

## Varietal innovation for high quality sweet cherry production

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### L'innovazione varietale nel ciliegio per produzioni di alta qualità

**Riassunto.** La qualità della frutta è un fattore di considerevole importanza per una produzione di successo. Esso dipende da un numero di parametri che necessita di essere riconosciuto e compreso, al fine di poter prendere decisioni informate su quali tipologie di ciliegio siano migliori per essere coltivate al giorno d'oggi ed in futuro, in modo da massimizzare le opportunità e fare sì che questa coltura rimanga redditizia in futuro. In un contesto di cambiamento climatico e diversificazione delle pratiche di produzione agricola, gli attori della filiera del ciliegio dolce si stanno rivolgendo all'innovazione varietale per lavorare su caratteri come il problema delle spaccature, la durezza, il calibro, le proprietà dei frutti e le caratteristiche dell'albero, in modo da ottenere produzioni di alta qualità.

**Parole chiave:** *Prunus avium*, nuove cultivar, selezione varietale.

### Introduction

These are exciting times to be a sweet cherry (*Prunus avium* L.) grower, but the maintenance of fruit quality from the tree to the consumer will continue to be our greatest challenge. In the past, producers didn't have a lot of choice when planting a cherry orchard, but today the range of varieties is increasing a lot and we have seen an explosion of new commercial varieties introduced over the last decades.

In every cherry producing country new varieties tend to be compared to the top five standard varieties. Our current orchard systems were designed to grow and sell these varieties and all other varieties are rated in comparison with them. Also, these leading varieties represent around 70% of the sweet cherry growth area in each country. But the variety offer is evolving and diversifying and next to these leading varieties, which are often the same for many years, are new varieties coming from varietal innovation that may answer new needs.

Sweet cherry is an important fruit worldwide and its sector has to continually face new challenges in different fields (i.e. economic, environmental and social), to remain competitive on global and domestic markets. For these reasons, it's necessary to find solutions that improve farm productivity, profitability and sustainability. Also, several things are now driving market growth and profitability, but the point is that the market will expand in direct relation to the quality of the product that we produce and varietal innovation is one of the ways to reach this goal.

### What does innovation and in particular varietal innovation mean?

Innovation can be defined as a concrete process that is planned, achievable and adapted to the needs of the business. Innovation is a mean to achieve strategic objectives, improve competitiveness, differentiate the product on the market and create value.

Varietal innovation is the combination of several defined criteria in the same product that will make high quality cherry production possible (Charlot and Vinciguerra, 2005). It is therefore a major component of the adaptation of agriculture to global changes. This is why, varieties have been considered for several years as a major strategic factor, on a national or company level, to conquer new markets and remain competitive.

### Why do we need varietal innovations?

Climate change and diversification of agricultural production practices are generating increasingly heterogeneous cultivation conditions. These new conditions require varieties that are diversified and adapted to the wide range of biotic and pedoclimatic conditions as well as European and world-wide markets. Also, varieties must be characterized to enable producers to make an optimal choice from the available material, in the light of their production objectives and technical and environmental constraints, always in a desire to optimize the fruit quality in order to make production more reliable and to ensure farm sustainability.

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To do this, methodological developments are necessary to (i) define the varietal ideotypes likely to meet the expectations of the stakeholders in the sector in various production and use contexts, (ii) promote genotype x environment interactions in the varietal experimentation networks and thus characterize tested varieties for their responses to resources and environmental stresses, (iii) characterize the available resources and the biotic and abiotic stresses expressed in agricultural trials, (iv) recommend the varieties on the basis of multiple criteria integrating the expectations of the different actors in the sector as well as the context of production and the use of the varieties.

### **Which varietal innovations are expected for sweet cherry?**

In general, and whatever its period of maturity, qualities for a sweet cherry variety should be as follows: productive but with the ability to self-regulate, homogeneous size, average fruit size of at least 26 mm, cracking and *Monilia* sp. tolerant, firmness, good organoleptic properties and adapted to various distribution channels.

#### *Fruit-cracking*

Cracking of sweet cherry is a highly complex phenomenon that is regularly observed and a large problem in most production areas of the world (Balbontin *et al.*, 2013). Cracking depends on several factors (genetic, physiological, climatic and agronomic) (Balbontin *et al.*, 2013) and generally occurs after rainfall. When the conditions are conducive to cracking (i.e., susceptible varieties, heavy rains when the fruit is at its most susceptible stage), the damage can be extensive, either virtually destroying the entire crop or simply making it unprofitable (due to the necessary sorting time and poor post-harvest maintenance of fruit quality) (Edin and Lichou, 1997).

After extensive efforts to find solutions and despite the different alternatives available through cultural management practices, cracking still represents a limiting factor for commercial production in areas where rain occurs during the harvest period. Additional agronomic measures and the use of plastic covers to protect fruit from rain may limit the risks but do not constitute an effective or reliable method of control for all climatic conditions (Charlot *et al.*, 2009). Selection and planting of tolerant cultivars is still the best option to reduce losses associated with this problem (Balbontin *et al.*, 2013).

#### *Fruit firmness*

For sweet cherry fruit, firmness is one of the traits most prized by marketers, consumers and growers, and it is often used for fruit quality assessment (Kalyoncu, 2009). Fruit firmness, implies better on-tree ripening, increased resistance to handling and transport damage, better adaptability to cold storage, longer shelf-life, and hence, fruit better suited to export (Sansavini and Lugli, 2008).

Genotypic differences in firmness between cultivars can be significant. In a recent factorial experiment, cherry firmness was greatly affected by cultivar, storage time, and time on the shelf after storage, and all of these factors interacted significantly, but cultivar accounted for the greatest proportion of the variance. (Toivonen and Hampson, 2012).

#### *Fruit size*

Fruit size is a critical fruit quality trait, in which a difference in diameter of only 2 mm for fresh market sweet cherries can make the financial difference between profit and loss, therefore, the development of new cherry varieties with large fruit is a major breeding goal.

Like other fruit tree species, cherry trees can only produce a certain amount of fruit. This quantity may consist of a large number of small fruits, a small number of large fruits or, preferably, a medium number of medium to large fruits. It's at this level that varietal innovation has its card to play, by providing varieties with a high agronomic potential that means varieties able to produce a sufficient number of fruits and of a size qualified as optimal.

However, and although the basic characteristics of the variety are the starting point, agricultural practices can have an important role and can greatly contribute to varying the final size. In order to improve fruit size, some kind of crop regulation (pruning or thinning) can be performed to reduce crop load and increase leaf area (leaf/fruit ratio) (Menzies, 2004). However, the more the variety does it by itself (self-regulation), the higher the profit will be.

#### *Taste properties: sugar content*

Consumer sensory evaluation of sweet cherry cultivars have shown that sweet tasting cherries were preferred the most (65%), while cherries that lacked flavor (31%), were too sour (27%) or not sweet enough (15%) were preferred the least (Turner *et al.*, 2008).

The levels of sugar present in cherry represent an important aspect because they contribute to flavor and determine the acceptability by customers. This is

why, knowing the potential receptivity for a variety by the consumer will help producers to make decisions on what to plant.

However, sugar content is just one aspect of taste properties or wildy of organoleptic quality of a variety and so this is not the only characteristic that defined the fruit quality for consumers. Fruit appearance (e.g. size, color) will get consumers to buy, but taste properties will make them buy again.

#### *Tree traits*

As there are no fruit without trees, it is important to approach the varietal innovation aspect with this in mind as well. In addition to the aspects of rapid fruit-set and easy tree management (growth, natural off-shoot intensity, fruit distribution on branches), which are important selection criteria, production reliability is threatened by a new parameter: climate change.

Due to specific vulnerabilities as perennial plantations and various temperature effects to elaborate fruit production, the fruit tree sector is facing a serious concern related to climate change. Since the beginning of the 2000s, impacts on tree physiology are beginning to be visible and are responsible for production irregularities of several varieties in different production areas. Thus, climate change is emerging as a critical challenge for cherry growers. There is an increasing urgency for developing studies on impacts and strategies for effective adaptation responses. Particularly, the breeding strategy must be revised to obtain varieties with characteristics that would not be affected by climate change, such as floral and fruit phenology and fruit quality, while also being tolerant to drought and high temperatures (Legave, 2009).

#### *Other varietal innovations*

Several aspects concerned by varietal innovation have been discussed here. However, this list is far from being an exhaustive list and expectations of cherry professionals are high in terms of resistance/tolerance to diseases and pests, but also in terms of post-harvest quality (epidermis resistance, stalk preservation), or even extension of the production calendar and segmentation of the market.

#### **Focus on varieties grown in France**

In total, and much dependent on the production's area, France grows around 25 varieties of red flesh sweet cherry. The three mains varieties are 'Burlat', 'Summit' and 'Sweetheart®Sumtare'. The 'Burlat' variety, accounting for 30% of French production, kicks off the season. With its red shiny fruit turning dark red when fully ripe, this semi-early blooming

variety is a common variety in early season. The 'Summit' variety comes into season 15-20 days later and accounts for 11% of production. With its heart-shaped appearance, and its soft and juicy fruit, it is a very popular variety. Then, 30-35 days after 'Burlat', comes 'Sweetheart®Sumtare'. This self-fertile variety have a high and regular production, a very good resistance on the tree (in the absence of rain) and after harvest (fig. 1).

#### **Conclusions**

In evaluating sweet cherry cultivars from both horticultural practices and marketing perspectives, there are several factors that need to be recognized and understood to make informed decisions about which cherries we need to be growing today and tomorrow in order to maximize our opportunities and remain profitable in the future by ensuring high quality production.

However, if market demand, social expectations, technical and environmental obstacles guide varietal creation, it's up to the breeders to make the right choices. They have to create what will be successful on the market, but we must not forget that in the fruit genetics sector, breeders work is based on creation processes that take a minimum of a decade. On average, it takes 20-30 years between the act of hybridization and the marketing of the single variety that emanates from it. So, today we are working with varieties created many years ago, and we are creating the ones that will be used in the future. But, who knows what the market will look like 20 or 30 years from now?

We can say that creating an innovative variety is not only dependent on genetics but also on how a product is grown and marketed. Growers must insure that cultural practices allow the variety to develop its full potential. Development of a marketing strategy guaranteeing that the innovative characteristics of the product are conveyed to the consumer is also necessary. The combination of these elements will ensure the success of an innovative variety.

#### **Abstract**

Fruit quality is a factor of considerable significance for successful production and it depends on a number of parameters that need to be recognized and understood to make informed decisions about which cherries we need to be growing today and tomorrow, in order to maximize our opportunities and remain profitable in the future. In a context of climate change and diversification of agricultural production practices, sweet cherry actors are turning to varietal innovation

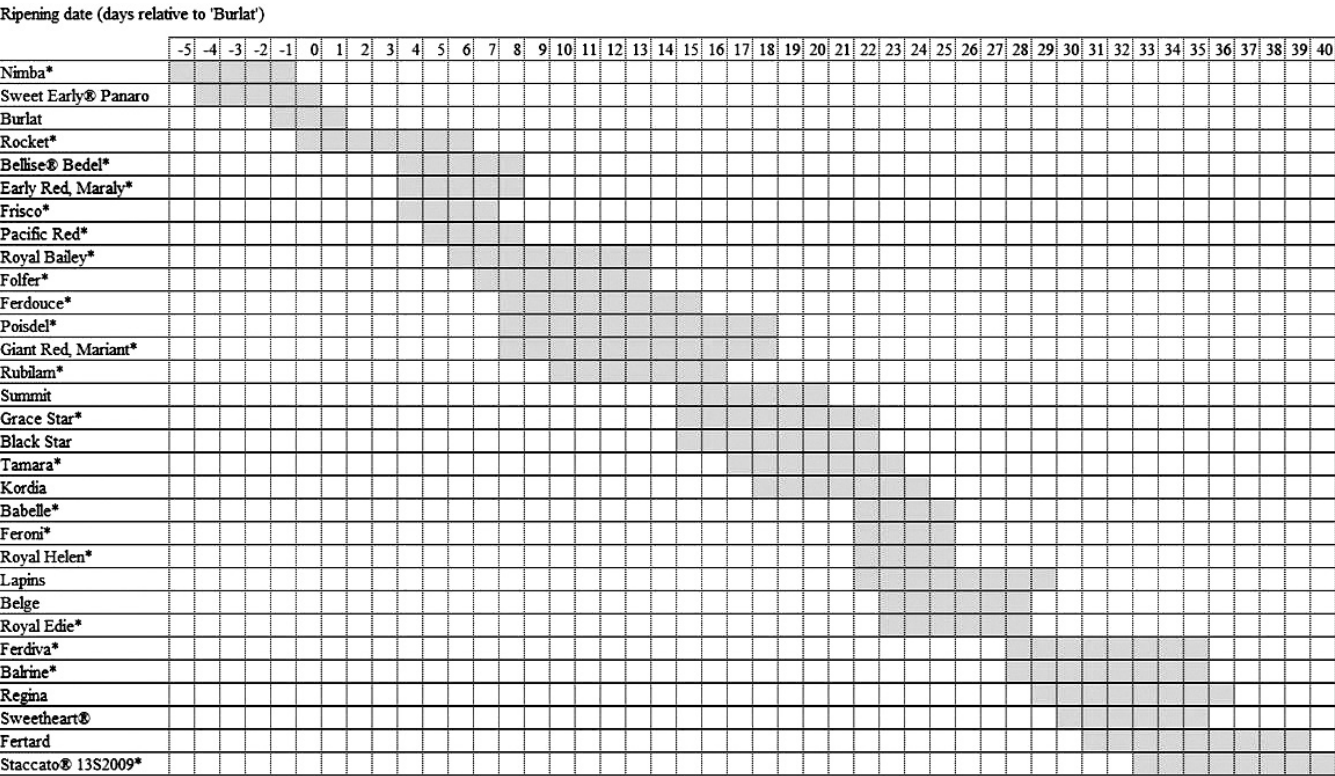


Fig. 1 - Ripening period of main red flesh sweet cherry varieties grown in France including some promising new varieties.

Fig. 1 - Periodi di maturazione delle principali varietà di ciliegio dolce a polpa rossa coltivata in Francia; sono incluse alcune nuove varietà promettenti.

to work on criteria such as cracking, firmness, fruit size, fruit properties and tree traits, in order to achieve high quality production.

**Keywords:** *Prunus avium*, new cultivar, selection.

References

BALBONTÍN C., AYALA H., BASTÍAS R., TAPIA G., ELLENA M., TORRES C., YURI J.A., QUERO-GARCÍA J., RÍOS J.C., AND SILVA H., 2013. *Cracking in sweet cherries: A comprehensive review from a physiological, molecular, and genomic perspective*. CHIL J AGR RES, 73(1): 66-72.  
CHARLOT G., VINCIGUERRA L., 2005. *Le 5e symposium international sur la cerise*. Infos Ctiifl, 215: 9.  
CHARLOT G., MILLAN M., FILLERON E., ARREGUI M., QUERO-GARCIA J., 2009. *L'éclatement de la cerise*. Infos Ctiifl, 252:

34-39.  
EDIN M., LICHOU J., 1997. *Cerise, les variétés et leur conduite*. In « Guide Pratique ». Ctiifl.  
LEGAVE J.M., 2009. *Comment faire face aux changements climatiques en arboriculture fruitière ?*. Innovations Agronomiques, 2009(7): 165-177.  
KALYONCU I.H., N. ERSOY N., YILMAZ M., 2009. *Some physico-chemical properties and mineral contents of sweet cherry (Prunus avium L.) type grown in Konya*. AFR J BIOTECHNOL, 8(12): 2744-2749.  
MENZIES R., 2004. *Increasing cherry fruit size*. Agfacts NSW Department of Primary Industries, 5212: 6.  
SANSAVINI S., LUGLI S., 2008. *Sweet cherry breeding programs in Europe and Asia*. Acta Hort, 795(1): 41-57.  
TOIVONEN P., HAMPSON C.R., 2012. *Phenotypic analysis of new sweet cherry and apple cultivars based on postharvest quality characteristics*. ACTA HORTIC, 945(1): 219-225.  
TURNER J., SEAVERT C., COLONNA A., LONG L.E., 2008. *Consumer sensory evaluation of sweet cherry cultivars in Oregon, USA*. Acta Hort, 795(2):781-786.