

'Qinquan 1', a new apomixis walnut cultivar

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'Qinquan 1', a new apomixis walnut cultivar.

Abstract — Introduction. Shanxi province is one of the main walnut production areas in the North of China. The cultivated species mainly belong to a Chinese walnut tree population, named 'Mian Hetao' (*Juglans regia* L.), which reproduces from seedlings. Although the walnut apomixis characteristics were discovered very early and have an important breeding value, this variety has not yet been reported as an important breeding resource. **Cultivar origin.** 'Qinquan 1' is a new cultivar of walnut tree (*Juglans regia* L.), selected in 1982 from walnut seedling resources in the department of Shanxi, in the North of China. This cultivar is characterized by apomixis, the ratio of which can reach 24.7%. After more than 20 years of selection and many local experiments, its characteristics were given and the cultivar was certificated in March 2007. **Cultivar characteristics.** Characteristics of 'Qinquan 1' fruits, trees, development stages, production and the apomixis rate are given. **Main cultural techniques.** Many characteristics of this new cultivar are suitable for its growth in the middle or south Loess Highlands (China), where the annual average temperature is 9~13 °C and rainfall is above 450 mm. The cultivar is also cultivable in the North of China where the soil and climate conditions resemble those of the original area. Other recommendations are given for improving the 'Qinquan 1' tree growth.

China / *Juglans regia* / selection / apomixis

'Qinquan 1', un nouveau cultivar de noyer apomictique.

Résumé — Introduction. La province de Shanxi est l'une des principales zones de production de noix dans le nord de la Chine. L'espèce cultivée appartient principalement à une population de noyers, appelée 'Mian Hetao' (*Juglans regia* L.), qui a été obtenue de semis. Bien que les caractéristiques d'apomixie du noyer aient été découvertes très tôt et qu'elles aient un certain intérêt pour son amélioration, une telle variété n'a pas encore été utilisée en sélection. **Origine de cultivar.** 'Qinquan 1' est un nouveau cultivar de noyer (*Juglans regia* L.) sélectionné en 1982 en collection de noyers dans le département de Shanxi, au nord de la Chine. Ce cultivar est caractérisé par son apomixie qui peut toucher 24,7 % de la production. Après plus de 20 ans de sélection et de nombreuses expérimentations locales, ses caractéristiques ont été déterminées et le cultivar a été certifié en mars 2007. **Caractéristiques de cultivar.** Cette partie présente les caractéristiques des fruits, arbres, stades de développement, production et taux d'apomixie du noyer 'Qinquan 1'. **Techniques de culture principales.** Beaucoup de caractéristiques de ce nouveau cultivar conviennent à sa croissance au centre ou au sud des montagnes du Loess (Chine), où la température moyenne annuelle est le 9 °C à 13 °C et les précipitations dépassent 450 mm. Le cultivar est exploitable également au nord de la Chine où le sol et les conditions climatiques ressemblent à celles de son milieu d'origine. D'autres recommandations sont données pour améliorer la croissance des noyers 'Qinquan 1'.

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Chine / *Juglans regia* / sélection / apomixie

Figure 1.
A 23-year-old 'Qinquan1'
walnut tree.



Figure 2.
Aspect of the nut production of
'Qinquan 1' walnut tree.



1. Introduction

Shanxi province is one of the main walnut production areas in the North of China. The cultivated species mainly belong to a Chinese walnut tree population, named 'Mian Hetao' (*Juglans regia* L.), which reproduces from seedlings. Although the walnut apomixis characteristics were discovered very early [1–4] and have an important breeding value [5], this variety has not yet been reported as an important breeding resource [6].

2. Cultivar Origin

'Qinquan 1' is a new walnut cultivar selected by our research team (Coll. Hortic. Sci., Henan Agric. Univ., Zhengzhou, China) and researched since 1982. It was obtained from selection of seedlings of *Juglans regia* L. in the department of Shanxi, in the North of China. After more than 20 years of selection and many local experiments, its characteristics were given and the Shanxi Province Science and Technology Committee certificated it in March 2007.

3. Cultivar characteristics

'Qinquan 1' is characterized by big fruit size, a thin shell, a full kernel, high production and excellent quality. The nature of its apomixis ratio is very high, reaching up to 24.7% on average. It still kept a high occurrence frequency in some years when apomixis ratios of other varieties were very low.

The tree of 'Qinquan 1' (*figure 1*) has strong vigor with a naturally round and open form. Young shoots are dark green and annual branches are silver-gray with middle dense lenticels and without hairs. The complex buds are mainly round, fairly large and with a dark brown top. The pinnate leaves have 9 to 15 small blades on each one. The latter are oblong, cogged, a little pointed and with a light green and glossed color, with a 2.3-cm-long petiole. Staminate inflorescences are 7.5 cm long and stigmas of female flowers are yellow-green. Green fruits are round (*figure 2*), yellow-green, without hairs, and covered with dense and yellow dots. Fruit petioles measure 3 cm; pericarps are 0.6 cm in thickness. Nuts are large and round, yellow, with a not very accentuated mucron and a flat bottom (*figures 3, 4*). Their surface is smooth and light-colored, and the shell is thin. Kernels are full and plump, with light yellow skin, releasing fragrance.

A mother branch can produce on average 1.8 small shoots in production: 70% of the shoots in production can give fruits. A shoot can form on average 1.7 small fruits, and

90% of them can become ripe. Moreover, 'Qinquan 1' has a strong continuous fruit-setting ability.

'Qinquan 1' pushes at the beginning of April in Zuoquan, in the center of Shanxi, a little later than the other cultivars. In mid-April, the staminate flowers open and disperse pollen, and blooming can continue for 6 to 8 days. After 3 to 5 days, the female flowers begin blooming and this lasts for 7 to 10 days. Therefore, the cultivar belongs to the protandry type but the female and male flowers may meet partially. Lateral branches of 'Qinquan 1' can bear fruit; the rate of fruit-bearing lateral branches varies from 28.9% to 31.5% of the trees pertaining to this cultivar. Young shoots grow rapidly in late May, and stop growing in mid-June; in late June, physiological drop of fruits may happen, but less than for other cultivars. This cultivar has stable apomixis characteristics; the average rate is 24.7% and the highest rate reaches 72.9%.

Fruits start to mature in mid-September, and the total growth lasts about 125 days. Defoliation occurs at the beginning of November or at the end of October, and the vegetative growth thus lasts approximately 210 days.

Grafted 'Qinquan 1' start fruiting in the 3rd year, and the economic fruiting period is in the 5th year. About 0.23 kg of kernel·m⁻² of covered surface is produced. The nut surface is smooth; the suture line is narrow and even joined closely.

The average walnut diameter is 3.24 cm, single fruit weight 10.3 g, and shell thickness 1.18 mm. The entire kernel is easily taken out; it appears yellow and white and smells fragrant. The kernel rate reaches 55.2% of the entire nut. 'Qinquan 1' is a late-fruit walnut; it resists drought, and walnut black spot disease and anthrax, and, moreover, it tolerates infertility.

Three main characteristics – apomixis ratio, single fruit weight and unit area production – were studied with a *t* test. The results indicated that the single fruit weight difference was not significant, but the other two characteristics reached the significance level.

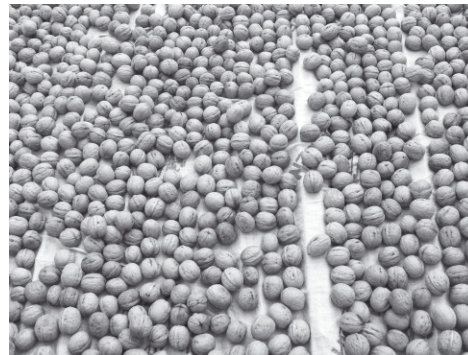


Figure 3. Nuts of 'Qinquan 1' walnut tree.



Figure 4. Details of nuts of 'Qinquan 1' walnut tree.

4. Main cultural techniques

The 'Qinquan 1' cultivar crown is bigger and higher than the crown of early-fruiting cultivar walnut. There are many characteristics such as the long full bearing period advantageous for its management, the stable production, the strong resistance, the excellent quality and so on, which are suitable for walnut growth in the middle or south Loess Highlands, where the annual average temperature is 9~13 °C and rainfall is above 450 mm. The cultivar is also cultivable in the North of China where the soil and climate conditions resemble those of the original area.

A plant density of spacing 4 m × 5 m or 6 m × 6 m may be adopted, or 3 m × 4 m at first, then 6 m × 8 m after intermediate cuttings. When young trees are vigorous, an early pruning could be adopted to control the crown volume. 'Zhonglin' and 'Liaohe' walnut tree series, new cultivars bred by

Chinese plant breeders, can be chosen as pollination cultivars. 'Qinquan 1' can be grown according to conventional management but, in the arid mountainous area, half of the flower buds of full production trees may be castrated before the beginning of flowering, which may raise the percentage of fruit set.

Basic fertilizers can be applied; nitrogenous fertilizer can be efficient before flowering, and 0.25 kg per tree of phosphorus and potash fertilizer compound can be added during flower bud differentiation.

In countries with a cold and windy spring, young trees must be protected. Weeds should be paid great attention, in addition to irrigation and fertilization management.

Information

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References

- [1] Schanderl H., Untersuchungen über die Blütenbiologie und Embryonenbildung von *Juglans regia* L., Biol. Zentrablatt 83 (1964) 71–102.
- [2] Loiko R.E., Apomixis of walnut, Acta Hort. 284 (1990) 233–236.
- [3] Spillane C., Steamer A., Grossnilaus U., Apomixis in agriculture: The quest for clonal seeds, Sex Plant Reprod. 14 (2001) 179–187.
- [4] Zhang Mei-Yong, Xu Ying, Ma Feng-Xian, Apomixis ability of *Juglans regia* L., J. Fruit Sci. 17 (2000) 314–316.
- [5] Badalvo P., The use of methods of hybridization and apomixis for obtaining the perspective forms of walnut, For. Prod. 12 (1983) 24–25.
- [6] Wu Guo-Liang, Chen Yan-Hui, Zhang Peng-Fei, Yang Jun-Qiang, Song Yu-Qin, Apomixis and new selections of walnut, Acta Hort. 760 (2007) 541–548.

'Qinquan 1', un nuevo cultivar de nogal apomítico.

Resumen — Introducción. La provincia de Shanxi es una de las principales zonas de producción de nueces en el norte de China. La especie cultivada pertenece principalmente a una población de nogales, llamada 'Mian Hetao' (*Juglans regia* L.), que fue obtenida mediante siembra. A pesar de que las características de apomixis del nogal fuesen descubiertas muy pronto y que posean un cierto interés para su mejora, nunca se ha empleado una variedad de estas características en selección. **Origen de cultivar.** 'Qinquan 1' es un nuevo cultivar de nogal (*Juglans regia* L.) seleccionado en 1982 en una colección de nogales en el departamento de Shanxi, en el norte de China. Dicho cultivar se caracteriza por su apomixis, que puede alcanzar el 24,7 % de la producción. Tras más de 20 años y de numerosos experimentos locales, sus características se determinaron y el cultivar fue certificado en marzo de 2007. **Características de cultivar.** Esta parte presenta las características de los frutos, de los árboles, de los estados de desarrollo, de la producción y del índice de apomixis del nogal 'Qinquan 1'. **Técnicas de cultivo principales.** Son numerosas las características de este nuevo cultivar que convienen a su crecimiento en el centro o en el sur de las montañas del Loess (China), en donde la temperatura media anual es de 9 °C a 13 °C y las precipitaciones superan 450 mm. El cultivar es explotable igualmente en el norte de China, donde el suelo y las condiciones climáticas se asemejan a las de su medio original. Se dan otras recomendaciones para mejorar el crecimiento de los nogales 'Qinquan 1'.

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