

‘Yuguan’, a Late-ripening Apple Cultivar in China

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‘Yuguan’ (Chinese name, which means that its surface is as smooth as jade and its quality is excellent) is a new late-ripening apple cultivar of high quality derived from a cross of ‘Golden Delicious’ × ‘Fuji’. The fruit is cylindrical, and its surface is smooth, waxy, and golden yellow. The flesh is light yellow, with a fine, crisp, and juicy texture and a sour–sweet flavor, and the aroma is strong and pleasant. Average fruit weight is ≈ 330 g, soluble solid content is $\approx 15.3\%$, titratable acid content is $\approx 0.52\%$, and flesh firmness is ≈ 8.6 kg·cm⁻². In the Changli area (lat. 39°22’N, long. 118°45’W), the fruit is best harvested in late October. ‘Yuguan’ exhibits resistance to *Glomerella* leaf blotch, based on both field resistance evaluation and molecular marker detection. This new cultivar is suitable for the fresh-fruit market because it has good eating quality off the tree as well as after cold storage for 6 months at 4 °C.

Origin

‘Yuguan’ is a new late-ripening cultivar derived from a cross of ‘Golden Delicious’ × ‘Fuji’ (Hebei Academy of Agricultural and Forestry Sciences 1985) performed in 2001 at an orchard in Changli County, China. A total of 5128 seeds were collected and sown in an apple nursery in early April of the following year, and these seedlings were transferred to an open-field nursery in May 2002. The fruit of this combination were first evaluated in 2006. ‘Yuguan’ (Series No. 0103-H5-101) was selected in 2009 because of its attractive appearance and excellent flavor. Ten or more ($n = 100$) trees budded onto SH₆ dwarf rootstock were planted in 2010 for phase 2

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group (RHS 200A) and present numerous oval lenticels.

Leaves are oval and exhibit a sharp apex and upward folding. The upper surface is leathery, and the lower surface is pubescent. The average blade length (of 20 blades) is ≈ 99.19 mm, and the width is ≈ 62.33 mm. The leaf tip is acuminate, the leaf base is rounded, and the leaf margin is serrated, with some biserrated regions. The petioles have a length of ≈ 3.1 cm.

The date of initial blooming of ‘Yuguan’ is around 20 Apr (accumulative temperature



Fig. 1. Fruit of ‘Yuguan’.

evaluation at three orchards in Hebei Province: Changli, Qinglong, and Cangzhou.

Description

‘Yuguan’ shows a spreading tree habit (Wang et al. 2005), strong branching ability, and moderately high vigor. The bark is brownish in color, belonging to the 200D brown group of the Royal Horticultural Society (RHS) (2015). The bark surface is smooth, with a few round/oval lenticels. Branches (1-year-old wood) are classified into the brown

is ≈ 599.2 °C); 2 to 3 d later, it reaches its full-bloom stage, and the flowering period lasts for ≈ 10 d. Each bud has five blossoms, and individual flowers are large, with an average diameter of ≈ 51.2 mm. The petals are oval and white with pale-pink blush. The tree exhibits good annual flowering and has a large number of flowers each year. ‘Yuguan’ trees bear fruit mostly on spurs with terminal floral buds and lateral floral buds.

‘Yuguan’ fruit ripens in late October in Changli, similar to ‘Fuji’. The average fruit weight is ≈ 330 g. The fruit is large and has



Fig. 2. Longitudinal section of the fruit of ‘Yuguan’ and ‘Golden Delicious’.

Table 1. Average values (\pm SD) of the physicochemical parameters of ‘Yuguan’ apples under cold-storage conditions.

Cultivar	Firmness (kg·cm ⁻²)	Soluble solid concentration (%)	Titratable acid concentration (%)	Vitamin C (mg/100 g)	Total sugar concentration (g/100 g)
Fresh					
Yuguan	8.6 \pm 0.32	15.3 \pm 0.4	0.52 \pm 0.09	4.6 \pm 0.5	10.62 \pm 0.69
Fuji	7.2 \pm 0.38	15.3 \pm 0.44	0.40 \pm 0.02	6.8 \pm 0.82	12.32 \pm 0.32
Storage, 90 d					
Yuguan	6.9 \pm 0.09	14.1 \pm 0.45	0.29 \pm 0.02	3.2 \pm 0.76	10.48 \pm 0.62
Fuji	5.9 \pm 0.23	13.5 \pm 0.4	0.19 \pm 0.03	4.6 \pm 0.85	11.26 \pm 0.42

Table 2. Genotypes of ‘Yuguan’ and its parents based on segregation of two ethylene biosynthesis genes and resistance to *Glomerella* leaf spot.

Cultivar	Marker genotype ⁱ		
	<i>Md-ACS-1</i>	<i>Md-ACO-1</i>	Resistance to <i>Glomerella</i> leaf spot
Yuguan	2:2 ⁱⁱ	1:2 ⁱⁱ	R
Golden Delicious	1:2 ⁱⁱ	1:2 ⁱⁱ	S
Fuji	2:2 ⁱⁱ	1:1 ⁱⁱ	R

ⁱ Three polymerase chain reaction–based genetic markers.

ⁱⁱ Genotype.

R = resistant; S = susceptible.

attractive, smooth golden-yellow (RHS 13C) skin, and a slight pink blush sometimes appears on the sunny side (Fig. 1). The fruit is cylindrical, with a fruit shape index of \approx 0.88 (average longitudinal diameter, \approx 82.41 mm; transverse diameter, \approx 93.20 mm), and it exhibits obvious waxiness. The stalk cavity has a moderate width and depth (Wang et al. 2005), and russeting is minimal or lacking. The thickness of the pedicel is \approx 2.3 mm and the length is \approx 2.2 cm. The calyx end has five obvious ridges (sometimes with five other weak ridges). The carpel is smooth, and each fruit has up to 10

seeds that are large and an auburn color (RHS 175A). The flesh is slightly yellowish (RHS 10D, Fig. 2), crisp, juicy, firm, and slightly tart, and has a pleasant aroma. At harvest, the average values for firmness (no peel), soluble solid concentration, total sugar concentration, acidity (expressed as titratable acid), and vitamin C concentration equal 8.6 kg·cm⁻², 15.3%, 10.62%, 0.52%, and 4.6 mg/100 g fresh weight, respectively (Table 1).

‘Yuguan’ has an excellent flavor and persists well during long storage, similar to ‘Fuji’ (Table 1). ‘Yuguan’ is homozygous for the

Md-ACS-1-2/2 gene and heterozygous for the *Md-ACO-1-1/2* gene, which are ethylene pathway genes encoding 1-aminocyclopropane-1-carboxylic acid synthase and oxidase (Table 2). These results suggest that ‘Yuguan’ has firm fruit at harvest and after 60 d of cold storage at 0 to 1 °C (Zhu and Barritt 2008).

‘Yuguan’ ripens in late October and is a rare yellow apple. ‘Yuguan’ trees exhibit strong adaptability and show optimal growth in most of the test area. These trees also show resistance to *Glomerella* leaf spot based on analysis of the simple sequence repeat marker S0405127—a tightly linked marker—for the presence of the R_{glS} locus for resistance to *Glomerella* leaf spot (Table 2) (Liu et al. 2017) and field evaluation (Fig. 3).

‘Yuguan’ is graft compatible with most common rootstocks (such as the *Malus robusta* Rehd. and SH series), and ‘Fuji’, ‘Changping 8’, and ‘Golden Delicious’ can be used as pollen donors. Young ‘Yuguan’ trees are vigorous, and appropriate training systems should be evaluated to promote optimal growth and fruit bearing.

Availability

After evaluation and approval by the Fruit Cultivar Approval Committee of Hebei Province, ‘0103-H5-101’ was named ‘Yuguan’ and released in 2019. This article represents the first detailed description of ‘Yuguan’ to be published. Under rules related to International Plant Variety rights, trees and budwood are available for research purposes and can be obtained from the corresponding author at the Changli Institute of Pomology, Hebei Academy of Agricultural and Forestry Science, China.

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Fig. 3. Field resistance to apple *Glomerella* leaf spot. The trees on the left are ‘Yuguan’ trees. The susceptible trees (‘19-38’) on the right were damaged by apple *Glomerella* leaf spot, and most of the leaves on the trees had fallen off.