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Utilization Value and Suggestions on the Development of Oil Peony

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Abstract: Tree peony was widely cultivated for approximately 2,000 years, which originated in China. Oil Peony is peony varieties that can be used to produce seed oil as edible oil. In 2001, the Ministry of Health approved that seed oil made by pressing and decoloring could be used as a new resource food. It is an emerging woody oil crop, and has landscape, medicinal and ecological value. Nowadays, it has become an important means to promote targeted poverty alleviation. Oil peony industry is new industry with promising prospect. But at present, the fundamental research on oil peony industry is still very weak, the industry chain needs to be elongated. Oil peony industry is still in the situation of blind development and cultivation on the whole. Based on the issues of variety selection, high-yield cultivation techniques, base construction, and deep processing technology in the oil peony industry in China. This paper put forward the suggestions and thinking for the national relevant policy support, cultivating fine varieties, establish germplasm storehouses and achieving specialized production.

Keywords: Oil Peony, Peony Seed Oil, Suggestions

1. Introduction

Paeonia sufivticosa, a perennial deciduous shrub, belongs to the genus paeonia in the Paeoniaceae family [1]. It likes warm, dry and sunny environment, weak alkali resistance, but not growing in acidic or sticky soil. Tree peony was widely cultivated for about 2,000 years, originated in China. Oil Peony is peony varieties that can be used to produce seed oil as edible oil, or the species that oil yielding rate is greater than or equal to 22% [2]. The test of peony seed oil was finished by Heze in 2006. In 2011, the Ministry of Health approved that seed oil extracted from the oil peony seed can be used as a new food resource, which made the peony seed oil officially entered the list of edible oil in China [3].

Owing to the large population and low self-sufficiency rate of edible oil, china is a big edible oil consumption country and import country in the world. China has vast land area, however, cultivated land is limited. It is impossible to increase yield of herbal oil crops on the large-scale. Planting herbal oil crops falls into a dilemma. Therefore, development of woody oil crops may be an important way to resolve this dilemma in vast hills, beaches and other suitable forest areas in China [4]. Extracting seed oil from oil peony is a new way of exploitation and utilization of the oil resources [5]. At present, flourishing development of the oil peony industry not only has a positive effect on promoting local economic development and increasing the income of farmers, but also has a very important strategic meaning to enhance the supply of edible oil in China [4]. Despite the high oil content and good quality of peony seeds, the cultivated area of tree peony is relatively less. Oil peony industry is still in a primary stage.

2. The Value and Application of Oil Peony

Oil peony is a great woody oil plants, whose seed oil has high yield and quality. The oil rate of peony seed is between 24% to 38%, and it is called as the best oil in the world [6]. Praised as “a stunning beauty of China”, the peony has already been a significant ornamental plant now. In addition, peony is a practical economic tree, Its root bark (“danpi” in

chinese), is a commonly kind of traditional Chinese medicine [7].

2.1. Woody Oil Crops with High Yield and Quality of Seed Oil

Oil peony has higher oil production than other oil crops. In recent years, the researcher used different extraction and analysis method to determine fatty acid composition. It is shown that Peony seed oil has a high content of unsaturated fatty acid, such as oleic acid, linoleic acid, linolenic acid, in which linolenic acid account for 42%. It matched olive oil, sunflower seed oil, camellia oil, but is higher than soybean oil and peanut oil (Table 1) [8-14]. Some scholars have studied a-linolenic acid toxicity and found that a-linolenic acid does not have serious negative effect. It is safety food [15]. In addition, the peony seed is also rich in protein, mineral element, vitamin and so on. Among them, many indicators are higher than olive oil.

Table 1. *Comparison of oil quality in peony seed oil and common edible oil.*

Oil category	Types	Unsaturated Fatty Acid Content
Herb Crop Oil	Sunflower Oil	91.10%
	Soybean Oil	82.10%
	Peanut Oil	77.30%
	Rapeseed Oil	80.92%
Woody crop oil	Olive Oil	85.30%
	Camellia Oil	90.11%
	Walnut Oil	87.30%
	Peony Seed Oil	92.28%

2.2. Excellent Ornamental Tree

As a sort of perennial shrub, oil peony is not only well used as woody oil crops but has landscape value and ecological value as well, which many edible oil plants and woody oil crops don't possess. Peony can planted in soil that isn't cultivated land. Planting in saline-alkali and Gobi desert in the north and west of China, peony forests have the effect of soil conservation, windbreak and sand-fixation, improving the quality of soil, etc. After transplanting and survival, peony can grow without rotation for forty years, which makes it a excellent landscaping tree.

Figure 1. *The flower of oil peony.*

2.3. Important Raw Material in the Food and Health Field

Peony seed oil can be processed into food, cosmetics, health products except direct consumption. Its flower also can be made into peony sauce, pastries, scented tea, and artware [16-18]. Peony essential oil can be extracted from its flower, leaf and bark, which is used as aromatic oil for daily cosmetics. The research showed that peony seed oil has an inhibitory effect on hyperlipidemia and hyperglycemia. It also has strong effect on anti-free radical damage, and anti-neurotoxicity. It can enhance the cardiovascular and central nervous system immune function [19-20]. Iinolenic acid contained in peony seed oil can be extracted to make reagent that is applied in the medical field.

3. Development Status of Oil Peony Industry in China

3.1. The Extraction Process of Peony Seed Oil

At present, many extraction methods are used to seed oil. The most common way is supercritical carbon dioxide extraction. Deng et al. [21] optimized some factors by using single factor test and orthogonal test, such as extraction temperature, pressure, time and flux of carbon dioxide in the process of extraction, received the highest oil extraction rate (30.7%). Beyond that, the method of ultrasonic-assisted and microwave-assisted extraction is short time and simple technology, Yi et al. [22-23] found that oil extraction rate reached 24.89% and 24.52% by using the method; Jiang et al. [24] used the response surface analysis to optimize ultrasonic-assisted extraction technology, and found that ultrasonic-assisted method can enhance the extraction efficiency of peony seed oil，reduce the free fatty acid and the acid value，the oil quality can be improved. In addition, Bai et al. [25] studied the way of refining peony seed oil, held that the decoloration rate is high under double-decoloring process of activated clay. In the process of decoloration, peroxide and lecithoid content was reduced, which ensuring the quality of peony seed oil.

Figure 2. *The infruit of oil peony.*

3.2. The Main Cultivated Varieties of Oil Peony

For the industrial planting, people normally choose oil peony with big amount of seeds, high oil rate and strong growth momentum. Now, paeonia ostii and paeonia rockii are the major tree peony cultivar groups in china (Table 2). Paeonia ostii are suitable for growth in the Yangtze river basin. There are more than twenty provinces and cities can plant it in the whole nation. Its representative variety is 'Phoenix White', the study from Beijing Forestry University showed this variety, with high plant, resistance humity, setting rate and adaptation, can be used as an excellent maternal parent in the future. Paeonia rockii are more suitable for growth in the semiarid region in the north because of its higher cold tolerance and drought resistance. This variety has high yield of seed oil, low stamens disc degree, most of them are integrifolious plant. Chen et al. [26] found that P. rockii 'Baokang Ziban' showed a strong advantage in high altitude, could be used as a good variety in Hubei province to extend. Zhou et al. [27] used twenty superior individuals of paeonia rockii as a testing materials, analyzed indexes including yield per plant and oil content of seeds, selected nine individuals which had good growth and fruiting characters and high oil yield per plant can be used as main materials of hybridization breeding in high altitude areas of Hubei Province. Wang et al. [28] comprehensively analyzed the fructifying rate, yield per plant and grain weight of 21 Paeonia rockii varieties from Gansu, and then screened out six peony varieties whose yield was higher than paeonia ostii 'Feng dan'.

Table 2. *The Main cultivars and distribution range of oil peony.*

Cultivars	Mainly Distribution
Paeonia ostii	Shandong, Anhui, Henan Province
Paeonia rockii	Gansu, Ningxia, Sichuan, Qinghai, Shanxi Province

3.3. The Base Construction of Oil Peony

Wild tree peony species in China are distributed in the Tibet, Yungui plateau, Qinba Mountain Area, Taihang Mountains and Yanshan Mountains, which shows the location trend from southwest to northeast [4]. According to statistics, the cultivated area of oil peony has reached 6.67×10^4 ha in 2014, and 1.333×10^5 ha in 2015 [1]. At present, the planting area of oil peony in China exceeds One hundred thousand ha, mainly distributed in over 20 provinces, such as Luoyang City in Henan Province, Heze City in Shandong Province, Lanzhou City in Gansu Province and Tongling City in Anhui Province. By 2013, the annual output of peony seeds reached 5.785×10^7kg, processing enterprises were nine, and the annual processing capacity reached 1.587×10^7 kg [5].

4. The Problems Existing in Development of Oil Peony Industrialization in China

In 2014, the State Council published the policy on accelerating the development of woody oilseed industry. The State Forestry Administration proposed to develop woody oil industries in poor areas in 2015. In 2016, the convention that oil peony and other woody oil helped the poverty alleviation held in Beijing. So greatly developing the woody oil industry is an important starting point for forestry to promote targeted poverty alleviation. But the basic research is weakly in china, oil peony industry still has many problems during the course of development.

Initially, the research on oil peony in China mainly focuses on the fatty acid composition analysis and the extraction and processing technology of peony seed oil. For the variety breeding of peony, ornamental characters such as flower color and flower type are increasingly being recognized. However, there are less research on cultivating fine varieties with high yield, oil yielding rate and adaptability [29-31]. In addition, the resource status and distribution range of oil peony is unclear, and the study on the overall resource status such as fruitfulness, oil content and quality of peony in different regions and varieties is almost in a blank. Therefore, it is the key problems to be solved urgently in the industrial development that selective improved variety of oil peony and the development and application of the related cultivation and production technique.

Second, the development of oil peony in China is still in a starting phase. The less planting area makes raw materials undersupply. Although some deep processing enterprises have been preliminary constructed in many places, the product is short of depth in processing, single variety, and low quality [32-34]. Therefore, how to fully use the limited land resources to ensure the supply of raw materials and explore new ideas and models that are suitable for the development of oil peony industry is one of the greatest obstacle in industrialized development.

Finally, with the development of the oil peony industry, variety breeding, base construction and deep processing technology need enough technology and capital to support. On the one hand, the state does not pay enough attention to the development of the oil peony industry, resulting in little invested funds and relatively behindhand technology [35]. On the other hand, large-scale development from the oil peony still needs strong support of state policies basically.

However, at present, relevant policies and regulations are not perfect, which obstructs the development of the oil peony industry to some extent.

5. Industrial Development Strategy of Oil Peony in China

5.1. Cultivating Fine Varieties and Strengthening Scientific and Technological Support

The genetic background of existing peony varieties in China is similar, resulting in low breeding efficiency and the small number of new varieties [36]. Carrying out breeding of peony varieties with extensive adaptability and high oil yielding rate, the optimizing method and yield determination standard for oil peony should be made as soon as possible and which based on indexes like high yield, stable yield, good economic characters and strong adaptability etc. At the same time, people should make the conventional breeding combined with modern biotechnology technologies such as molecular marker assisted breeding and transgenic breeding to achieve oil peony directed improvement.

Scientific and technological support is an inexhaustible driving force for pushing development of oil peony industry. To deepen the component analysis of peony seed oil, improve and elevate the extraction technology need to keep the natural ingredients completely, retain the effective substances in maximum, as well as maximize the extraction rate of peony seeds, ensure the quality of extracted peony seed oil [37]. It is necessary to establish scientific and technological support system composed of experts, technicians, bases and enterprises, perfect the mechanism for scientific and technological innovation, combine scientific research to peasants increase income. And then we can promote the healthy development of the industry.

5.2. Strengthening the Study on High-Yield Cultivation Techniques and Achieving Specialized Production

A large number of studies showed that intercropping and interplanting can significantly promote the growth vigor of peony and reduce mortality. According to growth habits, nutrition method and growth period difference, intercropping and intercropping techniques can be used to oil peony and economic forest, chinese medicinal materials and vegetables, which not only effectively solve the problem that no seed setting and income in the previous years, but also increase the output efficiency of the unit land [38-40].

Centralizing funds and technology, the core areas of peony seed oil that have better location condition, development foundation and strong technical force should be chosen. People should make scientific planning, rational distribution, and establish demonstration base for the oil peony. At the same time, we have to energetically support leading enterprises and continuously improve the industrial affinity.

5.3. Formulating Related Policy and Increasing the Input in Funds

The support of the relevant state policies is the fundamental guarantee for the vigorous development of the oil peony industry. The government should provide a series of preferential policies to increase the investment in the oil peony industry, improve related financial subsidy policies and incentive systems, encourage the scale exploitation of woody resources, and explore the establishment of industrial running mechanism to help solve the bottleneck problems faced by oil peony farmers in seedling cultivation, transplanting and infrastructure construction. In addition, People should attract more investment. Attracting both nongovernmental and social funds to invest in the peony industry [41-42]. On the one hand, it can effectively improve the current insufficient situation of edible oil in our country. On the other hand, it can achieve the environmental afforestation and the increase of peasants' income.

6. Conclusion

Peony seed oil has the high content of protein, zinc, calcium, carotenoids, amino acids and unsaturated fatty acid, such as oleic acid, linoleic acid, linolenic acid, which content reaches about 90%. It has the effect of reducing blood lipid and blood sugar, promoting cholesterol metabolism, antioxidant. It is an emerging woody oil crop and also a kind of advanced woody edible oil with development potential. Oil peony is a great woody oil plants, whose seed oil has high yield and quality. In addition, oil peony has landscape value and ecological value. It has no special requirements for the growing environment, and has significant advantages such as drought resistance, cold resistance, and poor tolerance. The peony has already been a significant ornamental plant now. Its root bark is a commonly kind of traditional Chinese medicine. Its main component is phenol, which has effects of anti-bacterium, diminishing inflammation, antipyretic analgesic, and enhancing immunity. Peony seed oil can be processed into food, cosmetics, health products and artware except direct consumption. In addition, remainder after oil extraction can also be used as fertilizer and feed. Accelerating the development of oil peony industry has important significance in improving the ecological environment, ensuring the security of grain and oil, and increasing the income of farmers. Now, There are still many problems in the industry of oil peony. Products are not well recognized, basic research is relatively weak, deep processing technology is backward and so on. Therefore, promotional efforts and related technology research need to be enhanced, the government also should strengthen policy and fund supports.

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