

In the study, 100 percent of Marathon (left) and Bingo (right) mandarins were healthy after six weeks or more of storage.

Putting fresh fruit to the test

Quality and shelf life were evaluated for new fresh mandarin and sweet orange selections.

By Mark A. Ritenour, Cuifeng Hu, Yu Wang and Fernando Alferez

ew fresh citrus fruit selections continue to be developed and released by the University of Florida Institute of Food and Agricultural Sciences (UF/IFAS) and the U.S. Department of Agriculture. In addition, promising new varieties are being brought into Florida from other regions of the nation and internationally.



As soon as possible, before substantial acreage is invested into these new cultivars, it is important to understand their field performance in Florida's different growing regions as well as their postharvest fruit quality and shelf life. This report focuses on fruit quality and shelf life performance of new mandarin and sweet orange selections developed by the UF/IFAS breeding program.

The mandarin selections were released through the Fast Track program which was co-developed by UF/ IFAS, Florida Foundation Seed Producers Inc. and New Varieties Development and Management Corp. The program is designed to allow growers and nurseries to plant and test promising experimental UF/IFAS fresh citrus selections much earlier than would be possible through the normal process of releasing new varieties. The sweet orange selections are not part of the Fast Track program but are recently released selections.

ABOUT THE EVALUATIONS

Fruit from these early selections are commonly produced from a single

tree that provides relatively few fruit for postharvest evaluations (perhaps 25 per harvest). Thus, multiple evaluations are required to really see a trend in postharvest performance. However, since 2007, more than 370 evaluations were conducted, and many selections have been evaluated over multiple seasons. Subsequent plantings by commercial growers are starting to provide much larger sample sizes for expanded studies.

Besides the usual tests for external (size, color, etc.) and internal quality (sugar content, acidity, etc.) at harvest, fruit were also evaluated for the development of decay and/or disorders during storage (40 degrees) after harvest.

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External peel color measurements are expressed as a*/b* ratios. As fruit turn from green to yellow or orange, a*/b* ratios increase from negative to positive values. Total soluble solids (TSS, mostly sugars) were measured using a temperature-compensated refractometer, and acidity (percentage citric acid) was measured by titration.

The fruit was usually not washed or waxed, and no fungicides were applied to the fruit to evaluate the inherent shelf life of each selection. However, keep in mind that shelf life can be extended through treatments such as the use of plant growth regulators, postharvest fungicides, washing/ waxing and determining the optimum storage temperature for each selection.

Table 1 (page 22) and Table 2 (page 23) represent average results for mandarin and sweet orange harvests, respectively, obtained between the 2008–09 and 2018–19 seasons. Some of this data was used to help decide which selections were chosen for release in the first place. The selections are listed by their designation code, plus common name in parenthesis when one has been associated with the selection. More than

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Share what's working for you in Citrus Industry magazine. Contact Tacy Callies at Tacy@AgNetMedia.com or 407-748-8441. Table 1. Summary of average fruit quality and shelf life of mandarin selections released through the Fast Track program

	LB8-9 (Sugar Belle)	900	950 (Florida Clementine)	N40W-6-3 (Seedless Snack)	411 (Heather)	C4-15-19 (Kid's Favorite)	7-6-27 (Bingo)	1420 (Marathon)	1351	711
Times Evaluated	9	5	6	7	10	3	4	3	6	3
Harvest Dates (range)	Dec. 5 – Jan. 25	Oct. 5 – Nov. 21	Dec. 9 – Jan. 9	Nov. 2 – Dec. 19	Dec. 19 – March 10	Nov. 6 – Dec. 19	Sept. 29 – Nov. 10	Sept. 29 – Dec. 11	Nov. 18 – Jan. 4	Jan. 18 – Jan. 28
Fruit Weight (grams)	175.9	102.6	103.3	122.4	273.4	105.7	73.2	92.8	152.0	156.1
Total Soluble Solids (%)	14.0	12.3	11.8	13.0	15.5	15.7	12.4	15.4	13.6	13.7
Acids (%)	1.02	0.75	0.48	0.63	1.10	0.77	0.75	0.69	0.81	0.89
Ratio	14.0	16.9	24.9	20.7	14.6	20.3	17.1	22.6	17.0	15.7
External Peel Color (a*/b*)	0.50	0.25	0.37	0.39	0.45	0.54	0.42	0.29	0.57	0.52
Storage Duration (weeks)	6	7	6 - 7	6 - 7	6	7	6	6	4 - 5	6
Healthy Fruit After Storage (%)	100	93	100	98	89	90	100	100	94	90

one harvest (evaluation) of each selection could occur in a single season, but often different evaluations occurred in different seasons.

MANDARINS

In general, mandarin fruit quality and shelf life were excellent (Table 1). Average TSS content was 11.8 percent or better (often in the 15 percent range) and TSS/acid ratio was 14 or better. Peel color was also generally very good at harvest, even for earlyseason selections like Bingo (7-6-27) and Marathon (1420).

Even without the use of fungicides, about 90 percent or more of the mandarin fruit remained healthy after six weeks or more of storage. Heather (411) had some harvests that did not

perform as well during storage, but more recent samples with large numbers of washed and waxed fruit (still no fungicide) resulted in better than 97 percent healthy fruit after six weeks of storage.

SWEET ORANGES

The sweet orange selections also had good quality, with average TSS

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Table 2. Summary of average fruit quality and shelf life of recently relased sweet orange selections

	T2-21	OLL 8	B9-65	SF14W-62 (Valquarius)
Times Evaluated	6	7	5	8
Harvest Dates (range)	Jan. 28 – Apr. 8	Jan. 22 – Apr. 8	Feb. 17 – Mar. 26	Dec. 13 – Feb. 24
Fruit Weight (grams)	233.6	260.0	234.2	186.7
Total Soluble Solids (%)	11.7	11.8	10.5	10.6
Acids (%)	0.89	0.82	0.81	0.66
Ratio	14.0	14.7	13.1	16.5
External Peel Color (a*/b*)	0.25	0.19	0.13	0.15
Storage Duration (weeks)	7	7	8	7
Healthy Fruit After Storage (%)	91	94	79	82

content of 10.5 percent or better and average TSS/acid ratio of 13.1 or better (Table 2). The fruit were also fairly well colored at harvest, but these selections are all harvested later in the season when natural peel coloration is usually good.

Fruit of T2-21 and OLL 8 both had good shelf life with an average of 91 percent healthy fruit after seven weeks

of storage. Fruit of B9-65 developed peel breakdown during one storage test and decay during another that brought down its average shelf life to 79 percent after eight weeks. Valquarius (SF14W-62) also developed peel breakdown during two storage tests and decay during another test, which brought down its average shelf life to 82 percent after seven weeks.

CONCLUSION

The fact that specific problems were isolated to specific harvests, while other harvests had 100 percent healthy fruit, suggests specific issues (e.g., adverse weather before harvest, rough handling, etc.) with those harvests that can be corrected with improved postharvest handling.

It is expected that future research will develop improved handling methods and treatments geared to each selection to maintain consistently good fruit quality and shelf life. The current results give baseline data that growers and shippers can use to determine which new UF/IFAS selections might be best for their operations.

Mark A. Ritenour is a professor and Cuifeng Hu is a biological scientist, both at the UF/IFAS Indian River Research and Education Center in Fort Pierce. Yu Wang is an assistant professor at the UF/ IFAS Citrus Research and Education Center in Lake Alfred. Fernando Alferez is an assistant professor at the UF/IFAS Southwest Florida Research and Education Center in Immokalee.





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