

New CREA citrus hybrids

Giuseppe Russo¹, Concetta Licciardello¹, Paola Caruso¹, Maria Patrizia Russo¹,
Donata Pietro Paolo¹, Giuseppe Reforgiato Recupero¹, Paolo Rapisarda¹, Gabriele Ballistreri¹,
Simona Fabroni¹ & Marco Caruso¹

SUMMARY

CREA recently released two new hybrids: Sun red and D2238. Sun red is a mandarin with the highest level of anthocyanins ever observed in citrus flesh. It is a diploid hybrid obtained from the cross between Oroval clementine and Moro orange. The fruit is small, with a variable number of seeds, and a strong anthocyanin pigmentation. For its high antioxidant capacity, Sun red could be directed at niche markets for fresh juice production. D2238 is an early-ripening grapefruit hybrid, obtained from the cross between Monreal clementine and a tetraploid grapefruit. Trees are very productive, with no alternate bearing. Fruits are seedless, with a pale orange rind and flesh, medium sized, with a juice percentage above 50% and a high persistence on the plant (fruits can be harvested from late January until late April-early May). Moreover, D2238 is characterized by a low content in furanocoumarins. This feature makes it particularly suitable for the market of fresh juices alternatively to grapefruit.

Index terms: hybrids, anthocyanins, furanocoumarins, juice.

Novos híbridos de citros CREA

RESUMO

O CREA lançou recentemente dois novos híbridos: Sun red e D2238. Sun red é uma tangerina com o mais alto nível de antocianinas observada em citros. É um híbrido diploide obtido a partir do cruzamento entre a clementina Oroval e a laranja Moro. A fruta é pequena, com um número variável de sementes e uma forte pigmentação antocianina. Por sua alta capacidade antioxidante, Sun red poderia ser direcionada para nichos de mercado para a produção de suco fresco. D2238 é um híbrido de pomelo de maturação precoce, obtido a partir do cruzamento entre a clementina Monreal e um pomelo tetraploide. As frutas são sem sementes, com uma casca de laranja pálida, de tamanho médio, com uma porcentagem de suco acima de 50% e uma alta persistência na planta (as frutas podem ser colhidas no final de janeiro até o final de abril - início de maio). Além disso, o D2238 é caracterizado por um baixo teor em furanocumarinas. Esta característica torna-o particularmente adequado para o mercado de sucos frescos, alternativamente, de pomelo.

Termos de indexação: híbridos, antocianinas, furanocumarinas, suco.

¹ Consiglio per la ricerca in agricoltura e l'analisi dell'economia agraria – CREA-OFA, Corso Savoia, Acireale, Italy

Corresponding author: Marco Caruso, Consiglio per la ricerca in agricoltura e l'analisi dell'economia agraria – CREA-OFA, Corso Savoia 190, 95024 Acireale, Italy. E-mail: marco.caruso@crea.gov.it

INTRODUCTION

Since many decades, breeders of CREA released several hybrids and clonal selections which are cultivated in different citrus producing countries. Here we describe two new varieties from the CREA breeding program: Sun red, a pigmented mandarin with the highest level of anthocyanins ever observed in citrus; and D2238, an early-ripening grapefruit hybrid with low furanocoumarin content. Both varieties have been protected under the Community Plant Variety Office in Europe, and we expect to release them in Italy and abroad in the next few years.

Sun Red

It is a diploid hybrid, originally coded as Ota9, obtained from the cross between Oroval clementine and Moro sweet orange. In the past, Tarocco was considered the pollen donor (Rapisarda et al., 2009; Butelli et al., 2012). However, recent molecular analysis based on clone-specific Single Nucleotide Polymorphisms (SNPs) confirmed Moro as the male parent.

Sun red ripens in January-February. Plants are thornless, with medium vigour (Figure 1A). The variety has been evaluated for many years in combination with sour orange and Carrizo citrange, while it showed graft incompatibility

in combination with Swingle citrumelo. Alternate bearing has been observed, but no specific cultural practices have been used to mitigate such behavior. Fruits are small (around 40-45g) (Figure 1B), with an average of 6.5 to 13 seeds per fruit (seeds were counted from 15 fruits in two different seasons). No trials in solid blocks have been performed to try to reduce seed number. At maturity, soluble solids are between 12 and 14° Brix, while acidity ranged from 1.2 to 1.6%. Juice yield is around 40-45%.

Small fruit size, rough surface texture, adherence of albedo, and presence of seeds make Sun red unsuitable for the market of fresh fruit. However, Sun red possesses peculiar features in terms of antioxidant capacity. Specifically, its flesh has, to our knowledge, the highest level of anthocyanins ever observed in citrus (Rapisarda et al., 2009). Pulp and peel start to accumulate anthocyanins much earlier than other pigmented genotypes (Figure 1C), and at full maturation pulp can reach more than 800 ppm total anthocyanins. Despite a huge anthocyanin accumulation, juice (Figure 1D) has no off-flavours typical of highly pigmented orange varieties. Moreover, Sun red juice showed higher ORAC activity and total polyphenols content compared to blood orange juice (Rapisarda et al., 2009). For its outstanding nutraceutical features, Sun red might be suitable for fresh juice production in niche markets.



Figure 1. (A) Sun red grafted on Carrizo citrange; (B) Fruits at ripening and (C) in mid-November, showing some flesh pigmentation; (D) Juice of Sun red (central) in comparison with those of Tarocco 57 IE 1 (left) and Moro nuc. 58 8 D1 (right).

D2238

It is the first triploid tangelo released by CREA. It is a progeny of Monreal clementine and a tetraploid grapefruit (Reforgiato Recupero et al., 2005). The plant is scarcely thorny, very productive (around 100-120 kg in adult plants), and start to produce very early (Figure 2A). Fruits are single or in bunches (Figure 2A-B), and are mostly in the inner canopy. Alternate bearing has not been observed. D2238 has been tested for at least 15 years in two different environments of Southern Italy, Palazzelli (Siracusa, Sicily) and Mirto Crosia (Cosenza, Calabria), showing qualitative and quantitative stability in both environments.

Fruit shape resembles those of grapefruits (Figure 2C) but the weight is lower (around 150-250 g). Pulp and peel are yellowish to orange, the flavor resemble that of grapefruit but with less bitterness. Compared to grapefruits, D2238 contains lower naringin (data not shown). Total soluble

solids ranged from 10 to 12.5° Brix. Fruits are ready to harvest from the end of January, about two months earlier than common grapefruit varieties like Star ruby or Marsh seedless. Specifically, at CREA experimental farm located at Palazzelli, maturity ratio is around 8-9 at the end of January, while Star ruby and Marsh seedless have 4 to 5. D2238 does not suffer of pre-harvest fruit drop, so fruits can persist on the plant until the end of April maintaining good organoleptic characteristics (Figure 3A).

In addition to earliness and lower naringin content, D2238 is characterized by a low content in furanocoumarins. Those compounds are known to interact with many drugs, impairing their metabolism (Bailey et al., 2013), consequently the market of grapefruits decreased in recent years (Chen et al., 2011). In D2238 juice sampled in 2016 we observed total furanocoumarin content of about 3 mg L⁻¹, even ten times lower than the above cited grapefruits (Figure 3B). Similar levels of furanocoumarins were also detected in 2014 and 2016 (data not shown).



Figure 2. (A) Two years-old D2238 plant with fruits; (B) Particular of the canopy of an adult plant; (C) Fruits of D2238.

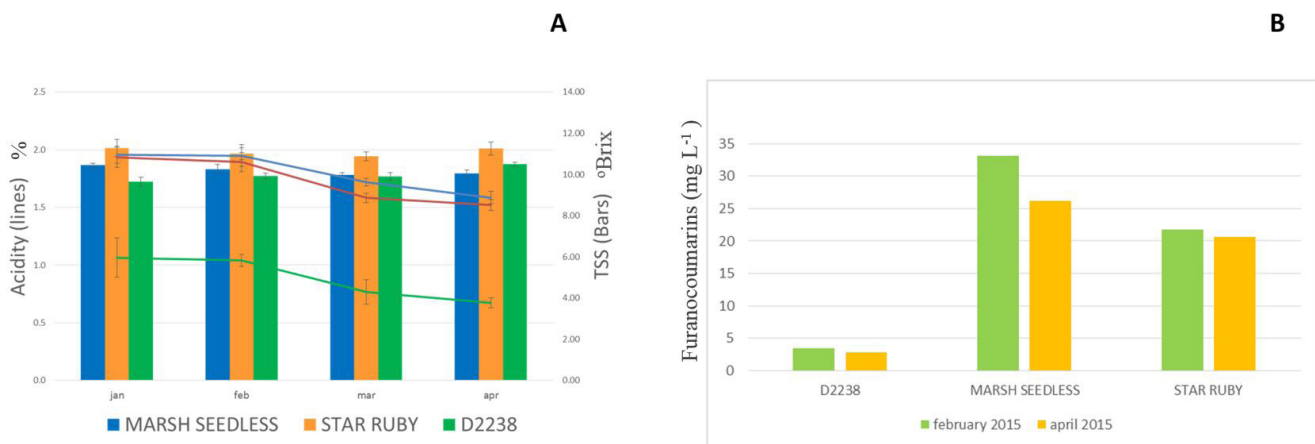


Figure 3. (A) Time course analysis of Total Soluble Solids (TSS) and acidity of D2238 fruits during maturation in comparison with Marsh seedless and Star Ruby grapefruits. Fruits were sampled at Palazzelli experimental station in 2016; (B) Levels of furanocoumarins in D2238 juice compared with those of Marsh seedless and Star ruby.

These important features makes D2238a unique fruit that might be considered for fresh juice market as an alternative to common grapefruits.

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