Description and selection within a peach backcross population and parental segregation for the aptitude for fruits postharvest conservation trait

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introduction

The peach tree (*Prunus persica* (L) Batsch) is a fruit specie with a wide varietal dynamics. The ideotype pursued in the breeding program of the EEA San Pedro (INTA) are peaches with overall good quality and high aptitude for refrigerated conservation (greater than 40 days), related to the absence of chilling injury (**Fig. 1**).

Figure 1. Cold damage. (A) Damaged fruit without juice (mealiness). (B) Undamaged fruit juicy.

Objectives

The aim of this study was to describe the quality characteristics of fruits from 45 peach genotypes obtained from the backcross (BC1) between Dixiland and DixFla 141 (a hybrid between Dixiland x Flavorcrest), make a preliminary selection and assessment the aptitude for conservation of Dixiland, Flavorcrest and DixFla 141.
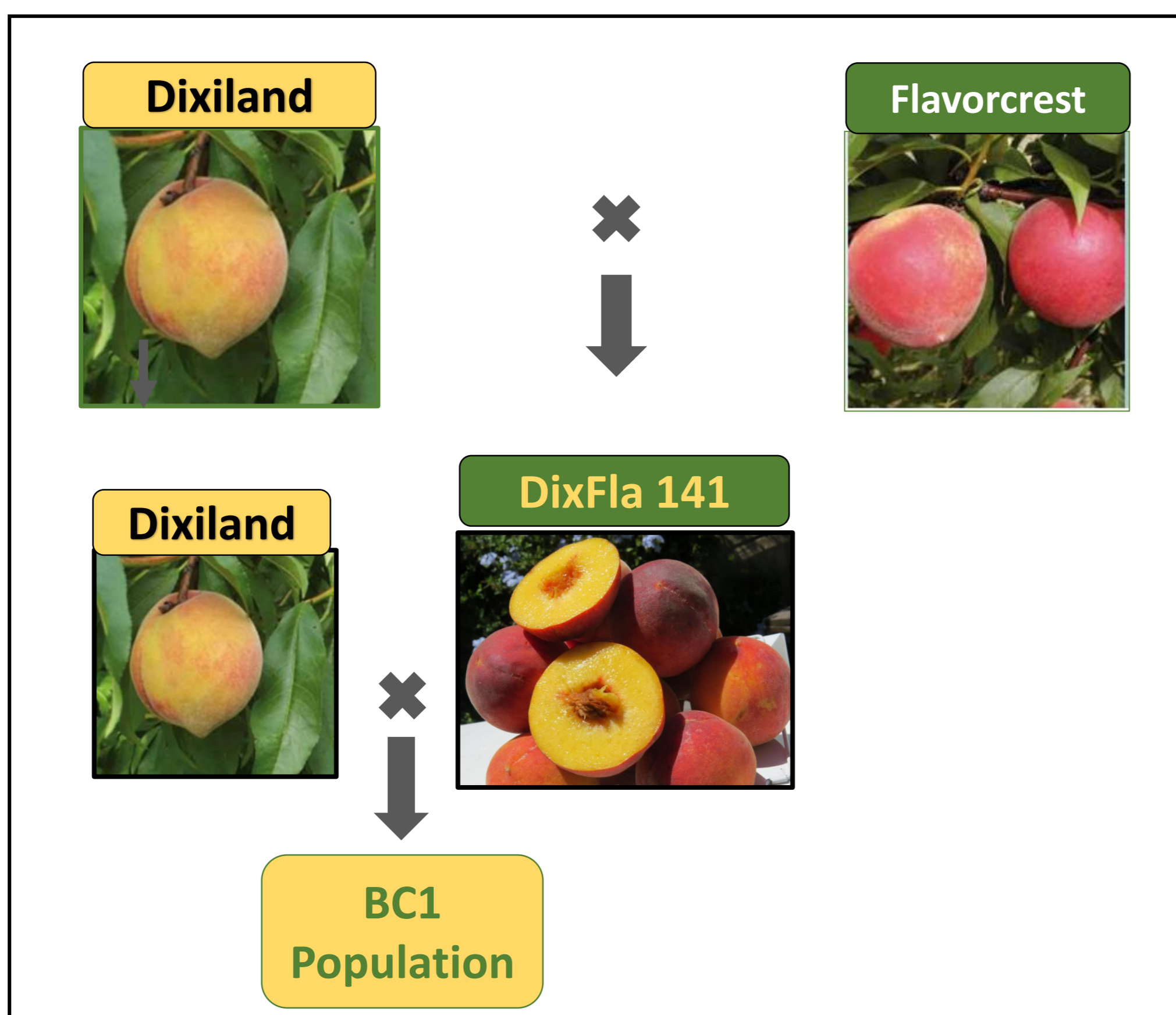

Figure 2. Scheme of backcrossing and selection within F1 and the BC1 population. The parents Dixiland and Flavorcrest were crossed as elite genotypes contrasting for size and red over colour. As a result, the F1 selection obtained DixFla 141. The backcross (BC1) was carried out in order to recover more characteristics from the Dixiland genotype.

Materials and Methods

The test was carried out in the 2020/2021 campaign at the EEA San Pedro Research Station (33°44'12.7"S, 59°47'58.2"O, Argentine). For the BC1 description (**Fig. 2**)., 10 fruits per genotype were taken at random, recorded at harvest time for the characteristics described in **Table 1**. Economic weights were defined as follow 100 points were distributed assigning higher and lower values according to their commercial interest and determined a score.

Table 1. Traits, Economic Weights and Scale assigned to each Trait.

Traits (X)	Economics weights (β)	Scales
Weight (WE)	3	1 point = 10 g
Fruit shape (width, height, thickness) (FSH)	24	Rounded = 10, Slightly oblong = 9, Moderately oblong = 7, Oblong = 5, Very oblong = 3
Apex shape (ASH)	8	Rounded = 10, Slightly pronounced = 9, Moderately pronounced = 7, Pronounced = 5, Very pronounced = 3.
Furrow type (FTY)	3	Very marked = 7, Marked = 9, Moderately marked = 10, Slightly marked = 7
Fruit symmetry (FSY)	11	Symmetric = 10 Asymmetric = 5
Stone size (porcentaje of Stone/Pulp) (SS)	2	Small = 10, Medium = 8, Large = 6
Type of pubescence (TPU)	8	Meagre= 10, Abundant = 7
Over colour of the epidermis (OEP)	15	1 point = 10 %
Reddish pigmentation in pulp (RPP)	3	Yes=5, No= 10
Sweet taste (ST)	5	High = 10, Medium = 8, Low= 6
Acid taste (AT)	5	High = 6, Medium = 8, Low = 10
Brix degrees (B)	11	1 point = 1 °Brix
Adhesion pulp-stone (APS)	2	Freestone = 10, Semi freestone = 9, clingstone = 8

$$I = \sum_{i=1}^{n} (\beta * X)$$

I= Score
n= 45 Genotypes
β= Economic weights
X= Phenotypic traits value (WE, FTY, AT, B, etc.)

For the evaluation of the aptitude for conservation 160 fruits of each genotype (Dixiland, Flavorcrest and DixFla 141) were taken and stored distributed in 8 treatments, in refrigeration (0-0.5 °C) for 0, 28, 35 and 42 days, added 4 days of maturation at 20 °C. Juice's percentage and pulp's colour were measured to detect chilling injury.

Results

The score identified three superior genotypes according fruit quality, becoming preliminary selections.
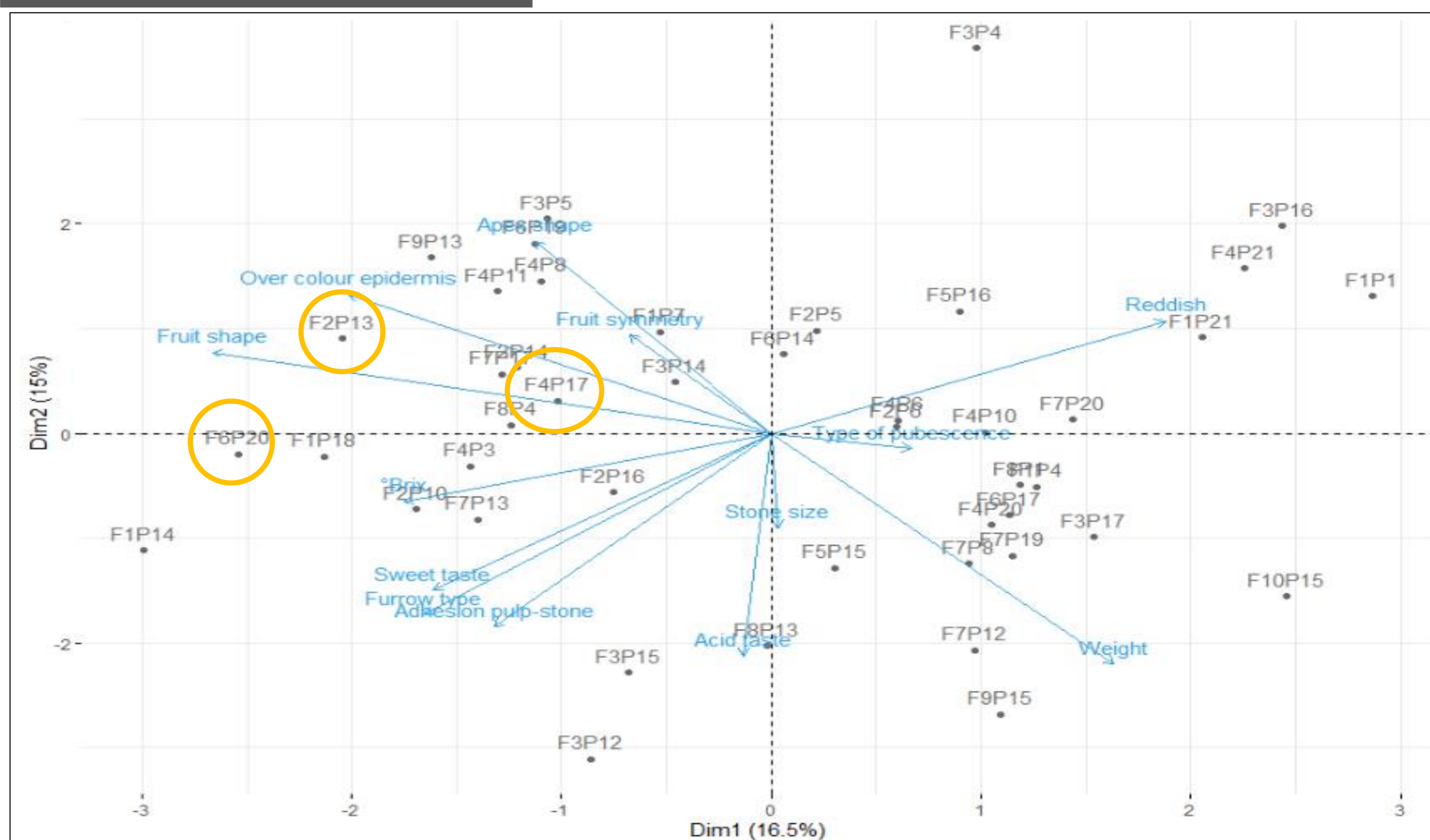

Figure 3. Behavior of variables and genotypes through Principal Components Analysis (PCA). The variables of greatest magnitude that contribute to SCORE are Fruit Shape, Over Colour Epidermis and Brix Degrees. Individuals F6P20, F2P13, F4P17, show the highest scores for all the variables analyzed. The PCA captures 31.5% of the variance of all the data in the first two dimensions.

Superior Genotypes

F6P20 **F2P13** **F4P17**

Mealiness is the main cause of fruit quality loss during the cold storage of the parental genotypes
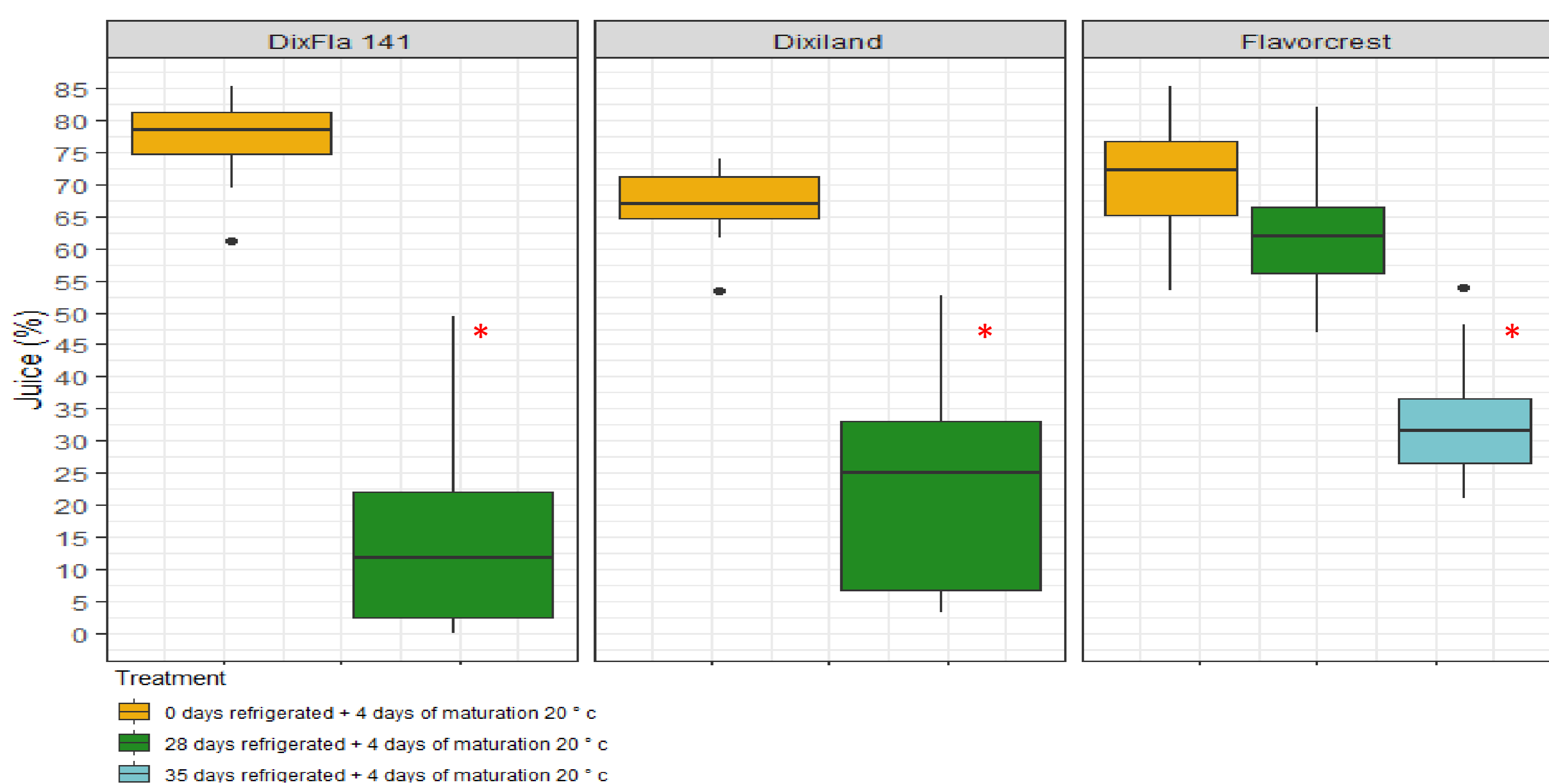

Figure 4. Variation of the percentage (%) of juice in different storage periods. The decrease in juice in values higher than 25% with respect to the control treatment (0 days refrigerated) indicate the presence of mealiness. The significant difference between treatments is indicated as a (*).

- The genotypes Dixiland and DixFla 141 did not reach 28 days, while Flavorcrest achieved between 28 and 35 days of refrigerated storage without presenting chilling injury for aptitude for postharvest conservation trait.
- Chilling injury by color changes was not detected through the period studied.

Conclusions

- The methodology used allowed to identify three superior genotypes within a population of low genotypic variability (full siblings).
- Segregation of the postharvest conservation aptitude trait preliminarily concludes that there would be no positive transgressive segregation among parental BC1 genotypes and the same behaviors would be expected from individuals within the backcross population.