



# A New Chinese Chestnut Cultivar "huaqiao 2" Characteristics, Orchard Environment Effect and Industry Standard System

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**Abstract:** "huaqiao 2" is a new chestnut (*Castanea mollissima*) cultivar developed from seeding tree by Xiangtan Research Institute of Forestry Sciences. Xiangtan Research Institute of Forestry Sciences has built some successful "huaqiao 2" chestnut orchards and professional cooperatives, chestnut orchard can effectively improve environmental quality and provide fruit, professional cooperatives use standardized production.

**Keywords:** A New Chestnut Cultivar, "huaqiao 2" Chestnut, Characteristics, Orchard Environment Effect, Industry Standard System

## 1. Introduction

"huaqiao 2" is from Chinese chestnut seedling breeding [1]. Chinese name: "huaqiao 2". It belongs to Plantae, Angiospermae, Dicotyledoneae, Balanopsidales, Cupuliferae, *Castanea*, Chinese chestnut. Distribution region: Hunan province of China. Cultivated species: Huaqiao chestnut 2. Application date of variety right: June 29, 2011. Authorization date of variety right: December 26, 2012. Number of variety right: 20120132. Variety right owner: Xiangtan Research Institute of Forestry Sciences. Cultivation people: Yingqiu Tian etc. Authorized department: The People's Republic of China State Forestry Bureau. It comes into blossom 2-3 years after planting. It has early maturity, good quality, glossy surface. The average mass of fruit is 16.2g. The yield is 6900kg·hm<sup>-2</sup> (yield of test tree), with high and stable yield, and suitable for planting in the neutral to acidic gravel soil. Huaqiao chestnut originated in xiangtan county, it is seed breeding community. it is famous in xiangtan city and in hunan province, it is the main local specialty in hunan province. Huaqiao chestnut breeding and cultivation technology research team was established in xiangtan research institute of forestry sciences in 1996. Growth habit of new chestnut cultivar "huaqiao 2" is described[2]. The results show that new chestnut cultivar "huaqiao 2" has many good attributes, such as early maturity, big size of the nut, high

resistance, easy management, fruitfulness and high economic value as well. It has a promising perspective for development in the central hunan as an excellent local variety [3]. According to the present situation of Chinese chestnut, the breeding of varieties should be strengthened, breeding characteristic variety, meet different needs [4].

## 2. Certificate of Plant New Variety Rights

The State Forestry Administration according to the regulations on the protection of new varieties of plants in People's Republic of China, approve the granting of new varieties of plants. Valid For 20 years (see Figure1). A unit or an individual that had accomplished the breeding enjoyed an exclusiveright in their right-granted variety. The right of the new plant variety is a new kind of intellectual property. The right to new varieties of plants must be balanced with the interests of farmers. Though the current law made regulations on the behavior and intellectual property of infringing the plant variety right, it still is not comprehensive and lacks vigor. Thus, it is necessary to research on the protection of new plant variety rights in China. Compared with advanced countries, the plant variety rights protection in China started pretty late, but the protection system has been improved by the stipulations of relevant laws and regulations and thus the application for the plant variety rights protection keeps

increasing. However, the birth of new varieties of plants is along with the infringement, and with the new varieties of

plants growing role in economic development, such violations is more and more.



Figure 1. Certificate of plant new variety rights.

### 3. Nut Characteristics and Phenological Phase

The average nut weight is 16.2g, it is a large oval nut, red brown, shiny, hairy, easy to peel. Nut kernel rate is 81.8% [5]. Germination on the first 10 days of March, female flower appear at the end of April, full-bloom period is on the first and behind 20 days of May, fruit-growth period is from middle 10 days of June to first 10 days of August, fruit ripe period is from the end of August to the first 10 days of September, deciduous period is on the middle and behind 20 days of November [6].

### 4. Nutrient Component Comparison

The field test of four chestnut varieties were conducted to compare their nutrient component in Yun-hu-qiao town, Xiangtan county, Hunan in 2006. The nutrient component includes starch, crude protein, total sugar, water content, crude fat and so on (see table 1). Experimental results show: The crude protein and total sugar of "huaqiao 2" are higher than other contrast varieties.

The nutrients of ripe chestnut were fully accumulated, so they had better storage trait. "huaqiao 2" large grain chestnut fruit, rich in nutrition, is well known for both inside and

outside the province, one of the best-selling products.

Table 1. Nutrient component comparison.

	huaqiao 1	huaqiao 2	tielitou	shuangji
Starch (%)	29.3	29.0	32.1	30.5
crude protein (%)	4.9	6.5	4.9	5.2
total sugar (%)	7.4	6.9	5.7	5.0
water content (%)	46.7	50.0	47.1	52.4
crude fat (%)	3.1	3.5	3.5	3.5

The above test data are based on wet basis. Sample source location: Yun-hu-qiao town, Xiangtan county, Hunan. Data analysis unit: the center for food testing and analysis of the agricultural products processing research institute of Hunan province. Data analysis time: September 14, 2005.

### 5. Variety Comparison

The field test of four chestnut varieties were conducted to compare their yields and correlated characters in Yun-hu-qiao town, Xiangtan county, Hunan from 1999 to 2006. Forestry experiment plot is the base for breeding improved varieties, improved culture technology and variety comparison test. The survey includes crown width, tree height, single plant cone number, cone weight per plant, nut weight per plant, cone weight per square meter, nut weight per square meter, single

nut weight, cone contains nuts rate, nut maturation rate, nut near maturation rate, borer damage rate and so on (see table 2).

Experimental results show: "huaqiao 2" chestnut tree is tall and big, high yield, big nut, early maturity, worm fruit less.

Table 2. Variety comparison.

	huaqiao 1	huaqiao 2	tielitou (contrast)	shuangji (contrast)
crown width (m <sup>2</sup> )	6*5.6	5.5*4.4	4.4*4.4	4.7*5.2
tree height (m)	6.6	5.6	4.4	4.9
single plant cone (individual)	317	498	489	304
Cone weight per plant (kg)	37.3	41.2	—	—
Nut weight per plant (kg)	11.9	13.7	—	—
Cone weight per square meter (kg)	1.1	1.7	—	—
Nut weight per square meter (kg)	0.35	0.57	0.48	0.26
Single nut weight (kg)	15.6	16.2	10.5	6.6
Cone contains nuts (%)	31.8	33.3	—	—
Maturation rate (%)	24.1	82.9	0	0
Near maturation rate (%)	73.1	17.1	0	0
Borer damage rate (%)	14	2	—	—

Weather condition: sunny, no wind. Survey location: Yun-hu-qiao town, Xiangtan county, Hunan, China. Investigator: Yingqiu Tian et al. Investigation time: August 29, 2006.

6. Production Technology Research

"huaqiao 2" and"shaoyang tali" are excellent chestnut cultivars in Hunan province. Taking "huaqiao 2" and "shaoyang tali" as the research object, comparative study on breeding, natural condition, characteristics etc, "huaqiao 2" and "shaoyang tali" have certain similarities and have their own advantages and disadvantages. Suggestions to foster strengths and avoid weaknesses, passing the implementation of industrialization of Chinese chestnut to achieve chestnut industry development in Hunan province[7]. For propagation of rootstocks, plants derived from direct seed-sowing either in winter or spring grew better than plants transplanted in spring. Grafting with one-year-old rootstocks in autumn was the best, while grafting with two-year-old transplanted rootstocks in spring was inferior, although the latter could also achieve reasonably good nursery plants[8]. In order to seek high-efficient, practical and simple grafting methods, to establish scientific and effective technology system of raising seedlings by grafting, and to achieve the intensive cultivation of "huaqiao 2" chestnut, the grafting techniques of "huaqiao 2" chestnut were studied through experiments, including Autumn grafting and Spring grafting. Taking “huaqiao 2” chestnut grafted seedlings as the research object, through the investigation of the rootstock grafted seedlings ground diameter, new branch diameter and length, survival rate and other content, established the rootstock grafted seedlings ground diameter, new branch diameter and length relationship equation, the chestnut Spring and Autumn grafting were compared. The results show that: Fall and Spring grafting require that the rootstock diameter is in 0.5cm above, in favor of grafting operation and growth of the seedlings. Survival rate of Autumn grafting is better than that of the Spring

grafting [9]. In order to find the relationship between diameter of the new branch and the length of the new branch, two kinds of grafting methods in Spring and Autumn on "huaqiao 2" were compared. Taking the grafted seedlings of "huaqiao 2" as the research object, diameter of the new branch and the length of the new branch were studied in this research. The results are shown as follows: The relation of length and diameter of new branch of grafting in Autumn:  $y = 43.838\text{Ln}(x) + 75.439$ ,  $r = 0.9550$ ; the relation of length and diameter of new branch of grafting in Spring:  $y = 45.869\text{Ln}(x) + 83.612$ ,  $r = 0.9486$ . Two kinds of grafting methods in Spring and Autumn were compared, diameter of the new branch and the length of the new branch are same [10].

Research work of "huaqiao 2" got help from the Central South University of Forestry and Technology and made a number of scientific and technological achievements. Results registration number: 943Y20060340 and 943Y20130689. The local standard of chestnut was established: Construction Technology Regulations of Cutting Orchard of Castanea mollissima "huaqiao 2" and Technological Standard of Nursery and Cultivation for Improved Variety of Huaqiao Chestnut [11]. No affecting on growth and fruit of using seedling branches scion on chestnut adult tree, To solve the problem of insufficient supply of scion [12]. The team continue to strengthen the breeding research work of huaqiao chestnut clones, has made gratifying achievements [13].

7. Environmental Effect of Huaqiao Chestnut Orchard

Experimental results show: chestnut orchard has cooling effect; chestnut orchard has moistening effect; chestnut orchard has the effect of increasing negative oxygen ion concentration; chestnut orchard has the effect of reducing positive oxygen ion concentration. Chestnut orchard can effectively improve environmental quality (see table 3).

**Table 3.** Environmental effect of chestnut orchard.

Test location	time	temperature (degree)	humidity (%)	negative oxygen ion concentration (individual/cm <sup>3</sup> )	positive oxygen ion concentration (individual/cm <sup>3</sup> )
Chestnutorchard (green seedlings in the orchard)	10:05	29.4	88.7	384	257
Chestnutorchard (no other crops in the orchard)	9:02	28.8	95.0	374	147
Empty land (there are weeds in empty land)	9:21	31.8	80.7	284	293

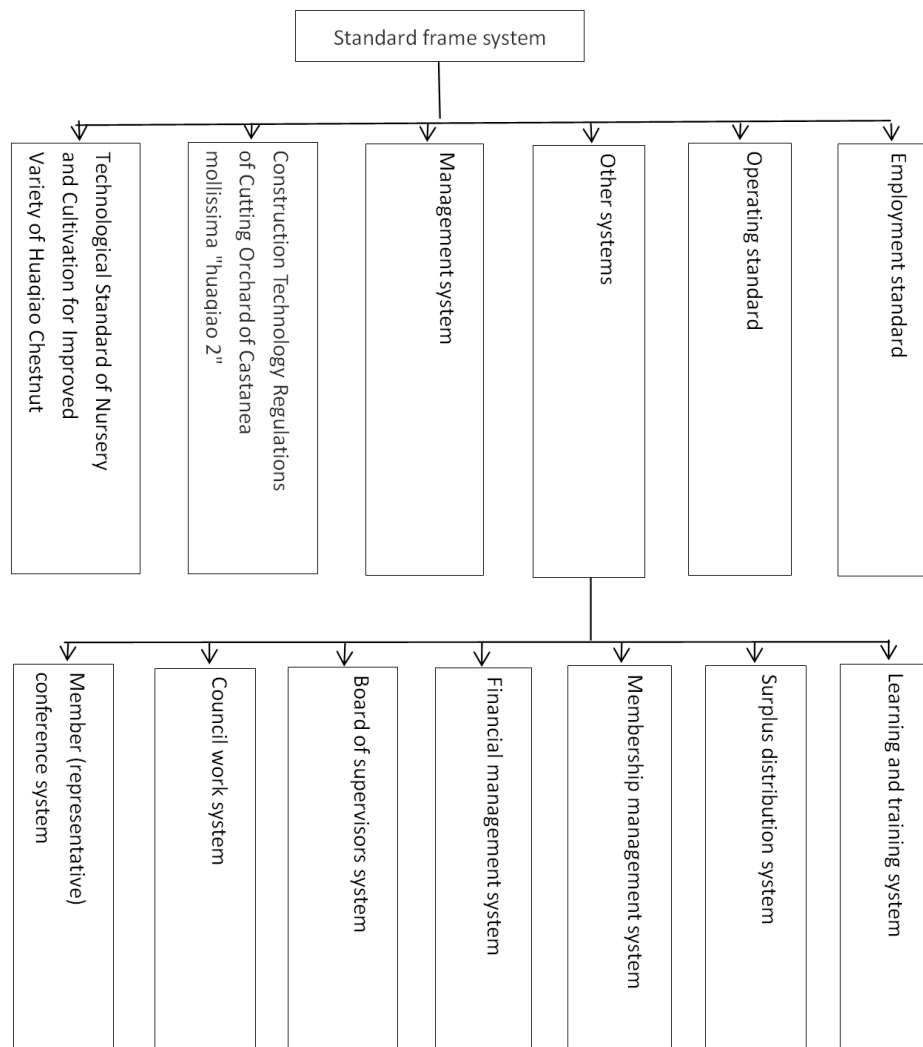
Instrument placement height: 1.5 meters off the ground, instrument air inlet to peak. Weather condition: sunny, no wind. Survey location: Shaoshan, Hunan, China. Investigator: Yingqiu Tian et al. Investigation time: June 13, 2016.

Chestnut trees are green plants. Sunlight encourages the growth of green plants. It is thanks to the green plants that the air is full of free oxygen. Green plants synthesize carbohydrates from carbon dioxide and water. At the same time, the introduction of green plants is also greatly improved the high-level construction of micro-climate. If green plants

should disappear some day, there would hardly be any life on the earth. The green plant is a kind of food factory.

## 8. Huaqiao 2 Chestnut Manufacturer's Standard

The following frame system is "huaqiao 2" chestnut cooperatives using standard(see Figure 2).

**Figure 2.** Huaqiao 2 chestnut manufacturer's standard.

Since the new management system was put into effect, the production of this cooperatives increased tremendously. Huaqiao 2 chestnut cooperatives has a complete organizational setup, management and risk control systems.

Comprehensive budget management is a scientific management system to strengthen internal management, market adaptability and competitiveness. As a special business subject, the agricultural cooperative has some

characteristics about the distribution of surplus comparing to profitable firms, the investment risk is big, the investment time is long, the income is slow and so on, but with a relatively stable income, benefit from a long time, the technology is not difficult, etc. Professional cooperatives play an important role in increasing employment, increasing farmers' income and promoting industrial development.

## 9. Conclusion

"huaqiao 2" chestnut was succeeded in the examination by hunan province forestry good varieties organization committee in 2007, number: hunan S0730 – cm9. "huaqiao 2" chestnut was approved by the State Forestry Bureau in 2012, number: 20120132. 2 scientific and technological achievements obtained science and technology progress prize of city. The two local standards of Huaqiao chestnut are established. Two huaqiao chestnut professional cooperatives are founded. A "huaqiao 2" chestnut seedling base is founded. A "huaqiao 2" chestnut cutting orchard is founded. Taking four national promotion demonstration projects of huaqiao chestnut, taking three hunan province projects, 15 articles which studied science and technology of huaqiao chestnut have been published, a monographs. In a word, "huaqiao 2" chestnut is a good variety, chestnut orchard can effectively improve environmental quality and provide food, professional cooperatives use standardized production.

## 10. Discussion

At present, the Chinese chestnut processing technology is not advanced, still in the primary stage, and is plagued by some major problems such as lower selling prices of fresh products and easy to decay. The removing of shell and inner cover of Chinese chestnut, the first working procedure in chestnut deep processing, is always the technique difficulty to be resolved, which has become a restricting factor in Chinese chestnut processing industry. Chestnut processed foods include: Chinese chestnut drink, chestnut can, fast-dissolving instant chestnut powder, chestnut puree, chestnut milk, chestnut jam, stir-frying chestnut, chestnut pastry and so on.

A new variety is an industry, which is rich in the resources of chestnut varieties, and is a good breeding material. Planting chestnut trees is conducive to environment and society. Research group should strengthen the research of varieties, high yield technology, storage and processing. Persist in innovation and breakthrough. Continue to improve the cultivation and research varieties, and continue to do well the new varieties promotion. Increasing the storage and processing research, do a good job in chestnut ball bract and male flowers resource reuse. Do well enterprise and brand. Do a good job in the application of national geographical indication product protection of huaqiao chestnut [14]. Research group would like to introduce foreign technology and talent. Including molecular breeding, plant extraction (flower and shell), chestnut processing, machinery and equipment, etc. Foreign experts can also learn from research

group. "huaqiao 2" new varieties are very good, produced a very good economic benefits. Research group has always been committed to international exchanges and cooperation and scored positive results.

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