techniques for the measurement of maturity and firmness in peach

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ISA FRUIT PROJECT

Objectives

Explore the relationship between non destructive (ND) measurements (impact and optical) and:

- ✓**Maturity: referenced by the date of harvest.** Peach trees produce a staggered fruit maturation, so high variability is expected for a certain harvest date. Thus, average values for each date are used as a reference.
- ✓**MTF:** Most extended reference **used by growers and fruit industry to assess postharvest handling on peach.**

Materials

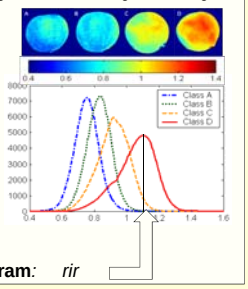
Richlady peaches from 2 seasons (2006: n= 311, 2007; n=400); from 3 and 5 harvest dates respectively.

Methods

Principal Component Analysis (PCA) and multilinear regression for MTF estimation were applied using the following ND measurements:

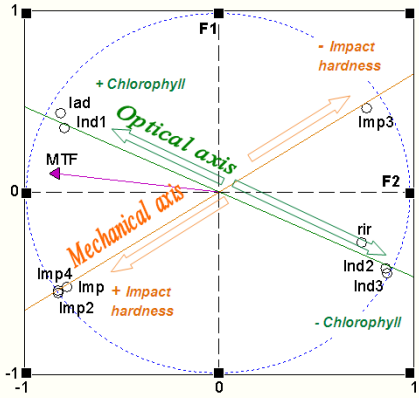
MECHANICAL:
LPF low mass impact measurements
Imp: Max. Aceleration (m/s^2)
Imp2: Slope (*Imp* / time)
Imp3: Time for Max. Aceleration (μs)
Imp4: Max. Deformation (μm)

Fig. 680nm/800nm images and histograms



OPTICAL:
Spectral indexes
Ind 1, Ind 2, Ind 3, Iad
(Combination of three wavelengths in the chlorophyll region)

Mode of 680nm/800nm image histogram: *rir*



Results

✓PCA was performed using data from first season (n=311). The first two factors gathered 80,4% of the variance.

✓**Two main variable axis, optical (Opt) and mechanical (Mec) were identified (axis are 70% complementary).**

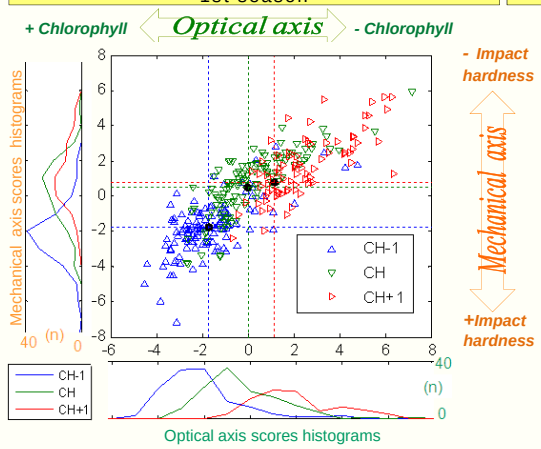
MTF projection onto the PCA space

✓MTF was explained on a 62% and 40% by Opt and Mec axis respectively (computed as the projection of MTF on the axis).

✓The quality of representation of MTF on the PCA plane was 70.3 %

MATURITY VS MEC AND OPT AXIS: Projection of scores onto Opt and Mec axis

1st season

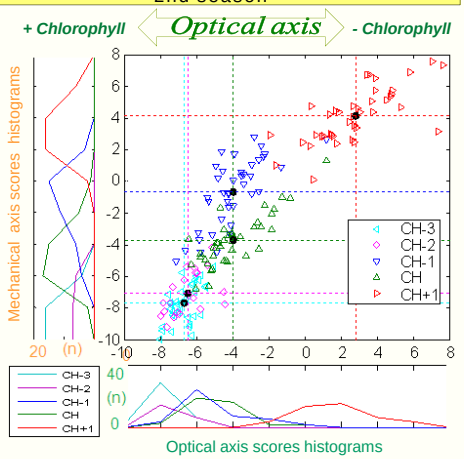


✓**A wide dispersion** was observed for each harvest date commercial harvest (CH),pre- CH (CH-1);post-CH (CH+1)

✓**Mean score values** for each harvest date (black dots in the fig.) appeared **ordered along Opt. and Mec. axis.**

✓The mean score on the Mec axis for the **commercial harvest date (CH)** increased due to softening during storage previous to the transport (5 extra- hours at 20C)

2nd season

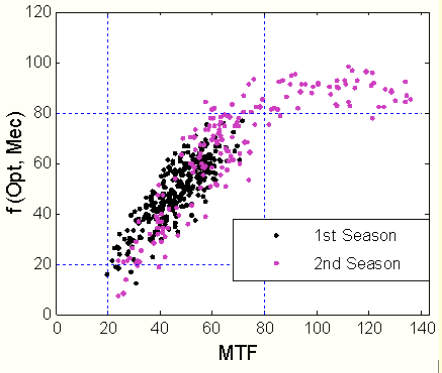


✓Pre-commercial harvest (CH-1) mean was missplaced by the Mec axis.

✓Three groups of harvest dates were correctly ordered by the optical axis:

- o CH-3 and CH-2;
- o CH-1 and CH;
- o CH+1

Multilinear regression MTF = f (Mec,Opt)



✓The combination of Opt. and Mec. values showed a linear relationship with MTF between 20N - 80N. R^2 = 80%

✓Whithin this range, this relationship remained unbiased and equiparable for both seasons.

Conclusions

✓Two groups of non destructive variables (optical and mechanical) have been identified on the PCA plane, explaining most (80.4%) of the variance. As the main source of variance in the dataset is expected to be related to maturity, this two groups of variables showed to be able to explain maturity variations.

✓The scores projection onto the optical axis distinguished harvest dates (reference of maturity) in an unbiased but unprecise way, while mechanical axis was influenced by postharvest incidences as well as by maturity.

✓**The feasibility of using optical and ND mechanical tecniques to estimate maturity and firmness, (between 20-80 N of MTF) in peach has been proved, being both techniques adaptable for on – line measurements.**

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