A new introduction from the Italian MAS.PES peach breeding program: 'MAISSA', a stony hard flat peach

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Abstract

MAS.PES is an apricot and peach breeding program located in northern Italy aimed at the introduction of cultivars featuring enhanced fruit quality and disease resistance (http://www.maspes.org). Among the most promising commercial outcomes, 'Maissa', early selected as 'BO06013020', is to be mentioned. It is a flat, yellow peach from a [Sweet Cap x BO 96028059 (Spring Red x Big Top)] cross, ripening in late August/first week of September in northern Italy (southern Po Valley, 44°50' latitude), around 50 days after 'Big Top' nectarine, a commercial cultivar of reference for the Italian peach industry. The tree growth habit is regular, of medium-high vigour, chilling is medium, yield is high; fruit shape is flat, rather regular, with over 70% blush, over 220g in weight; flesh texture is stony hard (*Hd* trait), while parents and grandparents were all classified as belonging to the slow softening texture type (a possible mutation at the *F* locus); it is of the 'low acid' type (*D* trait), with soluble solids over 17 °Brix when harvested at full maturity; it has a delicious flavour, rather unusual for a stony hard peach. Harvest could be adjusted according to commercial purposes, since flesh never melts, thus can be started when the fruit reaches 13 °Brix. 'Maissa' needs a careful field management in order to avoid brown rot damages on fruit.

Keywords: flesh texture, fruit quality, *P. persica*,

INTRODUCTION

There are may be at least two reasons for the selection of 'new' peach cultivars, a market that is already heavily saturated but always open to try 'novelties'.

The first comes from the great confusion that the present cultivar wealth represents for the peach industry, i.e. many 'new' cultivars bring just little if any novelty compared to the already known ones. Not to mention how difficult could be for the consumer to realize some intrinsic characteristics, such as the different flesh texture (melting, slow softening, stony hard) or flavor (low acid and acidic, other than mentioning the variability in sugar content), when buying a peach.

The second is the need to obtain new cultivars that can be cultivated and marketed under a controlled chain, from the farm to the grocery store (like in the apple 'variety clubs'), able to meet consumer expectations and minimizing the risk to saturate the market, one of the main burden of the peach industry, in Italy and elsewhere. This goal can be rather easily pursued even in peach, characterized by many 'useful' traits with Mendelian inheritance. These traits can very easily traced and selected within the breeding progenies. An example can be given by the type of flesh texture, some of them easily distinguishable by either its intrinsic structure and/or speed of softening. These characteristics allow to distinguish varietal groups differentiated by the final destination and/or commercial strategies, from the fresh to the processing market. The most known flesh texture are the

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melting, the slow softening (firstly described in 'Big Top' nectarine, than followed by many other nectarines and peaches, such as the *Rich* and *Royal* series, all introduced by Zaiger's Inc. Genetics, California , USA: Bassi et al., 2008; Bassi and Monet, 2008; Ghiani et al., 2011; Monet and Bassi, 2008; Okie et al., 2008), the non melting (mainly for canning) and the stony hard (Yoshida, 1976).

In this work we refer to the stony hard texture flesh, still almost unknown in the European peach market.

The stony hard texture in peach

The stony hard fruit, widespread in many far East countries (i.e. China, Japan) has many interesting features: lack of softening, even when over-mature, very high 'keeping' (up to three weeks in tree); crunchy texture (resembling those of the apples, unlike the rubbery texture of the non melting type), and the very low or no emission of ethylene, the only known case among the different fruit types on peach (Begheldo et al., 2008; Goffreda, 1992; Haji et al., 2001; 2003; 2005; Tatsuki et al., 2006). This fruit is not commercially known in the European markets, apart from a first series obtained from the self-pollination of the Korean 'Yumyeong' and introduced in Spain (by the former Experimental Institute for Fruit Growing of Rome, Italy, now CREA) under the name of 'Ghiaggio' (ice, in Italian), due to the appearance of the fruit (creamy-white, with no anthocyanins). The series, consisting of some very similar selections, is also characterized by a very high soluble sugar content (over 18-20%), when full mature.

The limits of the 'crunchy' texture peaches known so far, can be summed up in the extremely low acidity, which gives a sometimes flat 'honey' flavor (not so pleasant for the Western countries consumers), and in the very poor aromatic profile. Also, compared to the apparently similar non melting texture, with which the stony hard 'crunchy' type can be confused, the stony hard fruit is much less juicy. For these reasons, alternative solutions for the fresh market, e.g. the fresh-cut category, should be considered for its commercial exploitation. On the other hand, the great advantage of this fruit type should be underlined: the very high 'keeping' attitude on tree and the long shelf-life, which have no equal in any other type of peach.

Whereby, the introduction of the stony hard trait in commercial standard cultivars is being evaluated in some breeding programs. As far as Italy is concerned, there are two programs: at CREA (Forlì) and MAS.PES (http://www.maspes.org; Bassi et al., 2010; Bassi and Foschi, 2011).

The development of commercial stony hard flesh texture peaches.

The traditional approach to improve the weaknesses of this type of flesh is by cross-breeding: diverse stony hard accessions are crossed to high quality peaches and nectarines. Since the stony hardy character (*Hd*: Scorza and Sherman, 1996) is genetically recessive, it is then needed to go through a self-fertilization of the F_1 ones (or to back-crossing) to let the character be associated with various commercially useful traits: attractive blush, fuzzless skin (the 'nectarine' trait, not present in the known stony hard accessions), strong peach aroma, less 'honey' flavor (more acidic), etc.

Regarding this latter aspect, it should be considered that in peach (as in many other fruits) the taste is known to be affected by both acidity and sugar content. Acidity is influenced by a mendelian (dominant) character that causes a low synthesis of malic acid, inducing a content of total acids from two to four times lower than the standard type. These fruit are commonly defined as low-acid or honey-type (when the acidity is very low).

With respect to sugars content, it may exceed 20 °Brix (regardless of the acidity), but normally fluctuate between 9 and 15 °Brix (with the lowest values normally found in the early ripening accessions).

Taking into account the traits above, distinct types can be obtained, featuring peculiar flavors by appropriate combinations between the acids and sugars content. Thus, fruit ranging from 12-14 to 16-20 °Brix, and even above, can be obtained, from the early to the late ripening season, respectively. In addition, based on the variability induced by the acidity, fruits could be roughly classified into three main categories (low acid, balanced and acidic), depending on the titratable acidity values, ranging from: i) about 6 to 11 (or even below in the 'honey peach'), ii) from 11 to 15 and iii)over 15 meq/100 g of fresh fruit.

By cross-breeding and selection, variable levels of acids and sugars content can be associated in various combinations.

MATERIAL AND METHODS

Selecting peaches for the stony hard texture

As part of the MAS.PES breeding program, new cultivars including nectarines and stony hard peaches, are being sought for the Western markets, with very attractive fruits, high in sugar, but with enough acidity, thus not resulting in a too 'flat' (honey) taste.

As a source of the stony hard trait, the selection 'D41-62' was obtained by Prof. F. Hough at the University of Rutgers (New Jersey, USA). Its genetic background is most likely from the far East, crossed with USA accessions. The fruit is a perfectly round yellow peach, with a 30-40% red overcolour, very sweet ('flat') flavor, with a very high 'keeping' attitude, even three weeks after the beginning of commercial ripening, falling in mid July. This selection was crossed with peaches and nectarines of the Italian peach industry standard. The most promising results were obtained in a progeny derived from the cross between 'D41-62' and 'Big Top' nectarine, and some peaches.

Another breeding line is being built by employing as parent the flat white peach 'Sweet Cap', crossed by a slow softening yellow nectarine selection (from a cross between the melting flesh nectarine 'Spring Red' and the slow softening 'Big Top').

RESULTS

Following self-pollination of some F_1 from 'D41-62' and 'Big Top' progeny (to get back the recessive stony hard trait), some yellow, stony hard nectarines were obtained, with a 30% red overcolour, featuring from 20 to 25 °Brix. These selections are still under evaluation.

From the breeding line employing 'Sweet Cap', some seedlings of flat yellow peaches were obtained, including one lately named 'Maissa', featuring the stony hard flesh. It was first selected as 'BO 06013020' (Figure 1).

The tree is medium to high, of regular growth habit, the yield is high, the chilling requirement is medium. The fruit is flat, regular in shape, with over 60-70% of bright red overcolour on a deep yellow background, over 220 g in weight (the transversal size is 23 cm and above); the flesh is crunchy, with medium-low acidity, rather juicy, with a good 'peach' flavour; sugar content can reach up to 17 °Brix, if harvested at physiological maturity (Table 1). It needs a careful field management in order to avoid brown rot from *Monilinia* spp. on fruit.

Harvest time is from late August to early September in northern Italy (southern Po Valley, 44°50' latitude), around 50 days after 'Big Top' nectarine, a commercial cultivar of reference for the Italian peach industry (Figure 2).

Figure 1. Fruit of 'Maissa' ready for harvesting.

Table 1. Main features of 'Maissa' fruit in comparison with other flat peaches [1]

Cultivar	Fruit weight (g)	Firmness (kg/cm^2)	Soluble solids (°Brix)	Acidity (meq/100g)
Platifun	131	3.78	16.0	3.6
Sweet Cap	125	3.14	12.2	6.5
Maissa	167	3.48	17.2	3.4

[1]Courtesy of Astra 'Fruit quality lab', Ravenna, Italy, 2013

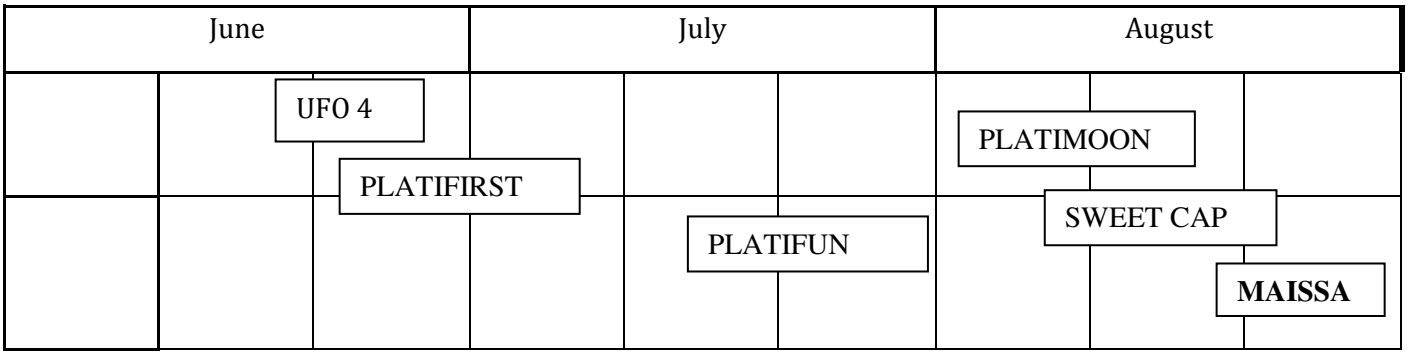

Figure 2. 'Maissa' harvest time compared to some commercial flat peaches

CONCLUSIONS

What makes very promising the commercial exploitation of 'Maissa' stony hard yellow peach is not just the crunchy flesh, but its juiciness and the sharp aroma of peach, a combinations so far never described in a stony hard peach.

In addition, thanks to its remarkable 'keeping' attitude on tree, this fruit can be harvested in a window of about three weeks, ranging from 13 (early harvest) to 17 °Brix (late harvest), with always pleasant taste, due to the (not too) low acidity. All of these characters, besides being so far unique in the peach cultivars landscape, make 'Maissa' easily distinguishable from any other peach in the fresh market, thus laying the foundations for a possible 'varietal club' marketing strategy.

The European plant propagation rights are in the process of being acquired, and the strategy of commercial introduction will be established shortly.

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