APPLIED PLANT RESEARCH
WAGENINGEN UR

Non-destructive fruit quality assessment in apple by I_{AD}-index: practical perspectives

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Introduction

Apple fruit quality at consumption depends on the ripening stage at harvest and on post-harvest conditions. Fruit skin colour, starch content, fruit firmness and TSS are commonly used to establish the harvest date of apples. However, skin colour is not always representative of the ripening stage and the other determinations are destructive and thus done on a limited number of fruits. Recently, a new non-destructive user-friendly portable device has been introduced for assessing fruit quality. This device, the DA-meter, calculates the I_{AD}-index, which is the difference in absorbance between two wavelengths ($A_{670} - A_{720}$) near the chlorophyll-a absorbance peak.
Within ISAFRUIT the I_{AD} was evaluated as a possible tool for assaying the apple fruit ripening stage and fruit quality.

Set-up

In the weeks around harvest and during storage the I_{AD} was measured as well as traditional quality attributes, like ground colour, fruit firmness, TSS, acidity and starch. Cultivars included Golden Delicious, Red Delicious, Elstar, Rubens®, Pink Lady and Galaxy.

Results

The I_{AD} decreased throughout fruit ripening (Figure 1). In fact, the distribution of I_{AD}-values became wider during ripening and shifted towards lower values. A decline in I_{AD} was also clearly seen during storage (data not shown).

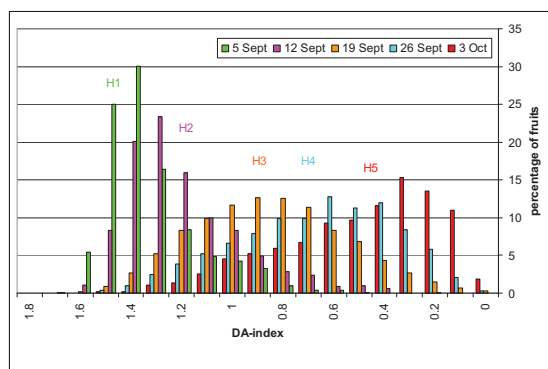
Figure 1. Distribution of Rubens® apples harvested at 5 different dates into different I_{AD}-classes.

A reliable distribution into different I_{AD} classes of a whole batch can already be obtained with a sample as small as 100 apples (Figure 2).
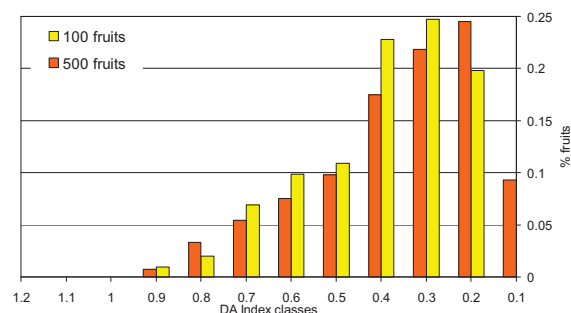

Figure 2. Distribution of Galaxy apples into different I_{AD}-classes obtained with samples of 100 and 500 fruits.

A good correlation was found between the I_{AD}-index and the start of ethylene production. Correlations between the I_{AD}-index and traditional quality attributes depended on the attribute and on the cultivar. Good correlations were found between ground colour (°h-values) and I_{AD}, acceptable correlations were found between fruit firmness and I_{AD}, and between acidity and I_{AD} in Golden Delicious, Red Delicious, Elstar, Pink Lady and Galaxy. An example is shown in Figure 3 for Golden Delicious. In Rubens® correlations were less convincing.

$y = 3.07x + 1.82$
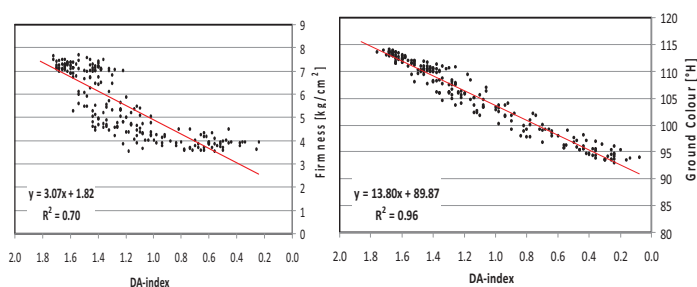$R^2 = 0.70$

$y = 13.80x + 89.87$
$R^2 = 0.96$

Figure 3. Correlations between I_{AD} and fruit firmness (left) and I_{AD} and ground colour (right) in Golden Delicious apples.

Conclusions

- Acceptable to good correlations have been found between the I_{AD}-index and traditional quality attributes like ground colour and fruit firmness in several cultivars.
- The I_{AD} can be a useful tool to assess apple fruit ripening for batches of fruits. Consequently the optimal harvest time can be predicted as well as the best storage strategy. As a result losses of fruits during storage decrease. Moreover, consumers obtain a better fruit quality.

The I_{AD} can be easily measured with a portable DA-meter.