertilizer which was applied for the preceding crop. It had particularly high potassium and phosphorus requirement, nitrogen, especially for root-cultivation should be dosed with caution. For base fertilization 50-70 kg/ha nitrogen, 80-100 kg phosphorus, and 120-180 kg potassium were applied in deep ploughing. In the second year 50 kg/ha nitrogen can be applied as starter fertilizer. The soil for *Angelica* should be loose.

The seedbed should be prepared as in a garden. Frost effect is necessary for the germination of the angelica seed. Therefore, the ideal sowing time is November. The seeds are sown *in situ*, they germinate and emerge in spring. The seeds may be sown early in the spring as well (in March), but in this case the seeds should be frozen 2-3 weeks before sowing. The sowing depth is 1.0-1.5 cm, the row width is 60 cm. 8 kg / ha of seeds is needed for autumn sowing, while 10 kg / ha for spring sowing. The increased dose for spring sowing is necessary because of the reduced germination ability of the plant. *Angelica* used to be propagated by seedlings but it was stopped because of the high costs. After the young plants have appeared thinning is required, with 8-10 plants per linear meter spacing. Mechanical weed control should be carried out throughout the *Angelica* cultivation. Chemical weed control can be used only as pre-emergence (ANTAL, 1992; GOSZTOLA, LENCHÉS, 2013).

Some agrotechnical elements are shown in *Figure 1*.



**Figure 1. Some agrotechnical elements of angelica production (Hitachinaka, Japan)**

After the young plants have appeared thinning is required, with 8-10 plants per running meter. Mechanical weed control should be carried out throughout the angelica cultivation. Chemical weed control can be used only as pre-emergent.

In dry periods irrigation is necessary for the plants. Depending on the weather it can vary from 150 to 200 mm of water. Its disease is gall (*Passalora depressa*), and its frequent pests are aphids. Crop rotation and chemical protection are two ways of prevention against them.

#### Harvest

The harvest of the drug leaves takes place in the second year. The fully developed leaves are cut off by a harvester loader. The best quality leaves are cut by hand. The angelica root is harvested by a plough without mouldboard, or in smaller areas they dig it out with a spade, at the beginning of October in the first or second year. In the second year essential oil can be produced from the green seed-bearing plant. In this case the time of the harvest is at the time of wax-ripeness. The harvest is done by a harvester loader or silo filler. During the harvest and the processing of the angelica plant there can be yellow cell sap leaking from the fresh parts. This can cause the inflammation of the skin, so protection is necessary (hand wash, gloves) while doing the job.

The expected yield of dry leaves is 0.6-0.8 t/ha. The dry root yield is 1.6-1.8 t/ha, 6-10 kg/ha essential oil can be obtained from roots, and 6-8 kg/ha from seeds.

#### Primary processing

The soil and other plant materials are cleaned off the roots and then they are washed with running water. The thick roots are cut into halves or into quarters and dried at 40-50 °C. The fresh leaves are dried at a low temperature (30-40 °C) immediately after they have been cut. Essential oil is gained from the washed and chopped roots by fractional distillation in intermittent periodic duty equipment. The distillation takes about 8-10 hours.

#### Traditional use

In Scandinavian countries the angelica has been known and used as a medicinal and culinary herb since the 12th century. It has been grown in England since the 16th century. Folk medicine recommends the scalded leaves for colds, and for the illnesses of the stomach, for carminative purposes or for respiratory illnesses. It has mild analgesic and spasmolytic effects as well. In case of rheumatic diseases and muscle inflammation it is used externally as a rubbing agent. The angelica root is sweet, spicy and it has a slightly bitter aroma that is the reason why it is used for seasoning liqueurs, wines and vermouth.

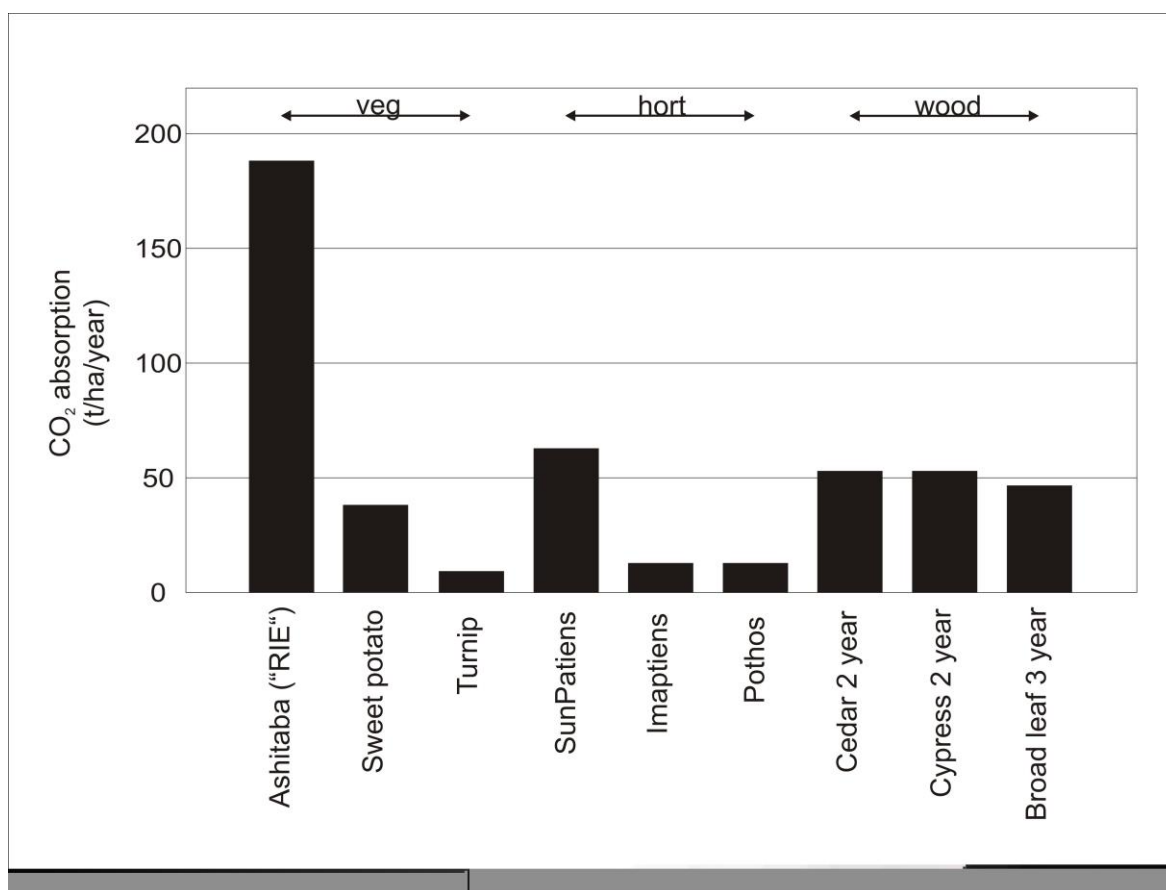
The fruit of the plant is an important component of spirits production (e.g. Cognac). It is a spice of various meals, soups, sauces, salads and compotes. The fresh young leaves are

used for making vegetable sauce in the Nordic countries. The essential oil of the angelica is utilised in cosmetics and perfume industry.

#### Therapeutic indications

The spasmolytic and anti-inflammatory effects of the plant were confirmed in *in vitro* experiment. The root furanocumarines inhibited the growth of certain cancer cells as specified in animal studies. In some *in vivo* studies the anti-ulcer, antioxidant, hepatoprotective, analgesic and sedative effects were demonstrated.

The *Ashitaba* has very big carbon dioxide absorptivity power. The CO<sub>2</sub> absorptivity power is very large compared with other plants (*Figure 2.*). The method by which it tries to counterbalance CO<sub>2</sub> is that it absorbs carbon dioxide that the enterprise put out with exhausted CO<sub>2</sub> by growing. The *Ashitaba* by using this thing starts and it is vegetable that contributes to the global environment.



**Figure 2. Confirmed *Ashitaba* could absorb 1460 tons (max) of CO<sub>2</sub>/ha/year in verification test done (Dr. Yutaka Urano, Tokyo University)**

## CONCLUSIONS

The concentration of greenhouse gases in the atmosphere, especially carbon dioxide is increasing apace on account of population's growing, human and industrial activities. These gases are not only unhealthy but also there has been growing interest in the global temperature of Earth. The *Ashitaba* (*Angelica*) could be used as strong carbon offsetting and it is used as medicine raw material, the health food supplement. Folk medicine recommends the scalded leaves for colds, and for the illnesses of the stomach, for carminative purposes or for respiratory illnesses. The spasmolytic and anti-inflammatory effects of the plant were confirmed in the *in vitro* experiment. The root furanocumarines inhibited the growth of certain cancer cells as specified in animal studies. In some *in vivo* studies the anti-ulcer, antioxidant, hepatoprotective, analgesic and sedative effects were demonstrated.

## REFERENCES

- GANONG, W.F. (1990): Az orvosi élettan alapjai. Medicina Könyvkiadó, Budapest. 804 p.
- ANTAL J. (1992): Angelika. In: Szántóföldi növénytermesztés. Ed.: Bocz E. Mezőgazda Kiadó, Budapest. 858-860 p.
- GOSZTOLA B.- LENCHÉS O. (2013): *Angelica archangelica* L.- orvosi angyalgyökér. In: Vadon termő és termesztett gyógynövények. Ed.: Bernáth J. Mezőgazda Kiadó, Budapest. 174-177 p.
- BERNÁTH J.-NÉMETH É. (2007): Gyógy- és fűszernövények gyűjtése, termesztése és felhasználása. Mezőgazda Kiadó, Budapest. 35 p.
- TAKÁCSNÉ HÁJOS M. (2004): Gyógynövények termesztése. Szaktudás Kiadó Ház, Budapest. 61-64 p.