Satsuma selections

for Citrusdal

Originating in Japan, Satsumas are an easy-peeling mandarin citrus that is known for its cold-hardiness. By Werner Swiegers and Prof. Paul Cronjé (Citrus Research International)

Satsumas are the first mandarins to ripen in Southern Africa, providing an early foot in the door to markets. However, they do come with significant challenges.

Citrus Research International (CRI) conducts cultivar trials to evaluate cultivar suitability to various climatic regions. Cultivar ripening windows, production and fruit quality are evaluated over a number of seasons, often spanning eight years. A cultivar trial was established in Citrusdal to evaluate the climatic suitability of this region for Satsuma production. Cultivars Aoshima, Belabela, Imamura, Miho Wase, Miyagawa Wase, Sugiyama and Ueno were imported to SA over time and introduced to the Citrus Improvement Scheme (CIS). These are open cultivars, apart from Belabela which is managed by cultivar agent Citrus Genesis.

Trial objective

The objective was to evaluate Satsuma cultivars for their suitability in a cool, inland production region. Important characteristics for a successful cultivar include consistent productivity, fruit size, rind colour, peelability, internal fruit quality (°Brix, acidity and ratio), seedlessness and an extended harvest period.

Trial evaluation

Field evaluations for various production parameters and laboratory analyses to determine optimal fruit maturity windows were conducted two to three times during the season. Miho Wase was used as the control Satsuma cultivar against which other cultivars were evaluated. Field evaluations included yield determination, Carrizo citrange rootstock compatibility, descriptions of characteristics of new cultivars to verify trueness to type, and determination of climatic suitability. Laboratory analyses included fruit size measurement, number of seeds, colour rating and internal quality measurements (juice content, °Brix and titratable acidity), which are used to indicate optimal fruit maturity. A °Brix:acid ratio of 9:1 for Satsumas is considered the build-up towards peak maturity at 10:1 according to export requirements. After peak maturity, the ratio increases to 11:1, but fruit are over mature when values beyond this are reached.

Results and discussion

Aoshima is a bud mutation from Owari. It is a mid- to late-maturing cultivar that can extend the Satsuma season. Aoshima has a tendency of alternate bearing. "On" years yield good crops. The fruit shape is flat to oblate with a smooth rind. A low percentage of sunburnt fruit was observed as fruit bearing is mostly within the canopy of the tree. During an "off" year the crop is fair to good and the fruit shape more oblate to round, with a slight neck. Pebbly fruit, associated with a higher percentage of sunburn, is due to fruit bearing on the outside of the canopy. Fruit size peaked at 1XXX (Table 1) with a slight neck and sunburn. Fruit from the off year are also slightly bigger compared to on year fruit (Fig 1).

Belabela is a late-maturing mutation from Owari and was the last to reach peak maturity of the Satsuma cultivars evaluated at Citrusdal. The cultivar cropped a good yield on the trees and fruit displayed a smooth rind texture. Fruit size ranged between calibre 1 and 1XXX (Table 1). In general, colour development was delayed compared to the internal maturity. Degreening of the fruit would be required, resulting in a pale yellowish rind. Belabela developed the best colour on the older trees ranging between T3 and T4 at peak maturity (Table 1). Internal quality for this selection was good.

Peak maturity was reached in June, which overlaps with a range of Mandarin hybrid selections as alternative options with better quality fruit and longer shelf-life characteristics (Fig 2).

Imamura is also a late maturing mutation from Owari. Production of Imamura is known to fluctuate over seasons ranging from fair to good yields. Similarly, at this trial site, young Imamura trees cropped fair to good yields. As the trees matured, the production improved from good to very good yields. The vigorous growth habit of this cultivar resulted in bigger trees compared to the other Satsuma selections. Peak maturity was reached at the end of the Satsuma season in May, with very good internal quality.

Week sampled	Cultivar	Size count	Juice %	°Brix	Acid %	Ratio	Seeds	Colour
Week 19	Aoshima	1 – 1XXX	63,80	9.2	0.85	10.8	0.41	T5 - T 8
Week 27	Belabela	1 – 1XXX	48.4	10.2	0.95	10.8	0.0	T3 – T4
Week 24	Imamura	2 – 1XX	52.8	11.1	0.98	11.3	0.3	T3 – T4
Week 17	Miho Wase	4 - 1	61.3	10.3	0.94	10.9	0.0	T5
Week 15	Miyagawa Wase	2 - 1	55.2	9.7	0.85	11.3	0	T6 – T7
Week 18	Sugiyama	2 - 1	45.9	9.5	0.87	11	0.7	T5 – T6
Week 20	Ueno	1 – 1XX	53.9	9.9	0.88	11.2	1.3	T4 – T5

Table 1: Optimal internal fruit quality measurements for each Satsuma cultivar on Carrizo citrange at the Citrusdal trial site

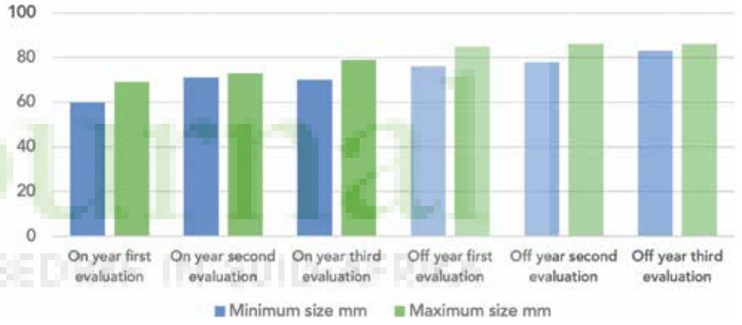

Figure 1: Aoshima fruit size (mm) illustrating the difference in fruit size, in the high low cropping cycles of on year vs off year

However, Mandarin hybrids and Clementine fruit will compete with Imamura in the market in this maturation window (Fig 2).

Miho Wase was the control variety at this trial site. It originated as a nucellar selection from Miyagawa Wase by means of controlled pollination. Miho Wase is one of the earliest maturing Satsuma selections. Yields were consistently good to very good, with good internal quality at peak maturity. Fruit size was smaller compared to most of the other Satsuma selections evaluated (Table 1).

Miyagawa Wase is a mutation from a seedy Zairai Satsuma. It has a less vigorous growth habit, resulting in a smaller tree canopy compared to Miho Wase. Maturity was reached just before Miho Wase, presenting it as an option to extend the Satsuma picking window (Fig 2). Yield was good, but Miho Wase cropped a slightly better yield. Fruit size peaked between count two and one, favourable for export demand (Table 1).

Sugiyama also originated as a bud mutation from Owari. Peak maturity was estimated from mid-March to mid-April at

	Week 14	Week 15	Week 16	Week 17	Week 18	Week 19	Week 20	Week 21	Week 22	Week 23	Week 24	Week 25	Week 26	Week 27
Miyagawa Wase														
Miho Wase														
Sugiyama														
Aoshima														
Ueno														
Imamura														
Belabela														

Figure 2: Maturity chart for Satsuma cultivars at the Citrusdal trial site

the Citrusdal trial site (Fig 2). Yield on the trees varied from fair to good. Like some of the other Satsumas there was a lack of flavour due to low °Brix levels and acids at peak maturity. Fruit rinds were smooth and fruit size was acceptable, ranging between count two and one (Table 1).

Ueno This Satsuma is a late-maturing mutation from Miyagawa Wase with a variable fruit shape from flat to oblate. There was sunburn on the outside fruit and a coarse rind texture in contrast to the smooth rind of fruit from the inner canopy. The tree is more vigorous compared to Miyagawa Wase. Miyagawa Wase cropped a slightly better yield than Ueno. Rind colour development was delayed compared to the internal fruit maturity. Ueno was the seediest cultivar of this evaluation (Table 1).

Conclusion

Growing Satsumas comes with many challenges of which their short harvest period is the biggest downfall. Notwithstanding equally problematic puffy fruit with low flavour. In Citrusdal the early maturing cultivars have delayed colour development compared to the internal fruit maturity, due to the lack of sufficient cold units at the time of fruit maturation. This is required for optimal colour development. The later maturing cultivars showed better colour development compared to the early maturing cultivars. Therefore, the earlier maturing cultivars require degreening, which can also result in uneven rind colour, at an additional cost. Satsuma rinds are not hardy and are sensitive to sunburn and pest damage. Additionally, fruit are prone to chilling injury at the low shipping temperatures required by various markets for pest treatments.

The late maturing varieties overlap with the Clementine and Mandarin hybrid season, which are stronger fruit with better flavour. These are all limitations to the planting of Satsumas in general, but are also relevant to the Citrusdal production region. The early maturing Satsumas currently have an early-to-market advantage, but there are early Clementine and Mandarin hybrid cultivars closing in on that maturity period.

One advantage of Satsumas is that they tend to crop good to very good yields and are relatively easy to farm, when following certain management practices. The choice of rootstock is important to avoid poor internal fruit quality and delayed colour development. Nitrogen should not be applied too late in the season to ensure better quality rinds, and optimum irrigation is required to enhance sugar levels and restrict fruit size.

Final thought

Due to the positive characteristics of Satsumas like early maturity, easy peelability, seedlessness and good production, they are a good option for citrus breeding programmes. Flavour improvement will also count amongst the objectives. Given constant mutations in citrus orchards, the possibility of an improved Satsuma variety with all the desirable traits has not been ruled out. Unfortunately, establishing a new cultivar either through breeding or mutation, takes years. And with robust competition from early Clementines and Mandarin hybrids, only time will tell the future of Satsumas.

Figure 3: Belabela bearing pattern

Figure 4: Imamura crop

Figure 5: Miho Wase fruit shape

Figure 6: Sugiyama crop T1 on colour plate

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