Journal of the American Pomological Society 65(3): 167-169 2011

'Changjo' Pear

I.S. Shin[1], S.S. Kang, Y.K. Kim, K.H. Kim, H.S. Hwang, Y.U. Shin, K.H. Cho, J.H. Kim, and H.R. Kim

Abstract

'Changjo' pear (*Pyrus pyrifolia* [Burm. F.] Nakai) was developed from a cross between 'Tama' and '81-1-27 ('Danbae' × 'Okusankichi')' made in 1995 at the National Institute of Horticultural and Herbal Science (NIHHS) of the Rural Development Administration in Korea. It was first selected as '95-1-27' in 2000 for its attractive eating quality, large size and good appearance. After regional adaptability tests at 10 sites for 5 years from 2005 to 2009 as 'Wonkyo Na-44', it was named in 2009. It blooms two days later than 'Niitaka', a mid-late season leading pear cultivar in Korea. 'Changjo' is strong in tree vigor and has an upright-spreading tree habit. It is classified as highly susceptible to pear scab (*Venturia nashicola* Tanaka & Yamamoto) having a degree of susceptibility similar to 'Niitaka'. 'Changjo' shows no visual symptoms on any leaves to black necrotic leaf spot caused by apple stem grooving virus. 'Changjo' is cross-compatible with major Korean pear cultivars such as 'Niitaka', 'Wonhwang' and 'Chuhwangbae' but not with 'Whangkeumbae'. The average optimum harvest time of 'Changjo' was Oct. 2, 10 days earlier than 'Niitaka'. The fruit is oblate in shape and yellowish-brown in skin color. Average fruit weight was 789 g and total soluble solids concentration was 13.1°Brix.

Introduction

Asian pear (*Pyrus pyrifolia* [Burm. F.] Nakai) is one of the most important temperate fruit crops in Korea, with a planted area of 16,239 ha in 2010 (4). Pear ranks fifth among all fruits (citrus, apple, persimmon, grape etc.) grown in Korea in terms of total production value and first among them for both export amount (23,048 tonnes) and value (US$54,053,615) (2010 figures), with the crop being sent to 34 countries including the USA, Indonesia, Taiwan and Malaysia. Pear cultivation areas and production in Korea have decreased during the last decade and are expected to decline further in the near future. However, it remains as an important export fruit crop. The decline in production mainly results from a decrease in consumption per capita and from poor price competitiveness. To overcome these weaknesses, it is essential to expand the diversity of pear varieties grown with respect to taste, appearance, size, and ripening time while maintaining good quality. 'Changjo' (Fig. 1), a mid-late season variety with large fruit size, high eating quality and good appearance, was selected to meet the needs of both consumers and exporters.

Fig. 1. Fruit of pear cultivar 'Changjo'

Materials and Methods

A total of 127 seedlings from a cross between 'Tama' and '81-1-27 ('Danbae' × 'Okusankichi')' were planted in a breeding field at the NIHHS in Suwon in 1997. 'Changjo' was first selected as '95-1-27' in 2000 for its attractive eating quality, large size and good appearance. After first selection, eight trees each of '95-1-27' and of the control cultivar 'Niitaka', propagated on *P. pyrifolia* seedling rootstock, were planted in 2002. All trees were trained to a central leader growth habit. The trees were evaluated for flower, tree and

[1] National Institute of Horticultural & Herbal Science, RDA, Suwon 440-706, Korea, shinis@rda.go.kr

Table 1. Tree characteristics and disease resistance of 'Changjo' at Suwon, Korea, 2005-2009.

Cultivar	Full bloom date	Tree vigor	Tree habit	Number of spurs per branch	Pollen quantity	Black necrotic leaf spot[z]	Scab resistance[y]
Changjo	Apr. 22	Strong	Upright spreading	Many	Abundant	Symptomless	7
Niitaka	Apr. 20	Strong	Upright spreading	Many	Negligible	Symptoms	7

[z] Symptomless: no visible symptoms on any leaves; symptoms: abundant black necrotic spots on all leaves.
[y] Rated on a 0 to 9 scale where 0 = highly resistant (no visible symptoms on any leaves) and 9 = highly susceptible (abundant sporulating lesions on several leaves or petioles and detachment of all infected leaves).

fruit characteristics according to standard guidelines (5, 6). During the blooming period, 100 flowers at balloon stage at the second or third position of a flower cluster were picked and anthers were collected. After dehiscense of anthers for 24 hours at 20°C, pollen was collected using the 100% acetone dipping method, and total quantity was weighed.

Cross compatibility with 'Changjo' was evaluated using a total of 100 flowers of each cultivar. Two flowers per flower cluster at the balloon stage were retained and each flower was emasculated by hand and covered with a paper bag until pollination. Fruit set was determined 30 days after the full bloom stage.

Each spring, flower thinning and fruit thinning were carried out to prevent biennial fruiting. Final distance between fruits at harvest was maintained at a minimum of 20 - 30 cm. No yield data were collected.

As trees came into bearing, five fruit were taken from each of eight trees at three times to ascertain the time of optimum maturity. After the fruits were weighed, they were cut in half longitudinally. Flesh firmness was measured on each side of the fruit with a hand-held penetrometer (QAsupplies FT327, USA) equipped with an 8 mm diameter plunger. Thereafter, total soluble solids concentration was measured on each fruit by expressing juice from each side of the fruit onto a digital refractometer (Atago PR-101, Japan). Titratable acidity of each fruit was measured from 10 mL samples of squeezed juice plus 40 mL distilled water and reported as percentage in terms of malic acid equivalents. The solution was titrated to an endpoint of pH 8.1 using 0.1N NaOH. Titrations were performed using an auto-titrator (Schott TitroLine Alpha, Mainz Germany).

The experiment was designed as a randomized complete block design with year as the designated block. Statistical significance was calculated by Tukey's studentized range (HSD) test of GLM using SAS statistical software (V 9.1, SAS Institute Inc., North Carolina, USA).

Description

'Changjo' has strong tree vigor and an upright-spreading tree habit (Table 1). It blooms two days later than 'Niitaka', a leading cultivar for mid-late season in Korea. Spurs are abundant and the number of axillary flower buds on 1-year-old shoots is moderate. Precocity is similar to 'Niitaka' on *P. pyrifolia* rootstock, with the onset of fruiting occurring in the third year. Flowers have 24 stamens per flower (a moderate number), more than the 20 stamens of 'Niitaka'. In pollination compatibility tests, 'Changjo' was highly compatible with all test cultivars, such as 'Niitaka', 'Wonwhang' (3), a leading cultivar for early season, and 'Chuhwangbae' (1) but not with 'Whankeumbae' (2) (Table 2). 'Changjo' requires optimal chemical control of scab, since it shows the same high degree of susceptibility to this disease as 'Niitaka', and is more susceptible than 'Wonwhang'. 'Changjo' was, however, classified into the symptomless group against apple stem grooving virus.

Table 2. Cross compatibility of 'Changjo' pear during 2008/2009 in Suwon.

Cross combination	Fruit set (%)	Cross combination	Fruit set (%)
Yeongsanbae × Changjo	56.0	Changjo × Soowhangbae	55.0
Mihwang × Changjo	80.0	Changjo × Chojuro	86.8
Niitaka × Changjo	74.4	Changjo × Imamuraaki	95.0
Chuwhangbae × Changjo	72.5	Changjo × Okusankichi	81.3
Wonwhang × Changjo	51.4	Changjo × Shinsui	97.5
Whangkeumbae × Changjo	0.0	Changjo × Whasan	74.4
Mansoo × Changjo	76.0	Changjo × Wonwhang	77.5
		Changjo × Chuwhangbae	90.0

Optimum fruit harvest time at Suwon is Oct. 2, more than 10 days earlier than 'Niitaka' over the 2005-2009 period (Table 3). The fruit is oblate in shape and yellowish brown in skin color. Average fruit weight was 789 g, while total soluble solids concentration averaged 13.1 °Brix and titratable acidity was 0.098% - both lower than that of 'Niitaka'. Fruit flesh was similar to that of 'Shinsui', being very juicy and having negligible grit. The fruit does not store for more than 30 days at ambient temperature or for more than 3 months after harvest at cold temperatures of approximately 1-2°C.

Availability

Protection for 'Changjo' was applied for in Dec. 2009 for registration in 2011 after two years of records on distinctness, uniformity and stability by Korean Seed Industry Law. Propagation material of 'Changjo' will be available after variety registration.

Literature Cited

1. Kim, Y.S., K.H. Hong, J.B. Kim, M.S. Yiem. U.J. Lee, W.C. Kim, J.H. Kim, S. B. Hong, S.B. Kim, J.Y. Moon, K.Y. Kim, M.D. Cho, and D.K. Lee. 1986. A new late-season pear cultivar 'Chuwhangbae'. Res. Rpt. RDA (Hort.) 28(1):57-61.
2. Kim, Y.S., W.C. Kim, K.H. Hong, J.B. Kim, U.J. Lee, S.B. Hong, J.H. Kim, Y.K. Kim, J.Y. Moon. K.Y. Kim, M.D. Cho, D.K. Lee, and D.M. Park. 1985. A new mid-season pear cultivar 'Whangkeum Bae' with high soluble solid content and beautiful appearance. Res. Rept. RDA (Hort.) 27:103-106.
3. Kim, W.C., H.S. Hwang, Y.U. Shin, D.K. Lee, S.J. Kang, I.S. Shin, B.D. Cheon, J.Y. Moon, J.H. Kim, and S.B. Kim. 1995. Breeding of a new large sized high-quality pear cultivar 'Wonwhang'. Res. Rpt. RDA (Hort.) 37:471-477.
4. Ministry of Food, Agriculture, Forestry and Fisheries. 2010. Food, Agricultural, forestry and Fisheries statistical yearbook. Seoul.
5. Rural Development Administration (RDA). 1995. Manual for agricultural investigation. Suwon, South Korea.
6. The International Union for the Protection of New Varieties of Plants (UPOV). 1994. Guidelines for the conduct of tests for districtness, uniformity and stability. Japanese pear (*Pyrus pyrifolia* (Burm. F.) Nakai var. *culta* (Mak.) Nakai).

Table 3. Fruit charactersitics and optimum ripening time of 'Changjo' at Suwon, Korea, 2005-2009.

Cultivar	Date of maturity	Fruit shape	Fruit skin color	Fruit weight (g)	Soluble solids (°Brix)	Acidity (%)	Grit	Firmness (kg)
Changjo	Oct. 2	Oblate	Yellowish brown	789 a[z]	13.1 a	0.098 b	Low	2.2 a
Niitaka	Oct. 12	Roundish oblate	Yellowish brown	716 a	13.3 a	0.102 a	Low	2.2 a

[z] Means followed by different letters are significant difference at 5% level according to Turkey's studentized range (HSD) test.