'Hahong' Nectarine

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'Hahong' is a new nectarine cultivar from the Rural Development Administration's National Institute of Horticultural & Herbal Science breeding program, which has been in operation since 1962. 'Hahong' is a mid-season nectarine that produces large, attractive, and yellow sweet fruit for the fresh market. The cultivar should be widely adapted to wherever peaches and nectarines are grown to provide growers with an alternative to 'SunGlo' that has superior fruit quality, particularly in terms of fruit size and sweetness. In 2009, Plant Variety Protection rights were granted in the Republic of Korea.

Origin

The 'Hahong' nectarine [*Prunus persica* (Batsch) L.] originated from a cross between 'SunGlo' and 'Cheonhong' at the National Institute of Horticultural & Herbal Science under the auspices of the Rural Development Administration (RDA), Suwon, Republic of Korea, in 1990 (Fig. 1). 'Hahong' was first selected and propagated in 2002 for testing as Wonkyo Da-26. This selection was grafted onto Chinese wild peach ('Maotao') seedling rootstocks and planted in seven different sites in the Republic of Korea: Suwon (lat. 37°16' N, long. 127°02' E), Chuncheon (lat. 37°53' N, long. 127°44' E), Yesan (lat. 36°41' N, long. 126°51' E), Chongwon (lat. 36°33' N, long. 127°32' E), Cheongdo (lat. 35°39' N, long. 128°44' E), Jinju (lat. 35°11' N, long. 128°06' E), and Naju (lat. 35°01' N, long. 126°43' E). At all evaluation sites except Suwon, three trees each of Wonkyo Da-26 and 'Cheonhong' were observed from 2003 to 2008. In Suwon, six trees of Wonkyo Da-26 plus three nectarine trees, one of each 'Suhong', 'Cheonhong', and 'SunGlo', were observed for comparison purposes. In all tests, the trees were planted with 4 × 5 m spacing and trained to an open center form. Pruning, fertilization, and pest management were performed according to local guidelines for peach cultivation (Shin et al., 2002). The tree and fruit characteristics were evaluated according to the National Manual for Agricultural Investigation (RDA, 2003) and International

Union for the Protection of New Varieties of Plants (UPOV) guidelines for the conduct of tests for distinctness, uniformity, and stability of peaches and nectarines (UPOV, 1995). 'Hahong' was evaluated for 6 years.

Description

Tree and fruit bearing. 'Hahong' trees are large and strongly vigorous with a semiupright growth habit similar to 'Cheonhong' and 'Suhong' (Fig. 2). Compared with the standard fertilizer for peach trees, nitrogen fertilization is recommended to be reduced to 5% to 10% the usual dose for 'Hahong' trees to mitigate their vigor. Fruit are mainly set on medium to long (25 to 35 cm) branches. Because 'Hahong' is productive without alternate bearing, flower buds or fruit are recommended to be thinned to maximize the fruit size. Leaves of the 'Hahong' tree have reniform nectarines, and the average leaf size is 4.4 cm wide and 16.7 cm long. 'Hahong' has been shown to exhibit higher average yields per tree than 'Cheonhong', which is the leading nectarine cultivar in the Republic of Korea (National Agricultural Products Quality Management Service, 2007) (Table 1). This yield difference becomes more apparent with tree age. In 2008, a tree of 'Hahong' produced ≈5 kg more fruit than one of 'Cheonhong'.

Seasonal growth. 'Hahong' in Suwon buds in late March and blooms fully in mid-April, similar to other cultivars (Table 2). Flowering in southern sites such as Cheongdo, Jinju, and Naju occurs ≈12 d earlier than in Suwon. The fruit of 'Hahong' ripens in mid-August, which is the middle of the peach and nectarine harvest season in the Republic of Korea. The fruit ripening time of 'Hahong' is ≈13 d later than that of 'Cheonhong'; the total fruit development period of 'Hahong' is ≈117 d.

Flowers. Flowers of 'Hahong' are showy as are those of 'Cheonhong' and 'Suhong' in contrast to those of 'SunGlo'. The flowers of 'Hahong' are large with an average diameter of 4.26 cm. The corolla is dark pink with five round petals. The inner part of the calyx is orange and the inner wall of the ovary has no pubescences. The stigma is positioned above the purplish red anther. The flowers are fertile with numerous bright yellow pollen grains, similar to the flowers of 'Cheonhong', 'Suhong', and 'SunGlo'.

Fruit. A sample of 30 fruit was collected each year from 2006–08 to determine their characteristics. The fruit of 'Hahong' were ovate in shape (Table 3). The fruit ground color was creamy yellow with most of the surface covered in a solid red blush (Fig. 3). Because the fruit became colored before ripening, an optimal harvest time should be judged to avoid premature harvest. Commercially ripe fruit changes the ground color of its skin from green–yellow to creamy or pale yellow. The ground color of fruit skin is a common indicator for determining when to commercially harvest nectarines. Fruit flesh is orange–yellow with a red pigmentation of ≈30% around the outer flesh and ≈5% to 10% around the pit. The average fruit weight of 'Hahong' is 266 g, which is significantly greater than that of 'Cheonhong' at 202 g and of 'SunGlo' at 189 g. The large fruit size of 'Hahong' was achieved by thinning, leaving 15 to 20 cm between fruit. The fruit flesh at harvest time was as firm as in other comparable cultivars. Skin cracking occurred in 'Hahong' less frequently than in 'Cheonhong'.

Fig. 1. Pedigree of the nectarine cultivar Hahong. OP = open-pollinated.

Table 1. Mean fruit yield of 'Hahong' and 'Cheonhong' in Suwon, Republic of Korea, 2006–08.

Cultivar	Yield (kg/plant)		
	2006	2007	2008
Hahong	20.5 a ²	34.8 a	48.0 a
Cheonhong	18.7 a	32.0 a	43.2 b

²Means with a column followed by the same letter are not significantly different, $P \leq 0.05$, by the least significant difference test.

Table 2. Seasonal growth of 'Hahong' compared with the nectarine cultivars Cheonhong, Suhong, and SunGlo in Suwon, Republic of Korea, 2003–08.

Cultivar	Sprouting date ²	Flowering date ²	Ripening date	Days to ripen
				from blooming
Hahong	30 Mar. a ²	18 Apr. a	14 Aug. a	117 a
Cheonhong	30 Mar. a	16 Apr. a	28 July b	104 b
Suhong	30 Mar. a	16 Apr. a	16 Aug. a	122 a
SunGlo	30 Mar. a	19 Apr. a	14 Aug. a	121 a

²Dates were recorded when the floral buds protruded 1 to 2 mm.

²Dates were recorded when 70% to 80% of the flowers were open.

²Means with a column followed by the same letter are not significantly different, $P \leq 0.05$, by Duncan's multiple range test.

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Table 3. Fruit characteristics of ‘Hahong’ compared with the nectarine cultivars Cheonhong, Suhong, and SunGlo in Suwon, Republic of Korea, 2006–08.

Cultivar	Fruit shape	Ground color of skin	Over color of skin	Flesh color	Fruit wt (g)	Flesh firmness (N) ^z	Soluble solids content (°Brix)	Titrateable acidity (%) ^y	Adherence of stone to flesh	Skin cracking ^x
Hahong	Ovate	Creamy yellow	Red	Yellow–orange	266.1 a ^w	16.33 a	12.6 a	0.42 b	Present	1 b
Cheonhong	Ovate	Greenish yellow	Dark red	Yellow	201.6 b	16.38 a	9.8 c	0.56 a	Present	2 a
Suhong	Ovate	Yellow	Red	Yellow	268.3 a	16.48 a	10.7 b	0.45 b	Present	1 b
SunGlo	Round	Greenish yellow	Orange–red	Yellow	189.3 b	No data	10.6 b	0.55 a	Absent	1 b

^zFlesh firmness was determined using a penetrometer with a 5-mm diameter plunger (TA plus; Lloyd InstrumentsTM; Ametek Inc., U.K.) on two opposite points of the equator of each fruit at harvest time.

^yVolume percent of malic acid.

^xDegree of skin cracking: 1 = 0% to 3%, 2 = 3% to 7%, 3 = 7% to 11%, 4 = 11% to 15%, 5 = greater than 15% of fruit with skin cracking at harvest time.

^wMeans with a column followed by the same letter are not significantly different, $P \leq 0.05$, by Duncan’s multiple range test.

Table 4. Flowering dates and chill units of ‘Hahong’ compared with other nectarine cultivars in Suwon, Republic of Korea, 2006–08.

Cultivar	Flowering date				Chill units
	2006	2007	2008	Avg	
Flodaglo	22 Apr.	14 Apr.	12 Apr.	16 Apr.	200 ^z
Flavortop	25 Apr.	20 Apr.	15 Apr.	20 Apr.	750 ^z
Earliscarlet	26 Apr.	20 Apr.	14 Apr.	20 Apr.	800 ^z
SunGlo	24 Apr.	20 Apr.	15 Apr.	20 Apr.	850 ^z
Summercrest	28 Apr.	22 Apr.	No data	25 Apr.	950 ^z
Hahong	25 Apr.	19 Apr.	15 Apr.	19 Apr.	800 ^y

^zBased on Okie (1998).

^yEstimated chill units based on the other five cultivars.

Fig. 2. ‘Hahong’ nectarine tree.

Fig. 3. Fruit of the ‘Hahong’ nectarine tree.

(0% to 3% occurrence). The juice from 10 fruits of ‘Hahong’ was pooled to form a composite sample, and its soluble solids content (SSC) was measured using a refractometer (Atago Co., Tokyo, Japan). The titrateable acidity was measured by the titration of 5 mL of juice with 0.1 N NaOH and expressed as the percent malic acid equivalent using an automatic Titroline titrator (Schott, Mainz, Germany). The average SSC of ‘Hahong’ was 12.6 °Brix, higher than that of the other cultivars, whereas the fruit acidity of ‘Hahong’ was lower than that of ‘Cheonhong’ and ‘SunGlo’ at 0.42%. The balance of sugar and acid gives the fruit a better taste than the other three cultivars. ‘Hahong’ has clingstone melting flesh similar to ‘Cheonhong’ and ‘Suhong’, whereas ‘SunGlo’ has freestone melting flesh.

Cold damage. Freezing injury of ‘Hahong’ was not observed at any of the seven evaluation sites, despite a minimum temperature of -19.7°C at Chuncheon from 2003 to 2008. ‘Hahong’ also fruited well at all evaluations, where the mean temperatures in January, the coldest month in the Republic of Korea, ranged from -3.70 to 0.95°C .

Chilling requirement. To estimate the chilling requirements of ‘Hahong’, flowering dates from 2006–08 were compared with five cultivars whose chilling requirements are already known (Table 4). ‘Hahong’ was estimated to have a high chilling requirement of ≈ 800 chill units based on the concurrence of flowering time with the cultivars Flavortop (750 chill units), Earliscarlet (800 chill units), and SunGlo (850 chill units).

Disease. ‘Hahong’ showed 1% to 5% leaf or fruit lesions caused by brown rot [*Monilinia fructicola* (Winter) Honey] and bacterial leaf spot [*Xanthomonas arboricola* pv. pruni (Smith) Dye], similar to the rates in ‘Cheonhong’. However, ‘Suhong’ and ‘SunGlo’ showed 6% to 10% brown rot damage, whereas ‘SunGlo’ exhibited 6% to 10% bacterial leaf spot damage.

Availability

Plant Variety Protection for ‘Hahong’ was achieved in 2009 and registration was achieved in June 2011 after 2 years of evaluating its distinctness, uniformity, and stability according to Korean Seed Industry Law. Requests for virus non-indexed scions for research purposes may be addressed to Ji Hae Jun (jun0810@korea.kr).

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