Analysis and Development Proposals of *Aronia mealnocrapa* Planting Industry in Heilongjiang Province

Shunjie ZHANG¹, Jinguang ZHAO², Chenyang XIE¹, Ming TAN², Hui LI²
1. Heilongjiang Forest By-product Research Institution, Mudanjiang 157011, China; 2. Changchun Zhongtian Agricultural Development Limited Company, Changchun 130000, China; Meteorology Bureau of Zhaozhuang County, Heilongjiang Province, Zhaozhuang 166500, China

Abstract *Aronial mealnocrapa* Elliot is a rare tree species that combined edible, medicinal, ornamental and ecological values. This article analyzes the economic value, domestic research and development status and development trend of *A. mealnocrapa*. Heilongjiang Province has been hurried to introduce *A. mealnocrapa*, lack of understanding of the characteristics of the tree species, resulting in serious cold damage and great economic losses. For these issues, proposals are put forward to promote the development of *A. mealnocrapa* planting industry.

Key words *Aronial mealnocrapa*; Economic value; Development prospects; Proposals

1 Introduction

*Aonial mealnocrapa* Elliot (*Rooseeae; Aonial*) is a perennial shrub, also known as Yeyingmei or Bulaomei, about 1.5 – 3.0 m high. *A. mealnocrapa* has fruit of purple-black cherry, and it is an emerging small berry species. It is native to the northeastern United States and is widely cultivated in European and American countries. It is divided into two categories; fruit type and ecological type. Research on cultivation techniques of *A. mealnocrapa* has become increasingly mature. The polyphenols in the fruit of *A. mealnocrapa* have strong antioxidant activity. They can effectively remove free radicals in the human body, protect the biological enzyme system from damage, and maintain normal physiological functions of the human body. *A. mealnocrapa* is widely used in landscaping, medicine and food industries, and the demand for the fruit of *A. mealnocrapa* and its processed products is enormous. China has introduced the economic tree species of *A. mealnocrapa* for nearly 20 years, and a fine variety of Fukangyuan No.1 has been bred. In 2014, the Forestry Department of Liaoning Province listed *A. mealnocrapa* as an economic tree species and began to promote the cultivation of Fukangyuan No.1.

2 Value of *A. mealnocrapa*

### 2.1 Edible and medicinal value

The fruit of *A. mealnocrapa* is rich in anthocyanins, proanthocyanidins, flavonoids, phenolic acids and other polyphenols. Polyphenols are among the most abundant in plants and contain many vitamins and mineral elements. The fruit of *A. mealnocrapa* contain high concentrations of flavonoids such as anthocyanins, which have strong antioxidant activity. Among them, cyanidin 3-O-β-D-galactoside is the main antioxidant component [1]. It can effective remove free radicals from the human body, protect the biological enzyme system from damage and maintain normal physiology of the human body [2-3] (Fig. 1). In Poland, the industry around the processing of the fruit of *A. mealnocrapa* has been established. After harvest, the fruit will be immediately processed into nutritious fruit juice drink, fruit tea, fruit sauce, health care capsule, tablet, etc, which are sold to Europe and the United States [4].

![Fig 1 Oxygen radical absorption capacity of wild cherry and other cherries](image)

### 2.2 Ornamental and ecological value

*A. mealnocrapa* is a precious flower shrub that combines ornamental flowers, leaves and fruits. The leaves turn into red as it cools down in autumn, and are known as "autumn magic". This tree species is highly resistant to stress, with strong cold tolerance and drought resistance. It can grow naturally in areas with precipitation above 500 mm [5]. *A. mealnocrapa* can be widely used in greening barren mountains and maintaining water and soil. The yield of *A. mealnocrapa* is high, and fruited period is reached 5 – 6 years after planting. The yield of fresh fruit can reach 15 t/ha [5]. In short, *A. mealnocrapa* has both ecological and economic benefits.
3 Domestic research and development status and development trend

It has been nearly 20 years since the introduction of the economic tree species of A. mealnocaipa in China. In 1989, the Afforestation Research Institute of Liaoning Province in Arid Zones introduced a variety from North Korea for the first time. In 1998, a variety was introduced from Russia. In 2001, the Afforestation Research Institute of Liaoning Province in Arid Zones undertook the "948 project" of the State Forestry Administration ("Introduction of Fine Germplasm A. mealnocaipa and Cultivation and Utilization Technology") and introduced 15 excellent varieties of Aornial spp. from the University of Wisconsin, USA. Among them, there are 8 excellent varieties of A. mealnocaipa. In 2005, the project passed the acceptance test, laying a good foundation for the further development and utilization of A. mealnocaipa in China. The bred fine variety Fukangyuan No. 1 passed the approval of Liaoning Provincial Fine Seed Identification Committee. In 2014, the Forestry Department of Liaoning Province listed A. mealnocaipa as an economic tree species. After that, Fukangyuan No. 1 has been planted and promoted widely. Currently, it has been promoted to Liaoning, Jilin, Heilongjiang, Hebei, Shandong, Xinjiang and other provinces, with a cultivated area of about 3 333 ha. In Haicheng, Liaoning, A. mealnocaipa has a planting area of 400 ha, and the bases cover 17 towns and more than 1 000 farmer households. In Dalian, A. mealnocaipa is mainly used for landscaping.

Currently, the planting industry of A. mealnocaipa is still in its infancy in China, and there are many market issues that need to be learned and explored. On March 20 and May 10, 2017, the program about A. mealnocaipa was broadcasted in two phases in Nong Guanzhan Di in CCTV-7. The cultivation and management of A. mealnocaipa were introduced. This will certainly promote the development of the A. mealnocaipa industry.

The research enthusiasm of the domestic related units for A. mealnocaipa has increased year by year. In the China National Knowledge Infrastructure (Fig. 2), there were only one or two articles about A. mealnocaipa published each year between 1991 and 2004. After 2011, the number has increased year by year. In 2017, 34 articles were published. It is estimated that 39 articles will be published in 2018.

4 Current status of planting of A. mealnocaipa in Heilongjiang Province

A. mealnocaipa industry has a broad development space in Heilongjiang Province, which has unique advantages in planting area, operators and support policy. In particular, the Forestry Department of Heilongjiang Province has completely forbidden commercial logging and vigorously developed the economy under the forest. There is an urgent need for continuing industry during the transition period of forestry. Recently, some individuals in Heilongjiang Province are optimistic about the development prospects of cultivation of A. mealnocaipa. The planting enthusiasm is high, and more consultations have been conducted with the Heilongjiang Forest By-product Research Institution. Some growers have rushed to introduce A. mealnocaipa varieties from Jilin and Liaoning, but they don't know much about the characteristics of the tree species. It is unclear whether the introduced varieties are fruit type or landscaping type. The recent survey found that A. mealnocaipa has been introduced to Heihe, Yichun, Tongjiang, Shuangyashan, Qitaie, Linkou, Hailin, Chaihe and other areas, but cold damage occurs extensively. In mid-June 2017, a survey was conducted in Qinghe Town, Tongjiang. It was found that the planting area of Fukangyuan No. 1 exceeded 130 ha; the aboveground part of the branches generated in 2016 were all frozen and died; and in 2017, new branches were sprouted from the base. The expected results were not achieved. Even worse, economic losses were caused. The prevention of freezing damage is now mainly carried out by the mean of soil burial, increasing production costs and operating procedures.

The economic forest research team of the Heilongjiang Forest By-product Research Institution introduced more than 300 plants of A. mealnocaipa cultivars in 2015. They were planted in the experimental area of Heilongjiang Forest By-product Research Institution, and the soil was barren. Through two years of planting test, the survival rate reached 84.78%. In April 2017, their retention rate, average plant height, average ground diameter, average branch number and maximum branch number were investigated to be 73.61%, 35.8 cm, 8.21 mm, 4.8 and 9, respectively. Shoots of some plants were frozen. In 2017, about 35% of the plants bloomed, with some production in autumn. In 2017, the cutting test of A. mealnocaipa was conducted, and the rooting rate was 93.76%.

5 Benefit analysis of planting A. mealnocaipa

5.1 Profit analysis of A. mealnocaipa (calculated by the first five years, calculated in terms of material and labor costs in 2018)

As shown in Table 1 and Table 2, the total investment, land rent plus input, was 137 250 yuan/ha (22 500 + 114 750). The total output value of fresh fruit was 570 000 yuan/ha. The average net profit of the first five years after planting was 86 550 yuan/ha [Total output 570 000 - Total input 137 250/5 = 432 750/5]. A. mealnocaipa can be harvested for many years once planted. If properly managed, A. mealnocaipa can be harvested continuously for more than 15 years. After the 6th year, the output value was 570 000 yuan/ha, so the net profit could reach 150 000 yuan/ha or more.

Fig. 2 Number of published articles about Aornial mealnocaipa from 1991 to 2018
Table 1  Total investment in the first five years after planting

<table>
<thead>
<tr>
<th>Year</th>
<th>Nursery stock</th>
<th>Field management</th>
<th>Topdressing</th>
<th>Harvest expense</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Quantity</td>
<td>Unit price/yn/pt</td>
<td>Amount</td>
<td>Unit price/yn</td>
</tr>
<tr>
<td>1st</td>
<td>9 000</td>
<td>3 27 000</td>
<td>15</td>
<td>2 250</td>
</tr>
<tr>
<td>2nd</td>
<td>30</td>
<td>200</td>
<td>6 000</td>
<td>15</td>
</tr>
<tr>
<td>3rd</td>
<td>30</td>
<td>150</td>
<td>4 500</td>
<td>15</td>
</tr>
<tr>
<td>4th</td>
<td>30</td>
<td>150</td>
<td>4 500</td>
<td>15</td>
</tr>
<tr>
<td>5th</td>
<td>30</td>
<td>150</td>
<td>4 500</td>
<td>15</td>
</tr>
<tr>
<td>Total</td>
<td>27 000</td>
<td>2 250</td>
<td>18 000</td>
<td>22 500</td>
</tr>
</tbody>
</table>

Note: Fertilizers were dominated by compost (200 yun/m³) and applied one every two years. Rent for 5 years: 4 500 yun/year/ha × 5 years = 22 500 yun/ha.

Table 2  Output value of fresh fruit

<table>
<thead>
<tr>
<th>Year</th>
<th>Fresh fruit yield/yn/kg</th>
<th>Unit price/yn/kg</th>
<th>Amount/yn</th>
</tr>
</thead>
<tbody>
<tr>
<td>3rd</td>
<td>12 000</td>
<td>10</td>
<td>120 000</td>
</tr>
<tr>
<td>4th</td>
<td>15 000</td>
<td>10</td>
<td>150 000</td>
</tr>
<tr>
<td>5th</td>
<td>30 000</td>
<td>10</td>
<td>300 000</td>
</tr>
<tr>
<td>Total</td>
<td>57 000</td>
<td>10</td>
<td>570 000</td>
</tr>
</tbody>
</table>

Note: The output value is calculated at the current market price.

5.2 Profit analysis of intercropping of *A. mealnocaarpa*  In the first three years after the planting of *A. mealnocaarpa*, due to the small plant size and large plant spacing, it is appropriate to interplant some crops, such as dandelion, cortex dictamni, red peony, and ritillary to increase the land income per unit area. The input cost of interplanting was 3 500 yun/ha, and the output value was 12 000 yun/ha, so the profit was about 7 500 yun/ha.

6 Prospects and proposals for the development of *A. mealnocaarpa*

6.1 Development prospects of *A. mealnocaarpa*  The fruit and extract of *A. mealnocaarpa* has a special effect on cardio-cerebral vascular diseases such as heart disease and high blood pressure. It was widely used in the pharmaceutical and functional food industries in Europe and America, and is expensive\(^4\). At present, *A. mealnocaarpa* has been processed into a variety of products such as beverages, wine, red wine, concentrated juice and food additives in China, and there have been dozens of companies that operate seedlings, fruit or extracts of *A. mealnocaarpa*. The declaration of *A. mealnocaarpa* as new food material has entered the publicity stage. If new food material is declared successfully, it will certainly promote the development of China’s *A. mealnocaarpa* food industry.

6.2 Proposals

6.2.1 Relevant policy and fund support to promote the development of the *A. mealnocaarpa* planting industry. First of all, the breeding of *A. mealnocaarpa* varieties should be strengthened, and research and regional trials on the introduction and cultivation techniques of *A. mealnocaarpa* need to be carried out to breed varieties (lines) that are cold-tolerant and high-yield and suitable for cultivation in Heilongjiang Province. Second, breeding and demonstration integration needs to be carried out to promote the development of the planting industry of *A. mealnocaarpa*. As Heilongjiang Province vigorously develops the under-forest economy, *A. mealnocaarpa* can be developed into a new variety to promote the development of under-forest economy in Heilongjiang Province. *A. mealnocaarpa* can be included into the subsidies for economic forest to improve the enthusiasm for planting through the support of relevant policies and funds.

6.2.2 Strengthening the study on functional foods of *A. mealnocaarpa*. The scientific and technological support for *A. mealnocaarpa* food needs to be increased. The relevant departments need to give enough attention and increase investment in science and technology in terms of policies, projects and funds. The production of raw materials for *A. mealnocaarpa* food must be standardized to provide green raw materials. The effective ingredients in the fruit of *A. mealnocaarpa* can be extracted using modern techniques such as pulverization, extraction, separation, purification and concentration to form a complete industrial train. Brands can be established and functional products can be developed to increase the added value of China’s *A. mealnocaarpa* products and enhance their international competitiveness\(^6\).

References


