

Research on Sustainable Development Strategies for Oil-use Peony in Heze City

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Abstract Oil-use peony is a treasure with broad prospects. Heze City plans to develop oil-use peony as a local key industry. However, there are still many urgent problems that need to be solved for the sustained and healthy development of the oil-use peony industry. This paper delved into the comprehensive benefits of oil-use peony and its industrial development from the aspects of cultivating high-quality germplasm resources, technological innovation, policy support, developing leading enterprises, improving industrialization system, comprehensive promotion, and strengthening storage and transportation technology, aiming to provide some reference for further development of Heze oil-use peony industry.

Key words Oil-use peony; Heze City; Utilization value; Problem

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Oil-use peony refers to the type of peony with strong seed setting ability that can be used to produce seeds and process edible peony seed oil, or refers to the varieties (or strains) of peony plants that produce seeds with a seed production rate $\geq 22\%$ ^[1-2]. The Municipal Government of Heze City has prioritized the development of the oil-use peony industry. On September 7, 2013, the industry standard *Peony Seed Oil* led by Heze City was certified in the grain and oil industry and upgraded to a national standard^[3-4]. On December 28, 2016, the former General Administration of Quality Supervision, Inspection and Quarantine of the People's Republic of China approved the implementation of geographical indication product protection for "Heze Peony Seed Oil". In November 2018, the Municipal Government of Heze City issued the *Overall Plan for the Development of Peony Industry from 2018 to 2022*, which proposed to guide farmers or enterprises to gradually expand the planting area of oil-use peony. As of now, the cultivation area of oil-use peony in Heze City has reached nearly 32 670 hm², and the annual production capacity of peony seed oil has reached 29 000 t^[5]. Seed oil is not only a highly nutritious edible oil, but also an important raw material for new medicines and cosmetics^[6]. With the gradual deepening of people's research on oil-use peony, its enormous development and utilization value will push Heze peony to the whole country and even the world. Peony seeds can be processed to produce high-end edible oils, daily necessities, cosmetics, pharmaceuticals, and other high-end products. The products after processing have a higher value, or the economic value is higher when peony seed oil is exported to foreign countries^[7-8]. Moreover, oil-use peony has extremely high ornamental value, and the development of its industry can quickly drive the development of surrounding and local

tourism. The planting of oil-use peony can not only drive the development of local tourism, but also fully leverage the marginal effects of land, invisibly increasing the country's arable land area, alleviating the serious shortage of arable land resources in China, and increasing farmers' income.

Problems in the Development of Oil-use Peony in Heze City

The great utilization value of oil-use peony has been recognized by the public and the country. Heze City took the lead in formulating the national standard of peony seed oil. In order to develop oil peony, a series of measures have been taken in breeding, cultivation mode, large-scale planting, policy support, technical services and other aspects. In order to develop oil-use peony, a series of measures have been taken in breeding, cultivation and planting patterns, large-scale planting, policy support, and technical services. In terms of cultivation and planting technology and mode selection, Heze City has successively organized some scientific research to tackle key problems such as off-season flower forcing and soilless cultivation, carried out new technology innovation on the basis of existing cultivation and planting technology, and compiled and printed *Technical Manual for Planting and Intercropping of Oil-use Peony* to help growers and growing regions implement standardized planting and production^[10]. In addition, Heze has also created various planting modes for intercropping peony with other plants. However, there are still many problems to be solved if we want to make the oil-use peony industry in Heze develop continuously and healthily.

The planting area of Heze City is facing problems such as small planting area, insufficient scale, and insufficient supply of raw materials such as peony seeds. Meanwhile, a standard technical system has not been formed in terms of planting time, planting density, growth period management, pest control, *etc.*^[11]. The characteristics of single variety, low purity and seedlings not tolerant to waterlogging and herbicides lead to a low annual yield of oil-use peony^[12]. There are more than 20 peony seed oil processing

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enterprises in the city, with an annual output of about 5 000 t. However, they generally have a small scale, and the processing technology is mainly physical pressing and subcritical extraction. There are problems such as insufficient technological innovation, obvious homogenization, uneven quality, weak market competitiveness, and no influential brands^[13]. The technological level limitations of leading enterprises, coupled with their high expenses in managing oil-use peony, have led to increased costs and increased product prices. After the transformation of small and medium-sized enterprises from traditional edible oil to peony seed oil production and processing, due to scale and technological limitations, the utilization rate of raw materials is low and the cost is also high^[14]. Meanwhile, the recognition of scientific and technological investment in oil-use peony has not been implemented, resulting in insufficient funding for research projects. The mechanism and system to promote the transformation of scientific and technological investment into productivity are not perfect, which ultimately affects the efficiency of scientific and technological investment in oil-use peony in Heze City^[15]. Moreover, the market development of oil-use peony products is just beginning, and faces various problems such as a lack of product promotion channels, single consumer group, and insufficient awareness of oil-use peony products, which have hindered the development of the oil-use peony industry.

Development Countermeasures of Oil-use Peony in Heze City

Strengthening technological innovation and increasing policy support

Firstly, it is necessary to plan reasonably and form a scientific layout, so as to guide the development of industrial operation of oil-use peony in accordance with the laws of market economy. Guided by the market, combined with the geographical and natural conditions, resource conditions and technical conditions of various regions, we should conduct professional and regional analysis and research on the production of oil-use peony. The second is to transform functions and play a coordinating and comprehensive service role. According to the requirements of the industrialization development of oil-use peony, we should eliminate institutional barriers, weaken departmental barriers, break industry boundaries and departmental divisions and streamline the relationships between departments to form simple, fast and efficient work procedures. The third is to formulate and improve preferential supporting policies, and actively support the development of the peony industry. We should strengthen technological innovation, establish a sound product technology system, and provide technical support for the development of the oil-use peony industry. The fourth is to strengthen technical training and promotion, accelerate the transformation of technological achievements, and further improve the training and promotion system at the city, county, and township levels. It is necessary to establish and improve technical training networks and teams, and widely carry out practical technical

training by establishing high-yield demonstration forests, supporting technology demonstration households, distributing practical technical manuals, organizing expert guidance, and holding training classes, so as to help farmers understand and master high-yield cultivation techniques and improve the level of production technology. Ultimately, we will change current situation in Heze where peony germplasm is mainly exported, transform resource and price advantages into technological advantages, expand peony commodity export relying on technological progress, and gradually expand market share.

Establishing and improving the industrialization system of oil-use peony

To cultivate a good oil-use peony market, it is necessary to establish an effective oil-use peony sales system, increase the promotion of the value and use of products related to oil-use peony, and improve market awareness. Based on selecting and creating excellence, we should produce high-quality products, and create well-known brands. That is to say, we need to continuously conduct research and development, reduce costs, improve quality, and expand the market. In order to improve the economic benefits for farmers and rural areas planting oil-use peony, it is necessary to develop processing industries in production areas to keep the value-added profits of processing in rural areas to the greatest extent. Therefore, the post-production processing system of primary oil-use peony products is an important factor in enhancing the development momentum of industrial production and improving economic benefits. The government should give sufficient attention to the organizational construction of the oil-use peony industrialization system. Under the policy promotion of government regulatory departments, through the Oil-use Peony Industry Association, various links such as scientific research, production, processing, and sales are organically organized to maximize the potential of each link, thereby promoting the industrialization process of oil-use peony and its rapid development and growth. Enterprises and farmers lack necessary bridges and bonds in their communication and dialogue with the government, while industry associations and professional cooperative organizations will just make up for the deficiencies in this system and build a good platform.

Expanding planting area and cultivating high-quality germplasm resources of oil-use peony

At present, the main oil-use peony varieties planted and promoted are Fengdan peony and Ziban peony, both of which have their own advantages and disadvantages. Accelerating the cultivation of high-quality germplasm resources is the key to reducing costs and improving quality of peony seed oil^[16]. Heze peony seedlings do not have an advantage in international competition, which also limits the development of potted peony plants and cut flowers. We should learn from the experience of Japanese peony seedling production and establish breeding bases for high-quality varieties that are compatible with cutting nurseries, rootstock nurseries, and planting nurseries. Hybrid breeding is an important method for the breeding of new peony varieties. The government

has increased investment and incentives in the research and development of oil-use peony varieties, enhanced the enthusiasm of scientific researchers, and continued to discover and cultivate high-quality oil-use peony varieties with stable traits, high oil content, and high oil output. When the technology is mature, oil-use peony will be planted in cultivation bases, so as to provide technical support for reducing the cost of oil-use peony at the source. Planting bases are the foundation for cultivating oil-use peony germplasm resources. The goal is to differentiate the breeding of peony varieties in peony parks, and establish bases for oil-use peony variety selection, testing, and breeding. By establishing peony germplasm resource banks, high-quality peony varieties at home and abroad can be introduced.

Establishing a sound business model and developing leading enterprises

Leading enterprises should be guided and supported to achieve a business management model that integrates seedling cultivation, afforestation, technological research and development, product processing, sightseeing tourism and sales to thereby promote the large-scale development, professional production and market-oriented operation of the oil-use peony industry and improve the core competitiveness of enterprises. During the operation and management of the bases, standardized production should be carried out throughout the production process of oil-use peony, including the environment of the producing area, cultivation management, pest control, fruit harvesting and processing, and peony seed oil processing to promote the effective combination of demonstration area construction, product quality safety management, and quality certification, thereby radiating and driving the upgrading of the industry. Heze City can set up a special development fund to encourage leading enterprises to take the lead in developing products and create their own brands. Heze City can take the lead in establishing and improving the standardization system of peony seed oil production and standardize product quality standards, help enterprises establish quality awareness and a good corporate image, strictly control the quality of products, and create a brand for Heze oil-use peony, thereby enhancing the competitiveness of the city's products.

Promoting comprehensively and expanding the market

It is necessary to fully study the market environment, industry characteristics and target consumer groups, while expanding and occupying the market by increasing product awareness and refining the core value of brands as the soul of enterprises. The publicity and popularization of relevant knowledge of peony seed oil should be strengthened, focusing on the promotion and introduction of the comprehensive value of peony seed oil in health care and medical treatment. Consumers should be encouraged to use oil rationally and scientifically through public service advertisements, popular science books, store posters and other forms, and we can also use new media and personal media to set up special WeChat and microblog accounts for promotion. Meanwhile, we can shoot professional documentaries on the origin, development and future

trend of oil-use peony, popularize the knowledge of oil-use peony, promote the popularity of oil-use peony, and publicize and promote the high nutritional value of peony seed oil and the concept of green and healthy diet, so that more people in Heze can understand it. The popularity of peony seed oil can be enhanced by participating in exhibitions, competitions, and other events on various types of oil, food, and health products throughout the province and country. Peony seed oil can be promoted to tourists and merchants from all over the world by holding various types of exhibitions, chambers of commerce and tasting parties through the annual World Peony Congress. Ultimately, it will enable the public to understand, accept, and use peony seed oil, and popularize it to the kitchens and dining tables of the general public.

Conclusions

The oil-use peony industry integrates the primary, secondary and tertiary industrial chains and plays a very important role in the economic development of Heze city, the increase of farmers' income, the protection of the ecological environment and the guarantee of the balance of grain and oil supply. The development of the oil-use peony industry in Heze City is still facing many problems arising from the initial development of most industries. We should recognize and understand the comprehensive benefits of oil-use peony and its industrial development, increase the planting area of peony seedlings, create a national oil-use peony production and cultivation base, build a national oil-use peony technology research and development center, and make great efforts to improve the technological research and development speed of oil-use peony variety expansion, cost reduction, and quality improvement and increase the market share of peony seed oil, so that oil-use peony can truly develop into a peony industry chain, form an extended industry chain with "oil-use peony cultivation, research and development, production" as the core, and attract sales, logistics, customers, auxiliary products, infrastructure and other industries. Ultimately, it will help Heze oil-use peony industry develop healthily, continuously and rapidly.

References

- [1] FU LS, LIU P. Summary of research on the development of oil-use peony industry[J]. *Forestry Economics*, 2017(11): 51–56. (in Chinese).
- [2] LU L, WANG EQ, GUO YZ, *et al.* Variety selection and high-yield cultivation techniques of oil-use peony[J]. *Inner Mongolia Agricultural Science and Technology*, 2014(1): 112–124. (in Chinese).
- [3] ZHANG XL, XIE ZJ, ZHU CH, *et al.* Analysis on the development prospects and strategies of oil-use peony industry[J]. *Rural Economy and Science*, 2015(12): 67–68. (in Chinese).
- [4] TAO HB, LU S, WANG YZ, *et al.* Analysis on the development prospects and countermeasures of oil-use peony in Hebei Province[J]. *The Journal of Hebei Forestry Science and Technology*, 2016(5): 81–83. (in Chinese).
- [5] ZHU ZL, WANG FS, MAO WY. A new resource of food: Peony seed oil [J]. *Food and Drug*, 2014(2): 133–136. (in Chinese).

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- House, 2019.
- [8] JINBACIWANG. Annotations to Four Medical Tantras of Jinba (Tibetan version) [M]. Beijing: Nationalities Publishing House, 2019.
- [9] LINMANZHAXI. Annotations to Four Medical Tantras of Linmanba (Tibetan version) [M]. Beijing: Nationalities Publishing House, 2019.
- [10] ZHONG GY, WANG CH, ZHOU HR, *et al.* Tibetan medicine: Pharmacognosy and species consolidation [J]. World Science and Technology—Modernization of Traditional Chinese Medicine and Materia Medica, 2008(2): 28–32, 41.
- [11] YANG HS, CHUCHENGJIANGCUO. Diqing Tibetan medicine [M]. Kunming: The Nationalities Publishing House of Yunnan, 1989.
- [12] LUO DS. Newly revised Jingzhu materia medica [M]. Chengdu: Sichuan Science and Technology Press, 2004.
- [13] MAO JZ (trans.). Miaoyin materia medica (Tibetan and Chinese version) [M]. Xining: Qinghai People's Publishing House, 2016: 103.
- [14] YUTUO · YUNDANGONGBU. Yutuo materia medica (Tibetan and Chinese version) [M]. Xining: Qinghai People's Publishing House, 2016.
- [15] SUKA · LUOZHUIABU. Ancestors' oral statement (Tibetan version) [M]. Beijing: Nationalities Publishing House, 2019.
- [16] DISI · SANGJIEJIACUO. Micebuyi · Yaoshi (Tibetan version) [M]. Beijing: Nationalities Publishing House, 2019.
- [17] Editorial Committee for Classic Literature of Tibetan Medicine. Six-uzhushi · Kezimeichuan (Tibetan version) [M]. Beijing: Nationalities Publishing House, 2019.
- [18] GAMADANPEI. Gamadanpei Yizhu (Tibetan version) [M]. Beijing: Nationalities Publishing House, 2019.
- [19] JIAYANGQINZEWANGBU, DALARUOBU. Degelaman Yizhu (Tibetan version) [M]. Beijing: Nationalities Publishing House, 2019.
- [20] GESANGDUNZHU. Tibetan medicine Jinsui materia medica [M]. Lhasa: Tibet People's Publishing House, 2015.
- [21] DAWAWENGA. Tibetan medicine materia medica · Jinghuayueguang (Tibetan version) [M]. Lhasa: Tibet People's Publishing House, 2004.
- [22] GAWUDUOJI. Tibetan medicine Jingjing materia medica [M]. Beijing: Nationalities Publishing House, 2014.
- [23] LUO DS. Chinese Tibetan materia medica [M]. Beijing: Nationalities Publishing House, 1997.
- [24] Editorial Board of Flora of China, Chinese Academy of Sciences. Flora of China [M]. Beijing: Science Press, 1993.
- [25] Qinghai Provincial Institute for Drug Control, Qinghai Provincial Institute of Tibetan Medicine. Chinese Tibetan medicine (volume one) [M]. Shanghai: Shanghai Scientific and Technical Publishers, 1996.
- [26] GAMAQUNPEI. Ganlu materia medica Mingjing [M]. Lhasa: Tibet People's Publishing House, 1993: 244.
- [27] HUADANJIANCUO, DANBEIJUNNI, DANQUCICHEN. Tibetan medicine specimen illustrated book · Mingjing [M]. Beijing: Nationalities Publishing House, 2011.
- [28] LUOSANGDUOJI. Complete atlas of Tibetan medicinal materials [M]. Lhasa: Tibet People's Publishing House, 2012.
- [29] BARUOQIANGDONG. Shiwanguan and Mijuehijuan (Tibetan version) [M]. Beijing: Nationalities Publishing House, 2019.
- [30] DONG DD. Study on the chemical constituents and quality standards of Tibetan herb *Arenaria serpyllifolia* L. [D]. Nanchang: Jiangxi University of Chinese Medicine, 2021.
- [31] BAI W, LI Z, TANG XH, *et al.* Research progress on *Eremogone brevipetala* [J]. South China Agriculture, 2013, 7(11): 5–8.
- [32] LIU ZG, KANG HL, CUI YL, *et al.* Research and investigation in germplasm resources of Kansu sandwort herbs in Qinghai Province [J]. Lishizhen Medicine and Materia Medica Research, 2016, 27(12): 2996–2999.
- [33] XUE JJ, LI JY, LI BJ, *et al.* Isoquinoline alkaloids from two species of *Thalictrum* genus plants [J]. China Journal of Chinese Materia Medica, 2022, 47(10): 2676–2680.
- [34] LUO D. A study on the chemical constituents of two species of *Thalictrum* L. [D]. Kunming: Yunnan Minzu University, 2021.

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- [6] YI JP, ZHU WX, MA HL, *et al.* Physicochemical indexes and fatty acid composition of peony seed oil [J]. Transactions of the Chinese Society of Agricultural Machinery, 2009, 40(12): 144–149. (in Chinese)
- [7] WANG ZJ, TANG LY, HE Y. Chemical components and pharmacological effects of tree peony bark [J]. World Phytomedicines, 2006(4): 155–159. (in Chinese).
- [8] LI PY, HAN SH, LUO DL, *et al.* Optimization of enzymatic extraction and nitrite scavenging capacity of flavonoids from peony leaves [J]. Food Science, 2016, 37(6): 77–81. (in Chinese).
- [9] SHAO WM. Research on sustainable development of peony resources in Heze [D]. Qingdao: Qinghua University, 2008. (in Chinese).
- [10] General Office of Shandong Provincial People's Government. Development plan for peony industry in Shandong Province (2015–2020) [A]. LZBZ(2015)7, 2015-01-12. (in Chinese).
- [11] YANG L, WANG HX, SU JH, *et al.* Preponderant antioxidant of peony seed oil [J]. China Oils and Fats, 2015, 40(2): 46–49. (in Chinese).
- [12] ZHANG T, GAO TS, BAI RY, *et al.* Utilization and research progress of oil tree peony [J]. Journal of Chongqing Normal University: Natural Science, 2015(2): 143–149. (in Chinese).
- [13] LIU DJ. Reflections on several issues concerning the development of China's oil-use peony industry [J]. China Forestry Industry, 2015(1): 67–71. (in Chinese).
- [14] HAN X, CHENG FY, XIAO JJ, *et al.* Crosses of *Paeonia ostii* 'Feng Dan Bai' as maternal parents and an analysis on the potential in tree peony breeding [J]. Journal of Beijing Forestry University, 2014, 36(4): 121–125. (in Chinese).
- [15] LI YM. Leader of peony seed oil industry: Interview with Zhao Xiaoping, chairman of Heze Ruipu Peony Industry Technology Development Co., Ltd. [J]. China Flowers & Horticulture, 2013(11): 48–49. (in Chinese).
- [16] KIM KYU-BONG, NAM YOON A, KIM HYUNG SIK, *et al.* α -Linolonic acid: Nutraceutical, pharmacological and toxicological evaluation [J]. Food and Chemical Toxicology, 2014(70): 163–178.

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