

Transplantation and Post-planting Tending and Management Techniques of Olive Trees (*Olea europaea* L.)

Jianzhou QUAN¹, Jing WANG¹, Wangnian LI¹, Dezhi JIANG^{2*}

1. Shiyan City Forestry Institute in Hubei Province, Shiyan 442000, China; 2. Hubei Academy of Forestry, Wuhan 430075, China

Abstract This paper introduced the preparation work before transplanting big olive trees (*Olea europaea* L.), including key technical measures such as plant excavation, transportation, planting, and post-planting tending. The aim was to provide scientific basis and feasible solutions for adjusting the density of olive trees in Shiyan City, and to assist in the high-quality development of the olive industry.

Key words *Olea europaea* L.; Big trees; Transplantation; Tending and management; Survival rate

DOI: 10.19759/j.cnki.2164–4993.2023.04.005

Olive (*Olea europaea* L.), a plant of the Oleaceae family, originated in Asia Minor and is one of the four major woody oil crops in the world^[1]. Olive oil is a high-end edible oil extracted from olive flesh, with an average unsaturated fatty acid content of 82% and an average oleic acid content of 74.2%. It is rich in active substances such as squalene, vitamin E and β -sitosterol^[2], and known as "liquid gold" and "queen of vegetable oils"^[3]. In the 1960s, under the call of Premier Zhou Enlai, China began large-scale introduction and trial planting of olive, which was widely planted in 15 provinces and regions south of the Yangtze River^[4–5]. At present, the cultivation area of olive in China is about 86 700 hm², with an annual output of about 66 000 t of fresh fruits and 8 412 t of oil. It is mainly distributed in provinces and cities such as Gansu, Yunnan, Hubei, Sichuan and Chongqing^[6].

Shiyan City is located in the Qinba Mountain Area of the Han River Basin, with the Qinling Mountains to the north and Daba Mountains and Wudang Mountains to the south, which can block the cold current and form the Qinba River Valley. It has the largest Danjiang Reservoir in the country. The whole region has no severe freezing damage and an annual sunshine duration of over 1 680 h. It is a suitable cultivation area for olive and one of the earliest areas in China to carry out olive cultivation^[7–8]. There are still remaining olive trees planted in 1970s in Wangzhuang Village, Anyang Town, Yunyang District, Shiyan City. Since 2009, Shiyan City has introduced more than 30 Olive germplasm resources, and more than 3 300 hm² of olive have been developed around the Danjiangkou Reservoir Area. The total area of olive is planned to reach 10 000 hm² by 2025^[9]. In recent years, the olive industry has developed rapidly in the Shiyan area, playing an important role in poverty alleviation and rural revitalization. Olive

has been listed as a key development support direction for the woody oil industry by the Shiyan Municipal Party Committee and Government. At present, in the development process of the olive industry, there are problems such as high afforestation density in the early stage affecting yield. Transplanting large trees can achieve quick fruiting, realizing resource utilization, and shortening growth cycle. This paper introduced the techniques of olive transplantation and later tending and management, in order to provide a plan for adjusting the density of olive in Shiyan City.

Preparation before Transplantation

Tree preparation

The olive trees that need to be transplanted are marked before transplantation, and the variety, specifications, growth, pests, diseases and age of the transplanted trees are recorded. In the first autumn, winter, or spring of the second year, the trees that need to be transplanted should be pruned to cut off diseased and useless branches and those damaged by insects, while retaining the main branches of trees and an appropriate amount of lateral branches and leaves, and fruit tree wound protection agents are applied to the trunk and branch wounds, so as to ensure the survival rate of large trees after transplantation.

Soil preparation

Relatively concentrated and contiguous plots with sufficient lighting, good water source and good soil permeability were selected as the construction site, with a soil pH value of 6.5–8.5. In the winter of the year before transplantation, comprehensive deep plowing is conducted with a depth of 30 to 40 cm. For gentle slopes with a slope of less than 15°, full reclamation and land preparation will be adopted. For mountainous areas with slopes ranging from 15° to 25°, belt or cave cultivation should be adopted, and terraced land should be constructed along contour lines as much as possible. The suitable specifications for hole-shaped land preparation are 0.8 to 1.0 m. The suitable specifications for strip land preparation are 0.8–1.0 m wide and 0.8–1.0 m deep. Flat land can also be planted by stacking soil. Before transplanting large trees, excavators can be used to pile up soil piles with a

Received: June 8, 2023 Accepted: August 9, 2023

Supported by Central Finance Forestry Science and Technology Demonstration and Extension Project (E[2023]TG14).

Jianzhou QUAN (1966–), male, P. R. China, senior engineer, devoted to research about breeding and cultivation of improved tree species.

* Corresponding author.

bottom diameter of 3 m, an upper diameter of 2 m, and a height of about 80 cm. During land preparation, 25 to 50 kg of organic fertilizer and 1 to 2 kg of phosphorus fertilizer should be applied to each hole as the base fertilizer.

Excavation, Transportation and Planting of Plants

Excavation and packaging

It is necessary to ensure that the soil ball is intact during excavation, with a diameter of 8 – 10 times the diameter of the olive tree at breast height and a height of approximately 2/3 of the soil ball diameter^[10]. During the process of digging out large trees, when encountering thick roots, a hand saw is used to cut them off, and scissors are used to cut off fine roots to ensure that the roots are not torn and reduce root damage. The excavated soil balls are wrapped with straw ropes or cloth strips to ensure that the soil balls do not split. For loose soil balls during the seedling raising process, water should be sprayed timely on the roots, and then the roots are wrapped with cotton cloth, which is placed in planting holes together with seedlings during transplantation.

Transportation

A crane is used to carefully lift packaged olive trees with a soil ball to a transportation vehicle. The position of the sling should be wrapped with a wide cloth to avoid scratching the bark and ensure the integrity of the soil balls. When loading, the tree crowns should face the rear of the car and the soil balls should be close to the driver's cab. For long-distance transportation, tarpaulins should be installed in the carriages to reduce the loss of plant moisture.

Field planting

After olive trees reach their destination, they should be planted as soon as they arrive, and the intermediate stage should be shortened as much as possible. If they cannot be immediately planted on the same day, they should be placed in a leeward area and covered with film or straw to prevent exposure to sunlight, and the soil balls should be watered regularly to prevent the plants from losing water. The planting density of large trees is 5 m × 6 m, and the trees are planted according to the requirements in planting holes dug in advance. Olive trees are carefully moved into planting holes, and the position of the tree body is adjusted to ensure the original direction of the tree body and straighten the tree trunk. Next, the straw rope or cloth strip for packing soil balls is unfastened, and the opening of each hole is covered with soil to a thickness of no more than 10 cm. Finally, an irrigation soil dam 10 – 15 cm in height is constructed on the top of the soil pile around the tree trunk. When the temperature is high, a 70% shading net can be used for shading.

Tending and Management after Planting

Supporting and fixation

After transplanting a large olive tree, due to the unfixed root system and the larger crown diameter, the tree is easily toppled in

strong winds, and the trunk must be fixed to facilitate root growth.

Irrigation and drainage

After the planting of olive trees, they should be watered in a timely manner. The first watering must be thoroughly to ensure that the soil balls are tightly combined with the soil without leaving any gaps. Afterwards, they should be watered continuously three times every 5 – 7 d. When the rainfall is heavy, watering may not be necessary. Subsequently, the trees are watered in a timely manner according to the situation, ensuring that they are not watered when the soil is not dry, and if watered, they should be watered thoroughly. In the season of abundant rainfall, attention should be paid to drainage and anti-waterlogging to avoid water accumulation, in order to prevent the occurrence of root rot^[11]. A kind of large-tree nutrient solution is injected within 10 – 15 d after transplantation of large olive trees to supplement the trees' nutrients and moisture until new shoots sprout.

Supplementary trimming

Although transplanted trees have been pruned, they may suffer varying degrees of damage or other reasons during excavation, loading and unloading, and transportation, which may prevent some buds from germinating normally and result in withered shoots, which should be promptly removed or cut to above the tender shoots or young branches. For trees that have been truncated (crown) or re-cut for planting, if the positions of remaining buds are not accurate or the cut buds are too weak, it is easy to cause withered piles or weak branches, and it is necessary to perform supplementary trimming (or re-pruning) in a timely manner. The large wounds after pruning should be smooth, clean, and disinfected, and tree protection agents should be applied in a timely manner.

Loosening, weeding and fertilization

Watering, rainfall, and human activities can cause soil compaction in tree trays, affecting tree growth. Loosening of the soil should be carried out timely to increase soil permeability, which is beneficial for root growth and development. However, during the survival period, the depth of soil loosening should be 10 – 15 cm to avoid damaging the new roots. Weeds and vines should be timely removed from transplanted olive gardens. After transplantation, fertilizers are reduced or not applied within the first year, and a urea solution with a concentration of 0.5% can be used for foliar spraying in the morning, evening, or cloudy days, once every 10 – 15 d.

Pest control

Olive trees are prone to infection with diseases and pests during the transplantation process due to various reasons such as seedling raising, pruning, weak tree resistance, and tender new leaves. It is necessary to inspect early and detect early, and timely preventive measures should be taken. The prevention and control of diseases and pests follows the principle of "prevention in the first place and integrating prevention with control". After transplantation, tree protective agents are applied to the wounds of the tree body, and subsequent inspection and prevention work are

carried out according to changes in the weather and the occurrence laws of diseases and pests, and timely prevention and control measures are taken.

Conclusions

Shiyan is a suitable cultivation area for olive trees. In recent years, the local municipal party committee and government have attached great importance to the development of the olive industry, and have included olive as a key support direction for the development of woody oil crops in Shiyan City. With the rapid development of the olive industry in Shiyan City, more and more olive orchards will need to be transplanted with large trees. Transplanting big trees is a complex project, and its season, climate and age can directly affect the survival rate of transplanted trees. However, as long as the transplanting measures are scientific and reasonable, and the trees are transplanted according to the process described earlier, and scientifically nurtured and managed in the later stage, the survival rate of transplanted big olive trees can be effectively improved, and the fruiting cycle can be shortened, thereby achieving early results.

References

- [1] HE SA, GU Y. Domestication and breeding of olive (*Olea europaea* L.) [M]. Nanjing: Jiangsu Science and Technology Press, 1984. (in Chinese).
- [2] LONG W, WANG YB, YAO XH, *et al.* Analysis of composition of nutrients and characteristic for virgin oil of *Olea europaea* L from Qingchuan

Country in Sichuan Province[J]. Journal of the Chinese Cereals and Oils Association, 2017, 32(8): 77–83. (in Chinese).

- [3] ZHU QP. Cloning of two key enzyme genes in the ethylene biosynthesis pathway of olive (*Olea europaea* L.) and prokaryotic expression of ACC oxidase gene [D]. Ya'an: Sichuan Agricultural University, 2016. (in Chinese).
- [4] LI N, DAI QQ, QI HH, *et al.* Effect of training system on fruit yield of different olive cultivars[J]. Forest Research, 2013, 26(4): 521–527. (in Chinese).
- [5] ZHANG YP, HU MY. Planting and processing of olive (*Olea europaea* L.) [J]. Special Economic Animals and Plants, 1998, 1(3): 26–27. (in Chinese).
- [6] ZHAO MJ, WU WJ, JIANG CY, *et al.* Olive germplasm resources development in Turkey: Status and enlightenment [J]. World Forestry Research, 2021, 34(1): 102–106. (in Chinese).
- [7] PENG XM. Division of olive (*Olea europaea* L.) cultivation in Hubei Province[J]. Hubei Forestry Science and Technology, 1992(2): 23–29. (in Chinese).
- [8] HE AQ, WANG CX. Successful trial planting of olive (*Olea europaea* L.) in the Danjiang reservoir area of Northwest Hubei[J]. Nonwood Forest Research, 1987(1): 2–6. (in Chinese).
- [9] SUN WY, XIAO XH, WANG YF, *et al.* Analysis of leaf and fruit phenotypic characters of olive (*Olea europaea* L.) varieties introduced and cultivated in Shiyan City[J]. Hubei Forestry Science and Technology, 2022(3): 10–13. (in Chinese).
- [10] CHEN J, WANG DJ. Transplantation technique of olive (*Olea europaea* L.) [J]. Practical Forestry Technology, 2012(6): 12–13. (in Chinese).
- [11] MAO CY, ZHANG JD. Transplantation techniques of big trees in urban landscape greening[J]. Forestry Science & Technology, 2003, 28(2): 56–58. (in Chinese).

Editor: Yingzhi GUANG

Proofreader: Xinxiu ZHU

(Continued from page 15)

- [17] LI Q, ZENG J, GONG P, *et al.* Effect of steaming process on the structural characteristics and antioxidant activities of polysaccharides from *Polygonatum sibiricum* rhizomes[J]. Glycoconj J 2021, 38(5): 561–572.
- [18] LIANG X, CHEN X, LI C, *et al.* Metabolic and transcriptional alterations for defense by interfering OsWRKY62 and OsWRKY76 transcriptions in rice[J]. Sci Rep, 2017, 7(1): 2474.
- [19] SCHEUER H, GWINNER W, HOHBACH J, *et al.* Oxidant stress in hyperlipidemia-induced renal damage[J]. Am J Physiol Renal Physiol, 2000, 278(1): 63–74.
- [20] LI S, TAN HY, WANG N, *et al.* The role of oxidative stress and antioxidants in liver diseases[J]. Int J Mol Sci, 2015, 16(11): 26087

– 26124.

- [21] CUI MY, YIN YF, ZHU FM, *et al.* Effects of FVGL on levels of SOD, MDA and GSH-Px in rats with oxidative damage induced by D-galactose[J]. Acta Chinese Medicine and Pharmacology, 2021(12): 47–51. (in Chinese).
- [22] DENG QF, ZHOU X, CHEN HG. Advance in study on hepatoprotective effects and its mechanism of polysaccharides[J]. China Journal of Chinese Materia Medica, 2016, 41(16): 2958–2967. (in Chinese).
- [23] LIANG YF, YOU QX, GU QY, *et al.* Anti-vascular oxidative stress effect of corn silk polysaccharide on hypertensive rats induced by high salt[J]. Chinese Journal of Gerontology, 2022, 42(12): 3037–3040. (in Chinese).

Editor: Yingzhi GUANG

Proofreader: Xinxiu ZHU