

‘Miho’ and ‘Seto’—New High Quality Satsumas For Texas

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INTRODUCTION AND HISTORY

Satsuma mandarins (*Citrus unshiu* Marc.) are among the most cold hardy citrus varieties that have sufficient fruit quality for potential commercial marketing as well as for homeowners outside the typical citrus belt in the Lower Rio Grande Valley (Mortensen, 1983). Satsuma mandarin was first reported in Japan more than 700 years ago where it is now the major cultivar grown, but more than likely it originated in China (Ferguson, 1996). The first recorded introduction into the United States was in Florida by George R. Hall in 1876 (Ferguson, 1996). The name “satsuma” is credited to the wife of the United States minister to Japan, General Van Valkenberg, who sent trees home in 1878 from Satsuma where it was believed to have originated (Ferguson, 1996). While this fruit is grown primarily for fresh consumption, a portion of the crop is canned as fruit segments or juice in Japan, China and Spain. In these countries, deeply colored juice is blended with orange juice to improve color or sold as single-strength tangerine juice. Fresh fruit is also imported into Canada and non-citrus producing areas of the U.S., where it is the earliest seasonal citrus crop to reach the market (Ferguson, 1996).

Approximately one million ‘Owari’ satsuma trees were imported from Japan (1908-1911) and planted throughout the lower Gulf Coast states from the northern Florida Gulf coast to Texas, where an extensive tangerine industry developed (Ferguson, 1996). The earliest citrus in Texas was from seed planted in dooryards by the early settlers (Mortensen, 1983). The coastal area near Houston and Beaumont had a citrus “boom” until February, 1911, when the temperature dropped to -13.3°C at Alvin. Most growers were lucky to save 10 percent of their trees. This was followed by the 1915 hurricane, so the Texas Orchard Development Company

moved its operations to the Lower Rio Grande Valley where a railroad had recently been built. The Texas Experiment Station at Beeville was also growing citrus and reported success with satsumas in a publication in 1909. There were an estimated 800 acres of trees in the Winter Garden (Uvalde-Crystal City-Pearsall) in 1945 (Mortensen, 1983).

Satsumas have been observed to tolerate temperatures of -9.9 to -11.0°C without injury if trees are totally dormant and the temperature doesn’t remain there more than 3 hours (Ferris and Richardson, 1923; Mortensen, 1983; Ferguson, 1996).

Because of their low total heat requirement, some cultivars ripen earlier than most other citrus. Hence, the satsuma is ideally adapted to regions with winters too cold for other citrus fruit but with growing seasons warm enough to produce fruit of early maturity and good quality. The range of climatic adaption for commercial culture is therefore narrow and restricted to the higher elevations and colder areas of the sub-tropical zones. Although these areas are subject to severe freezes, current cold protection methods, using in-tree micro-sprayers, can protect trees to a height of approximately four feet. This cold protection strategy may be the key to at least partial revitalization of satsuma planting in these areas (Ferguson, 1996).

‘Miho’ and ‘Seto’ Cultivars. Early-maturing, high-quality, cold-tolerant varieties of satsumas were obtained from Japan for evaluation in Texas. ‘Miho’ and ‘Seto’ are two such varieties developed from seed produced by controlled pollination of ‘Miyagawa’ satsuma (similar to ‘Okitsu’, which was introduced to Spain in 1983, starting its commercial spread in 1987, (IVIA, 1983)). ‘Miho’ and ‘Seto’ were obtained as seed from the Fruit Tree Research Station - Okitsu Branch, Obitsu, Shimizu, Shizuoka 424-02 Japan in November, 1984, and subsequently planted in containers in

Table 1. Characteristics of satsuma varieties in Texas (Sauls, 1998).

Variety	Fruit size	Seed	Peel color	Flesh color	Peel	
					adherence	Season
Owari	Medium	0-4	Red-orange	Orange	Loose	Nov-Dec
Armstrong Early	Large	0-4	Red-orange	Lt-orange	Loose	Oct-Nov
Kimbrough	Medium	0-4	Red-orange	Orange	Loose	Nov-Dec
Obawase	Large	0-4	Red-orange	Orange	Loose	Oct-Nov
Okitsu	Medium	0-4	Red-orange	Orange	Loose	Nov-Dec
Miho	Large	0-2	Red-orange	Orange	Loose	Oct-Nov
Seto	Large	0-2	Red-orange	Orange	Loose	Oct-Nov
Mr. Mac	Medium	0-4	Red-orange	Orange	Loose	Nov-Dec
Changsha tangerine	Medium	20-30	Orange	Orange	Loose	Oct-Jan

MIHO

Fig. 1. 'Miho' satsuma fruit.

SETO

Fig. 2. 'Seto' satsuma fruit.

the greenhouse in December. Trees were grown on their own roots for 2 years before budding additional trees on sour orange (*Citrus aurantium* L.). 'Miho' and 'Seto' were first fruited in 1990. They were then propagated and tested in San Antonio and at the TAMU Research and Extension Center in Uvalde.

Tree and Fruit Descriptions. Original trees were grown from seed planted in 1984; thorniness is slight on young trees propagated from the original seedlings. Mature leaves are lanceolate and range in size from 12-16 cm long and 5-6 cm wide, with almost non-existent petiole wings, with 'Seto' leaves being the larger. 'Seto' leaves are oblong as opposed to elliptic for 'Miho'.

Budded trees are small to medium in size (3.0-3.7 m), with a low-growing, spreading habit (4.0-4.6 m). 'Miho' tends to have more upright branching, while 'Seto' branches tend to droop. Own-rooted trees are approximately two-thirds the size of budded trees.

The color of 'Miho' fruit (Fig. 1), orange group 25A, (Royal Horticulture Color Chart) develops in late summer and early fall; peel is smooth and thin and leathery. Fruit has been allowed to hang until early December but soluble solids indicate the fruit should be harvested around or just before Thanksgiving. Average fruit size is 9 x 4 cm, usually with 10 segments.

The color of 'Seto' fruit (Fig. 2), orange group 25A, (Royal Horticulture Color Chart) develops in late summer and

Table 2. Yields of the satsuma variety trial planted at the TAMU Center in Uvalde.

Variety	Rootstock	Average yield		
		1999	2000	2001
----- lbs per tree -----				
Kimbrough ^z	Sour Orange	9.1	200.2	70.7
Okitsu	Sour Orange	3.9	88.7	137.3
Okitsu	Own	0.0	0.0	1.0
Miho	Sour Orange	2.4	124.3	162.3
Miho	Own	0.0	3.0	31.8
Seto	Sour Orange	0.5	84.8	83.4
Seto	Own	0.0	16.5	76.0

^zOwn-rooted Kimbrough trees were not available at planting.

early fall; peel is notably smoother and thinner than other satsumas. The fruit is noticeably flat and hence packs extremely well. Fruit has been allowed to hang until early December but soluble solids indicate the fruit should be harvested around or just before Thanksgiving. Average fruit size is 10 x 3 cm, usually containing 11 segments.

Fruit of both cultivars are as large as 'Armstrong Early' and 'Obiwase', with the same maturity period, but with fewer seeds (Table 1). Peel color, flesh color and peel adherence are similar to other satsumas in Texas.

Comparisons to Other Varieties. 'Miho' and 'Seto' were compared to other satsumas ('Okitsu' and 'Kimbrough') at the TAMU Research and Extension Center in Uvalde. Trees were either grafted onto sour orange or grown on their own roots. Two-year-old container-grown plants were planted at the TAMU Research and Extension Center in Uvalde in May, 1996. Trees were planted 3 meters apart in rows 6 meters apart. The soil is a high pH (8.2) Uvalde silty clay loam. Trees were initially watered with drip irrigation which was later converted to micro-sprayers. Trees were protected using a "dry" cedar mulch in the winters of 1996 and 1997. The entire trees were covered these 2 years. In 1998, the trees were not covered and a low of -8.9°C was recorded. Some leaves were lost, but for the most part the wood was not damaged. Trees were undamaged by -6.7 and -6.1°C in January, 1999. The trees set their first crop in 1999, followed by crops in 2000 and 2001. Little pest management has been needed to date, although there were early tree losses to termites and cut ants. Weekly irrigation and good weed control have been the main management to date. Fruit were harvested on a per tree basis with yields recorded in pounds per tree.

The yields for 1999, 2000 and 2001 are presented in Table 2. Trees on sour orange were the most precocious trees in the study and have produced the most fruit to date. Own-rooted trees produced their best crop in 2001. 'Miho' on sour orange has produced the most fruit and 'Seto' on sour orange has been very consistent. Fruit quality has been variable due to the vegetative nature of the trees. Fruit quality was the best in 2001. 'Seto', regardless of rootstock, had the best fruit quality in 2001.

Based upon several years of observation and testing, both varieties should do well in other locales in Texas. The trees

have been indexed and found to be free of citrus tristeza virus at the Citrus Budwood Foundation at the TAMU-K Citrus Center in Weslaco and will be entered into the Certified Citrus Budwood program for further testing, after which time budwood will only be available from that program. Meanwhile, limited budwood may be obtained from the authors.

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