



# Introduction Performance and Cultivation Techniques Of 'Huami No.2' Huangpi in Chaozhou City

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## Abstract

Chaozhou Fruit Research Institute introduced 'Huami No.2' Huangpi from South China Agricultural University of Guangdong Province in 2017. Through years of cultivation, the botanical characteristics, biological characteristics and fruit traits of 'Huami No.2' Huangpi were observed and studied, and the key points of cultivation techniques suitable for local promotion were summarized.

## Keywords

'Huami No.2' Huangpi; Introduction; Cultivation techniques

Yellow peel, scientific name [*Clausena lansium* (Lour.) Skeels], also known as yellow loquat, yellow marble, king jar, oil skin, oil plum, etc., belongs to the genus *Clausena* in the Rutaceae family. Burmf.) is a fine fruit tree native to southern China, with a long history of cultivation. Currently, kumquats are cultivated in Guangdong, Fujian, Guangxi, Hainan, Yunnan, and Taiwan.

The fruit of the kumquat is rich in nutrients. Every 100g of fresh fruit contains 1.0g of protein, 0.2g of fat, 14.9g of carbohydrates, 50mg of calcium, 25mg of phosphorus, 0.7mg of iron, and 39mg of vitamin C [1]. It also has the effects of strengthening the spleen and appetite, eliminating phlegm and transforming qi, moistening the lungs and relieving cough, and removing malnutrition. The seeds can treat hernias, and the peel can eliminate wind swelling and remove malnutrition. Therefore, there is a saying among the people that "eat kumquats when you are full and eat persimmons when you are hungry" [2]. In addition to being eaten fresh, the fruit can also be processed into jelly jam, candied fruit, cold fruit, fruit cakes, and beverages, which are deeply loved by consumers. In addition, the kumquat tree is strong, adaptable, easy to manage, has few diseases and pests, produces high and stable yields, has strong cold resistance, and has a long economic life. It is a fruit with high economic benefits and great development prospects.

Wongpi (Kumquat) is a distinctive fruit of Chaozhou City. Its fruit can be processed into candied fruit, preserved fruit, and jam. Wongpi fermented black bean curd, one of Chaozhou's three famous treasures, is made from the fruit. Currently, the area of Wongpi cultivation in Chaozhou City covers approximately 15,000 mu (approximately 16,000 acres), primarily the black-skinned and yellow-skinned varieties. With rising living standards, Wongpi fruit has become increasingly popular with consumers. Amidst fierce market competition, Wongpi prices have steadily risen, boosting production efficiency and expanding the area and scale of cultivation, moving from scattered plantings in front of and behind houses to large-scale, commercialized, and continuous planting. Despite its long history of cultivation in Guangdong, Wongpi has been relatively limited in variety and has several drawbacks. For example, the

predominantly black-skinned Wongpi variety suffers from small fruit size and a sour taste. Furthermore, systematic and standardized cultivation and management practices are lacking, hindering the full economic benefits of Wongpi cultivation. The 'Huami No. 2' kumquat is a high-yielding, mid-ripening variety with an average single fruit weight exceeding 10 grams. It boasts a beautiful skin color, tender flesh, a moderately sweet and sour taste, a rich aroma, and few seeds. Its excellent overall growth characteristics make it suitable for regional cultivation. The introduction of 'Huami No. 2' has increased the diversity of kumquat varieties in the region, improved and enriched the local kumquat varieties, and adjusted the regional kumquat industry structure to meet market diversification. Furthermore, by combining appropriate cultivation techniques, it can better leverage the variety's advantages, improve kumquat production and economic benefits, thereby encouraging local fruit farmers to cultivate improved kumquat varieties and promoting the development of the region's kumquat industry.

## 1. Overview of the Experimental Field

The experiment was conducted in the Huangpi variety conservation demonstration garden of the Chaozhou Fruit Research Institute. Located at 24°10' north latitude, the garden enjoys a southern subtropical monsoon climate with an average annual temperature of 21-22°C, a minimum temperature of 1-2°C, an average annual sunshine of 1900-2400 hours, annual rainfall of 1800-24 mm, and a frost-free period of more than 355 days. The orchard soil is slightly acidic, with moderate fertility, good drainage and irrigation, and moderate cultivation and management conditions.

## 2. Test Methods

In 2017, we imported 'Huami No. 2' yellow-peeled cultivar from South China Agricultural University in Guangdong Province. We grafted seedlings previously grown in the experimental plot, planting them at a row spacing of 3.3 meters and a plant spacing of 2.6 meters. We observed and recorded their growth characteristics and phenological periods annually, and analyzed their fruit quality.

## 3. Results and Analysis

### 3.1 Botanical characteristics

A normal, mature, fruit-bearing tree of the 'Huami No. 2' yellow bark has a rounded crown, an upright stance, and medium vigor. The trunk is gray-brown with a rough surface texture. The average main axis length of the compound leaves of the current-year, mature autumn shoots of the 'Huami No. 2' yellow bark is 11.4 cm, the average petiole length is 1.1 cm, and the average diameter of the petiole is 2.83 mm. The petiole is gray-green and rounded. The leaflets are planar and alternate, oblong in shape, with a broad cuneate base, a slightly wavy margin, and a pointed apex. The average petiole length is 0.5 cm, the average leaflet length is 7.8 cm, and the average width is 3.8 cm. The leaf shape index (length-to-width ratio) is 2.05. The leaves are glossy, green, glabrous, and green on the underside. The inflorescence has a green main axis, white-green obovate buds, yellow-white lip-shaped petals, free stamens, oval yellow anthers, a spherical ovary with a heavily hairy surface, an erect, lightly hairy style, and a free yellow-green calyx.

### 3.2 Biological characteristics

#### 3.2.1 Growth habits of branches and shoots

Young 'Huami No. 2' yellow-bark trees typically produce four new shoots per year, becoming fruit-bearing and prolific trees after two years. Mature trees normally produce three new shoots per year, beginning with autumn shoots after fruit harvest, with the last autumn shoot emerging in this region typically in mid-to-late October. If mature trees can manage to keep their last autumn shoot emerging around mid-to-late October, winter shoots are generally difficult to produce. However, under unusual circumstances such as heavy rainfall and high winter temperatures, and if the plant is overly vigorous, winter shoots are more likely to emerge. Once winter shoots emerge, they will not mature sufficiently to become fruiting branches the following year, and they will deplete the tree's organic nutrients. Even if flowers appear the following year, their quality will be relatively low, affecting yields and causing a reduction in production. Therefore, if winter shoots are detected, they should be removed manually and the tree sprayed with a 600-fold dilution of 25% paclobutrazol suspension concentrate plus 100 grams of potassium dihydrogen phosphate diluted with 50 kilograms of water to inhibit winter shoots.



Figure 1. Huami No. 2 yellow-skinned fruit-bearing tree.

### 3.2.2 Flowering and fruiting habits

In this region, the yellow-peeled 'Huami No. 2' variety typically begins flower bud differentiation after December, with buds appearing in late January of the following year. Heading occurs from late January to late February, initial flowering occurs in mid-March, peak flowering occurs from late March to early April, final flowering occurs in mid-April, and anthesis ends in late April. Small fruiting occurs from late April to early May, with fruit expansion beginning in mid-to-late May to early June. Fruit color changes gradually in early June, starting with green at the base and then gradually transitioning from yellow-green to yellow-brown at the top. The skin turns light yellow-brown from late June to early July, becoming thinner and rounder, signaling near maturity. In mid-to-late July, the skin turns yellow-brown, and the soluble solids content reaches approximately 20.0%, marking maturity.



Figure 2. Yellow-skinned fruit of Huami No. 2.

### 3.3 Fruit characteristics

'Huami No. 2' yellow-skinned fruit is oval in shape, with an average weight of 10.5g per fruit, a longitudinal diameter of 29.15mm, and a transverse diameter of 20.94mm. The peel is yellowish-brown with visible rust and oil cells, and a small amount of hair. The peel tastes bitter with a slight spicy kick. The average seed weight is 1.62g, the average peel weight is 1.48g, and the peel is 0.55mm thick. The flesh is waxy white, soft, tender, and crumbly. It is juicy, sweet, slightly sour, and has a rich aroma. The edible content is 71.31%, the soluble solids content is 17.31%, the total sugar content is 11.3%, the reducing sugar content is 7.9%, the total acid content is 1.66%, and the vitamin C content is 512mg · kg<sup>-1</sup>.

## 4. Key Points of Cultivation Techniques

### 4.1 Planting and garden establishment

#### 4.1.1 Garden selection

'Huami No. 2' yellow peel is highly adaptable to sunlight, preferring full sun and tolerant of partial shade, but not excessive shade. It is also not very particular about soil, adapting to red loam, sandy loam, and gravelly soils. Therefore, it is best to plant it in an open, sunny area with good drainage and irrigation, rich in organic matter. This will ensure strong growth, high yields, and a long lifespan.

#### **4.1.2 Planting at the right time**

According to the growth characteristics of yellow peel, spring planting (March-April) is the best time for planting, and autumn planting (September-October) is also an option. The seedling specifications require that the diameter of the main trunk of the grafted seedling is 1 to 1.5 cm at 10 cm from the ground or the diameter of the grafting point is 0.8 cm, the seedling height is more than 40 cm, and it is healthy, free of pests and diseases, and the last branches are fully mature. The planting density is generally 4m × 5.5m or 4m × 4m. Before planting, dig a planting hole with a length, width and depth of 0.6m × 0.6m × 0.5m. Fill the base fertilizer, apply 1.5kg of bean cake powder + 0.75kg of phosphorus powder, or 25kg of soil and miscellaneous fertilizer to each hole. Backfill in layers, and each layer must be mixed with soil. Finally, it is cultivated into a planting hole with a diameter of 0.6m and a height of 0.2m [4]. The best temperature for transplanting is 20-25°C. After transplanting, water the tree enough to establish roots. Cover the tree tray with grass to keep it moist. Keep the soil in the planting hole moist for 30-60 days after transplanting.

#### **4.2 Shaping and pruning**

To cultivate an ideal crown for the yellow bark tree, timely shaping and pruning are required. After the young trees are established and survive, they can be topped or pruned at about 50 cm from the trunk. When the new shoots grow to about 15 cm, they can be topped. After that, 3 to 4 branches with relatively balanced growth and even distribution of orientation can be selected from the primary main branches. When the main branches mature and grow to about 30 cm, they can be topped or pruned again to promote branching. After that, 2 to 3 strong branches can be selected as secondary main branches each time they branch. After 2 to 3 years, a natural round crown with light transmission and ventilation can be formed. Pruning of adult fruiting trees is mainly carried out after the fruit is harvested. The main purpose is to cut off weak branches, dead branches, diseased and insect-infested branches, and inner branches, and to shorten the original fruiting branches to promote the timely sprouting of autumn shoots.

#### **4.3 Flower and fruit management**

##### **4.3.1 Thinning flowers and fruits**

The first flowering period of the 'Huami No. 2' yellow peel in this region is mid-March, the peak flowering period is late March to early April, the last flowering period is mid-April, and the flowering period ends in late April. Excessive fruiting can easily lead to small or uneven fruit sizes, so it is important to pay attention to flower and fruit thinning. After the first flowering period and before the peak flowering period, about 1/3 of the flowers at the top of the flower spike can be cut off; fruit thinning should be carried out 25 to 30 days after the flowering period [3].

##### **4.3.2 Harvest at the right time**

The small fruit period for the 'Huami No. 2' yellow peel in this region is from late April to early May, with fruit expansion from mid-to-late May to early June, and ripening in mid-to-late July. Harvesting is still premature in late June and early July, when the peel turns light yellowish-brown and the acidity is strong. Mid-to-late July, when the peel turns yellowish-brown, is the ideal harvest period, with soft, tender flesh, a sweet, slightly sour taste, and a soluble solids content of up to 20.0%. The yellow peel of the 'Huami No. 2' fruit generally maintains peak quality for about a week on the tree. If the peel turns dark brown to bronze, the fruit becomes soft and wrinkled, indicating it is overripe.

#### **4.4 Fertilizer and water management**

Fertilization of young trees should follow the principle of frequent and thin fertilization. After the trees have been established and have grown mature, thin manure water or 0.2% urea water can be applied once before each bud sprouts and during the greening period, using the "one shoot, two fertilizers" method to promote and cultivate strong shoots [5]. Fruit trees should be fertilized 3 to 4 times a year, mainly before and after budding, after flowering, and after fruit picking. Organic fertilizers are mainly used, supplemented with appropriate amounts of compound fertilizers. Before and after budding and after flowering, bran cake fertilizers and compound fertilizers can be diluted with water and applied for drench application. Heavy fertilizers can be applied after fruit picking to promote tree recovery and the growth of autumn shoots. Chicken manure or sheep manure can be used for deep ditch application. For individual trees with poor tree vigor and many fruits, the amount of fertilizer should be appropriately increased to promote tree recovery and the growth of autumn shoots.

## 4.5 Pest and disease control

### 4.5.1 Diseases

#### 1. Tip rot

The disease is most common during the young shoot growth period of yellow peel. For prevention and control, you can use 25ml of 5% emulsifiable concentrate avermectin + 80g of 25 % wettable powder prochloraz and carbendazim diluted with 50kg of water for spraying.

#### 2. Anthrax

60% Biotide 1200mg /L or 10% Seco 750-500mg /L dilution can be sprayed [4].

#### 3. Stem base root rot

Yellow bark root rot, also known as foot rot or skirt rot, primarily affects the stem base and roots. To prevent and control it, first remove the soil near the affected area and scrape off any necrotic and rotten parts with a knife (reaching the wood). Then, apply a 150-fold dilution of 20% copper rosinat solution to the affected area. Repeat the application with the same solution and dosage two weeks later for a significant preventive effect.

### 4.5.2 Pests

Local insect pests are primarily fall armyworms, followed by aphids, wax moths, mealybugs, and scale insects. For pest control, spraying with a combination of imidacloprid, abamectin, chlorpyrifos, and acetamiprid can help curb their spread.

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