HILL PUBLISHING

Progress in Evolutionary Biology, 2025, 1(1), 18-21
https://www.hillpublisher.com/Journals/peb/
ISSN Online:

Analysis on the Biological Characteristics and Ecological Value of Walnut

Lixian Zi

Southwest Forestry University, Kunming 650224, Yunnan, China.

How to cite this paper: Lixian Zi. (2025). Analysis on the Biological Characteristics and Ecological Value of Walnut. *Progress in Evolutionary Biology*, 1(1), 18-21.
DOI: 10.26855/peb.2025.12.004

Received: August 12, 2025
Accepted: September 17, 2025
Published: November 25, 2025

***Corresponding author:** Lixian Zi, Southwest Forestry University, Kunming 650224, Yunnan, China.

Abstract

Walnut is a kind of common plant, not only has high nutritional value, but alsohas certain ecological value. This paper combines the relevant theory and practice, the biological characteristics of walnut ecological value analysis, in this paper, first of all, the botanical characteristics of walnut, biological characteristics analysis, which focuses on the root, branch, bud, flower and other key parts of walnut. including: can play a certain role in improving the air and soil, can play a role in the conservation of water and soil and water conservation function, but also can play a certain role in improving the biological species in the planting area. It is hoped that the relevant thinking results put forward in this paper can provide some beneficial reference and reference for the relevant research on the ecological value of walnut.

Keywords

Walnut; Biological characteristics; Ecological value

Introduction

Walnuts are often considered a nut with high nutritional value. Existing research on walnuts has largely focused on their nutritional value. However, walnut fruit not only possesses high nutritional value, but the walnut tree itself also possesses significant ecological value. This article, drawing on relevant theories and practical experience, explores the biological characteristics of walnuts, including key parts such as roots, branches, buds, and flowers; and also analyzes the ecological value of walnut trees. Furthermore, the conclusion offers brief recommendations for walnut cultivation. This research will further clarify the ecological value of walnuts and enrich research on their ecological value [1].

1. Botanical Characteristics of Walnut

Walnuts belong to the dicotyledons, order Caryophylles, family Juglandaceae, and genus Juglans. They are a valuable relict plant from the Tertiary temperate deciduous broad-leaved forests. There are eight species in China (including three introduced species): Juglans regia, Juglans ferrugaceae, Juglans mandshurica, Juglans regia, Juglans regia, Juglans fusca, Juglans nigra, and Juglans nigra. The two species primarily cultivated for commercial purposes in China are Juglans regia and Juglans ferrugaceae, also known as Yangbi walnut or soaked walnut. Walnuts are cultivated throughout northern and southern China, while Juglans ferrugaceae is primarily found in Yunnan, Sichuan, and Guizhou. Both Juglans regia and Juglans ferrugaceae can live for over a century, with some reaching over 500 years. Trees typically reach 10 to 20 meters in height, with a massive crown, longitudinally fissured trunks, and white lenticels on new branches. Leaves are odd-pinnately compound, alternate, and the flowers are unisexual, hermaphroditic [2-5]. Male flowers are arranged in drooping catkins. They are drupes with a bony outer seed coat that becomes the shell.

Note: The article was originally published in *Journal of Agriculture and Food Science*, and this is an authorized translation of it.

2. Biological Characteristics of Walnut

2.1 Walnut Root

Walnuts are deep-rooted trees with a root system consisting of taproots, lateral roots, and fibrous roots. The taproot is well-developed, while the lateral roots extend farther out, and the fibrous roots are dense. The roots of mature walnut trees are distributed vertically in the soil layer from 0 to 60 cm. Horizontally, the roots are primarily located below the crown and within the crown's projection, that is, within the area centered on the trunk.

2.2 Walnut Branches

Walnut branches can be divided into new shoots, secondary branches, one-year branches, two-year branches, and multi-year branches according to their age. Among them, new shoots are divided into spring shoots and autumn shoots. New shoots grown in spring are called spring shoots, and vigorous spring shoots grow for the second time to form autumn shoots. The branches that sprout from the new shoots' side buds in the same year form secondary branches. The new shoots from the time they fall leaves to the time they sprout in the second year are called one-year branches. One-year branches include fruiting branches, nutrient branches, and male flower branches. Fruiting branches are branches that bloom and bear fruit. Nutrition branches only bear leaves and form the skeleton of the tree [3-7].

Dry branches or overgrown branches. Male flowering branches bear male flowers and die after wintering. Branches that have been growing for two years are called biennial branches. Branches that are three years old or older are called perennial branches.

2.3 Buds of the Nuclear Bud

Walnut buds are classified into mixed buds (female flower buds), male flower buds, leaf buds (vegetative buds), and latent buds. Mixed buds germinate to produce fruiting branches, which then produce clusters of flowers and fruits at the top. Leaf buds (vegetative buds) often develop at the branch tips or below the mixed buds on fruiting branches, above the male flower buds, or overlap with them. Walnuts have strong apical dominance, and plump terminal buds tend to produce vigorous branches. Lateral buds below the terminal bud rarely produce branches or fruit. Lateral buds in the middle and lower parts of branches often wither and fall off, forming bare strips. Consequently, the crown of a walnut tree often appears sparse. Male flower buds often develop in the middle and lower parts of one-year-old branches. These pure flower buds germinate to form male inflorescences. The nature of the terminal buds in walnuts varies with age. In young trees, the terminal buds grow rapidly after germination, forming the backbone branches that form the trunk.

2.4 Walnut Flowers

Walnuts are monoecious plants with male and female flowers, and their flowering periods are different, leading to different maturity times. The stigmas of female walnut flowers typically do not secrete nectar, and pollen is often dispersed by wind. Early-bearing walnuts typically produce fruit in the same or second year after grafting, while late-bearing walnuts produce fruit later, typically three to five years after grafting [8-10].

3. Analysis of the Ecological Value of Walnuts

3.1 It Has a Certain Regulatory Effect on Climate Factors

Walnut trees are typically tall and lush, significantly influencing the climate of their habitats, maintaining a relatively humid climate and clean air. Specifically, their trunks and leaves reflect and block some solar radiation, reducing its adverse effects on the ground. They also reduce wind speeds that pass over the ground, reducing air flow and thus maintaining warmth and moisture. Walnut trees also release oxygen, improving oxygen levels in the air and absorbing carbon dioxide, contributing to improved air quality. Furthermore, their canopies intercept precipitation, some of which is absorbed and infiltrated by the soil, increasing both soil and air humidity. Data indicates that a 50-year-old walnut tree can increase the humidity of the surrounding air by over 15%, raise soil moisture by 5-6%, and improve air temperature and dust levels.

3.2 Functions of Maintaining Soil and Water and Conserving Water Resources

As mentioned above, walnut trees have a relatively large, well-developed root system and a relatively large crown. These advantages contribute to soil and water conservation and water conservation. For example, the roots of a ten-year-old walnut tree often reach approximately 3 meters and penetrate 0.6 meters underground, covering an area two to three times that of the crown. One characteristic of such a large root system is its excellent ability to fix and absorb soil, commonly known as soil retention and consolidation. Furthermore, the tree's broad crown effectively intercepts precipitation, reducing the impact of rainwater on the surface soil. This intercepted precipitation, through evaporation, directly increases air humidity. Some of this intercepted precipitation also seeps into the surface soil, further increasing its water content. Furthermore, walnut leaves also play a significant role in soil and water conservation and water conservation. For example, walnut leaves that fall to the ground will form a layer of humus on the ground. This humus layer can better protect the soil, reduce the evaporation and loss of water in the soil, and further promote the soil's water absorption capacity [11-13].

3.3 Effects on Biological Factors

First, large-scale walnut forests can significantly improve the soil, water, and air quality within the planting area, making the area more suitable for biological growth. For example, walnut forests are often ideal habitats for birds and other wildlife, effectively increasing biodiversity. Second, walnut trees generally have large canopies. A continuous grove of walnut trees not only improves the local ecology but also creates a pleasant visual effect, often resulting in a more aesthetically pleasing landscape. Third, the fallen branches of walnut trees provide favorable conditions and nutrients for the growth of fungi, effectively enriching the local food chain. Furthermore, walnut trees secrete a substance called juglone, which is commonly found in large quantities in their stems, leaves, and roots. Once secreted and seeping into the soil, this toxic substance acts as a natural herbicide, inhibiting the growth of other plants beneath the trees. Consequently, weeds are rarely seen where walnut trees grow, and the topsoil is often relatively bare. However, it is worth mentioning that juglone can have certain toxic effects on some other herbaceous plants and woody plants, so other economic crops should not be planted around walnut trees.

4. Conclusion

In summary, walnut is a relatively common plant in my country. Walnut not only has high economic value, but also has good ecological value. For example, it can improve the air and soil, maintain water and soil, and conserve water resources. It can also play a certain role in improving the biological species in the planting area. However, there are many things to pay attention to during walnut planting. For example, walnuts are usually suitable for growing in a sunny, warm and cool environment. Walnuts have relatively high requirements for growth space, etc. Therefore, during the walnut planting process, not only should the local climate environment be fully considered and the walnuts should be able to fully adapt to the growth environment, but also the spacing between walnut trees should be maintained, and a dispersed planting method should be adopted for planting. In addition, during the walnut planting process, attention should also be paid to relevant disease and pest control work to promote the smooth growth of walnuts.

References

[1] Zhou ZS. Ecological value of walnut forests. Econ For Res. 2001;(3):34.

[2] Pan D, Zhai MP, Guo SJ. Chemical composition analysis of volatile gases from walnut plants. J Shandong Agric Univ (Nat Sci Ed). 2007;38(2):234-8.

[3] Ma QG, Le JX, Song XB, et al. 70 Years of Fruit Tree Research in New China - Walnut. J Fruit Sci. 2019;36(10):1360-8.

[4] Feng BK. Research progress on the ecological conservation function and processing technology of walnut. Shaanxi For Sci Technol. 2015;(1):10-3.

[5] Cui J, Li GF, Li J. Current status and development strategies of walnut production in Qujing City. Shelterbelt Sci Technol. 2019;(10):57-9.

[6] Zhang HP. Research on high-yield cultivation technology of walnut and pollution-free control of diseases and pests.

Seed Sci Technol. 2019;37(13):106-7.

[7] Yuan YH, Wan ZW, Cheng ZJ, et al. Walnut high grafting technology and promotion and application. Shanxi Agric Econ. 2019;(18):99-100.

[8] Zhao J. A brief analysis of walnut planting technology and its role in promoting agricultural economy. Shanxi Agric Econ. 2019;(17):126.

[9] Wu YL. Research on pollution-free integrated control technology of walnut diseases and insect pests. Shanxi Fruits. 2019;(5):32-3.

[10] Mao XY, Wu QZ, Tian HL, et al. Research progress on antioxidant effect of walnut kernel. China Oils Fats. 2017;42(8):82-5.

[11] Li L, Ruan JL, Qian WL, et al. Multi-index evaluation of the impact and role of walnut on the ecological environment. Food Res Dev. 2017;38(3):1-4.

[12] Jin M, Xu DP, Zhan J, et al. Extraction, separation and anti-fatigue activity of iridoid glycosides from walnut meal. Food Mach. 2019;35(7):172-5,236.

[13] Guo Y, Qin HX, Wei Z, et al. Protective effect and mechanism of pentapeptide from Changbai Walnut against hydrogen peroxide-induced oxidative damage in PC12 cells. Food Sci. 2019;40(13):143-9.