

OVERVIEW OF WALNUT CULTURE IN CHINA

Z. Baojun, G. Yonghong
Economic Forestry Inst. of Liaoning,
116031, Dalian, China

Abstract

China is one of the leading countries in the world in walnut production. The application of grafting and budding has pushed walnut culture into a new stage. The production of walnut has increased significantly in recent years. From the early 1980s, walnut orchards have been established with cultivars selected or bred in China.

1. Introduction

There are 6 species in the walnut genus in China; they are *Juglans regia*, *J. sigillata*, *J. mandshurica*, *J. cathayensis*, *J. ailantifolia* and *J. ailantifolia* var *cordiformis*. Only *J. regia* and *J. sigillata* (cultured in Yunan and Guizhou Province, China) are cultivated, the others are wild. Walnut is distributed from 21°29' to 44°54' north latitude and from 75°15' to 124°21' east longitude in China. Walnut distribution in China is divided into six agricultural regions. These are East Coast, West North, Sinkiang, Central South, West South and Tibet.

2. Walnut production in China

Evidence has shown that *J. regia* is native to China. China's walnut production has increased for the last several years because of increased planting and bearing acreage, improved walnut cultivars, and better tree management. In 2003, China became the world leader in walnut production, followed by the United States. Walnut production in different administrative areas is shown (Figure 1). Figure 2 shows China's walnut production of different years.

3. Planting material

3.1 Rootstocks:

Walnut trees in China were propagated only from seed, not by grafting or budding, until 1980s. Selected or cross bred cultivars are now used in newly established walnut orchards. *J. regia* seedlings are used as rootstocks.

3.2 Cultivars:

Research on breeding of the best cultivars adapted to different ecological conditions of China is being continued. The general goals of breeding are: high yield, good nut quality, and tolerance of disease. Walnut cultivars are divided into two types according to their fruiting age after planting. One is early bearing (lateral fruiting) that blooms and sets fruit in 3-4 years after planting. The other is late bearing (terminal fruiting cultivar), that blooms and sets fruit in 8-10 years. Table 1 lists the cultivars currently being planted in China.

Table 1. The characteristic of cultivars generalized in China

Cultivars	Tree fruiting style	Lateral Fruitfulness (%)	Fruit weight (g)	Kernel weight (g)	Kernel percentage (%)	Shell thickness (mm)	Kernel color
Liaoning 1	Lateral	≥90	9.4	5.6	59.6	0.9	Extra Light
Liaoning 3	Lateral	100	9.8	5.7	58.2	1.1	Light
Liaoning 4	Lateral	≥90	11.4	6.8	59.7	0.9	Light
Liaoning 5	Lateral	≥95	10.3	5.6	54.4	1.1	Light
Liaoning 7	Lateral	≥90	10.7	6.7	62.6	0.9	Extra Light
Liaoning 8	Lateral	≥90	11.3	5.9	52.4	1.3	Extra Light
Xiangling	Lateral	≥81.7	12.2	8.0	65.4	0.9	Light
Lübo	Lateral	≥80	11.0	6.5	59.0	1.0	Extra Light
Fenghui	Lateral	≥89	12.2	7.0	57.7	0.95	Extra Light
Shanhe 1	Lateral	≥47	12.0	7.2	60.0		Extra Light
Xilin 1	Lateral	≥68	10.0	5.6	56.0	1.2	Light
Xinzaofeng	Lateral	100	13.1	6.7	51.0	1.23	Light
Xifu 1	Lateral	≥90	12.5	6.6	53.0	1.2	Light
Zhonglin 1	Lateral	≥90	14.0	7.5	54.0	1.0	Extra Light
Baokexiang	Lateral	≥70	12.0	7.9	60.0	1.0	Extra Light
Beijing 861	Lateral	≥85.5	9.9	6.6	67.0	0.9	Light
Lipin 1	Terminal		9.7	6.7	70.0	0.6	Extra Light
Lipin 2	Terminal		13.5	9.1	67.4	0.7	Extra Light
Jinlong 1			14.85	9.1	61.0	1.1	Light
Jinlong 2	Terminal		15.92	8.9	56.0	1.2	Light

4. Agricultural techniques

4.1 Propagation

Walnut propagation (grafting and budding) has been studied under various conditions and the results differed from one ecological area to another. **Bench grafting** generally achieves

a stable success rate of 80-90%, but this requires more investment and management. It is carried out during winter. **Budding** is a newly adopted method to propagate walnut cultivars even though it has been studied for almost three decades. **Patch budding** has achieved a successful rate of more than 80%. But the success rate not only depends on the ecological environment but also on the weather condition at the site where the budding was carried out. Rain, especially the rainfall around the time when budding is performed, is detrimental. Budding is carried out from the last ten-days of May to the end of June. Even in this time frame frequent rainfall can significantly lower the success rate. The water causes the patch to fail due to bleeding at the union which prevents callus formation. **Top working** is used to graft a desired cultivar on larger tree and is carried out in the spring when the new shoots have grown 5-8 cm long. **Bark grafting** is a common method and can have a high success rate. **Micropropagation** is still on the experimental stage.

4.2 Establishing the walnut orchard and management

Spacing can vary from a minimum of 3 x 3 m to a maximum of 8 x 8 m in new orchards. That depends on the cultivars and conditions. With early bearing cultivars or in poor soil, density can be high. On the contrary, with late bearing cultivars or in good soil conditions, density can be low. The most common training systems for walnut are the central leader training system and the modified central leader training system. Due to less rainfall, most walnuts need irrigation. Generally surface irrigation is applied in China.

The most common walnut disease in China is walnut blight (*Xanthomonas juglandis*) and walnut anthracnose (*Glomerella cingulata* (stonem.) Schr.et .Spauld.). For protection, formulations of copper and sulfur are applied before bud burst.

In China, walnut is harvested over a wide time interval, because walnut is grown in different ecological conditions. Generally, walnut harvest spreads from the beginning of August to the end of September. Hand-harvesting is the most common harvesting method.

5. Walnut exportation from China

In the first 3 decades of the 20th century, China exported 3000 tons walnut kernel to Europe each year. By the 1970s and 1980s, China's walnut exporting volume accounted for half of world walnut trading volume. Since 1986, U.S. has dominated the world walnut trade and taken the place of the role of China in world walnut trading. At present, the total shelled walnut exportation is about 10000 tons every trading year. Major destinations are Europe, Japan, Canada, New Zealand and Middle East. This low exportation quantity is due to the fact that walnut growing is not carried out intensively, and that cultivar standardization was disregarded until recent times. Other factors are the insufficient number of associations of growers, and the lack of a necessary marketing organization implemented by the government. However, the enhancement in the number of standard walnut orchards in the future will result in more profitable and valuable product for export.

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