REFLECTANCE PROPERTIES OF SWEET CHERRY FRUIT

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Abstract

Based on the most recent data, the average amount of sweet cherry produced in Hungary is around 10-12 thousand tons. Therefore fast and effective method is important for sweet cherry fruit quality analyses. The aim of the study was to examine the applicability of reflectance measurements for sweet cherry fruit quality analyses. In our experiment five cherry species (Vera, Cristalina, Germersdorfi, Noir de Mechet, Canada Giant were examined in order to measure the spectral differences between species. Further more, spectral alteration was examined between different health and maturity status of the fruits in the case of a specified, the Germesdorfi species. The four new indices are appropriate tools for cherry quality analysis. Thus reflectance measurements can also support more precise and automated fruit selections. The methods for the differentiation of species could also be viable at a concerned habitat; however, the climate, habitat and soil conditions strongly affect the yield quality. Concerning the fast determination of water content, WBI could be a reliable method for the assessment.

Key words: sweet cherry, spectrometer, reflectance measurements, fruit indices

INTRODUCTION

The total sweet cherry production of the world ranges between 1.4 and 1.6 million tons. Regarding the growing area, Europe has a leading role as more than 50% of sweet cherry is produced here.

The Hungarian sweet and sour cherry breeding has been going on since1950. In the frame of this programme are 13 released and 1 candidate sweet cherry varieties, and 9 released and 2 candidate sour cherry varieties. Sweet cherry varieties in the National Variety List are the following: 'Margit' (1987),'Linda' (1988), 'Katalin' (1989), 'Alex'(1997), 'Kavics' (1999), 'Vera (2002), 'Rita'(2004), 'Petrus (2007), 'Paulus'(2007), 'Aida' (2007), 'Carmen (2007) 'Tünde'(2008), 'Sándor'(2008) (Apostol 2011).

The total area of new orchards planted between 1998 and 2005 with governmental support is 750 ha, out of which the intensive orchards with a plant density above 1000 trees/ha make up for only 3.3%. Unfortunately, in most orchards the "semi-intensive" spacing of 7 x 5 m and 6 x 4 m were applied. In recent years, the cultivars planted on the largest areas were (in decreasing order): cv. 'Katalin', clones of cv. 'Germersdorfi', cvs, 'Linda', 'Kordia', 'Bigarreau Burlat', 'Szomolyai fekete', 'Van' and 'Margit'. In addition to these, the following foreign cultivars were also planted by the

Hungarian producers: cvs. 'Sunburst', 'Stella', 'Regina', 'Valerij Cskalov', 'Sylvia', 'Sweetheart' and 'Krupnoplodnaja' (Thurzó, 2008).

Based on the most recent data, the average amount of sweet cherry produced in Hungary is around 10-12 thousand tons. Therefore fast and effective method is important for sweet cherry fruit quality analyses. One of the possible methods for quality analysis is the reflectance measurement of the fruits, because reflectance measurement is a valid tool for vegetation analysis as well (Burai et al. 2009. Champagne et al, 2001)

MATERIALS AND METHODS

The aim of the study was to examine the applicability of reflectance measurements for sweet cherry fruit quality analyses. In our experiment five cherry species (Vera, Cristalina, Germersdorfi, Noir de Mechet, Canada Giant were examined in order to measure the spectral differences between species. Further more, spectral alteration was examined between different health and maturity status of the fruits in the case of a specified, the Germesdorfi species. Out of every sweet cherry species 25 fruit samples were measured in three repetitions.

The reflectance spectra were measured by a hyperspectral (0.55 nm spectral resolutions) AvaSpec 2048 spectrometer within 400 – 1000 nm wavelength interval. The AvaSpec 2048 system consists of a spectrometer, a fiber optic and a halogen light source, and a spectral sampling box

The fiber optic has two connections; one is for the spectrometer, and one is for the light source. The light source ensures the permanent light intensity in the whole measurement range. The sampling box is insulated so the sampling is not disturbed by any external light.

Before the spectral measurement the spectrometer had to be calibrated. For the calibration white and dark reference measurement is needed. The calibration was made by a special calibration reference unit. For reflection measurements WS-2 reference tiles was used for diffuse reflection The WS-2 white reference tile is made out of a white diffuse PTFE (polytetrafluoroethylene) based material, meeting the highest demands with regard to high grade diffuse reflectance.

Several parameters were examined based on the spectra. The colour, maturity and health status was analysed in the yellow –red (570-730) wavelength interval, where a significant sigmoid growth of reflectance appears.

RESULTS AND DISSCUSIONS

The characteristics of the reflectance curves of each fruit species are caused by the large amount of absorption of anthocyanin content at 450 –

570 nm wavelength intervals. On the other hand, reaching the red interval the reflectance of healthy cherry fruits are raising markedly at 700 nm due to the red color (Figure 1.). Though the shapes of the spectral curves are tend to be similar, there are differences among species in intensity and the yellow –red (570-730) wavelength interval.

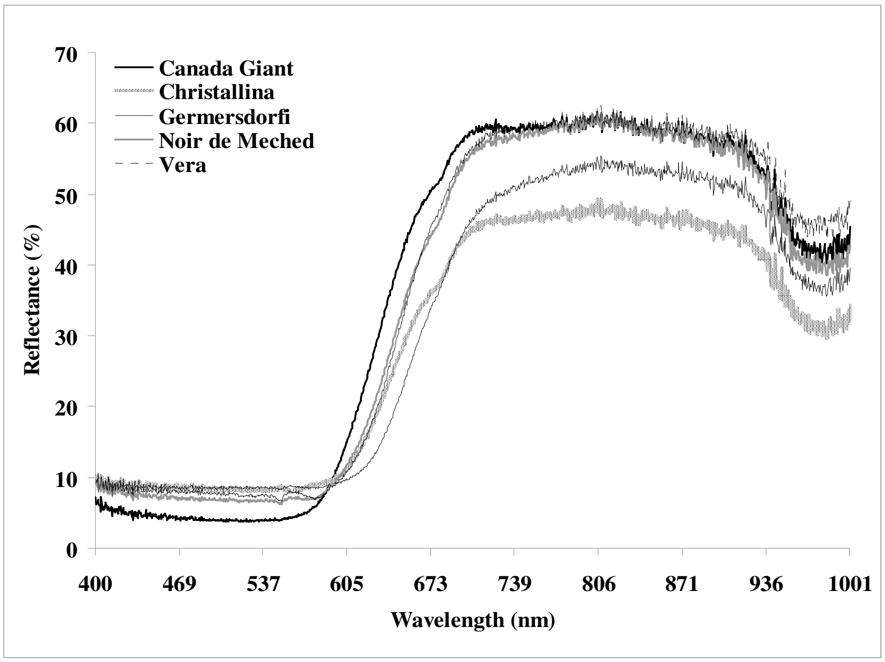

Figure 1. Spectral properties of different cherry fruits

There are much more spectral differences between fruits regarding the ripe and health status. Healthy and ripe fruits show the highest reflectance (%) in the red and NIR spectral interval, since the amount of anthocianin is probably the highest, and there is no damage which could case oxidation of these flavonoids (Figure 2.). Due to the damages and other diseases (*Monilia*) brownish oxidation occurred in fruits, and the anthocyanin content is definitely decreased. Therefore the reflectance in the red interval is lower and there is no rapid sigmoid increase between yellow red intervals. Due to unripe had less anthocyanin but more carotinoids (yellowish colour), and the effect of starting oxidation processes effects in overripe fruits, low reflectance occurred in red- NIR.

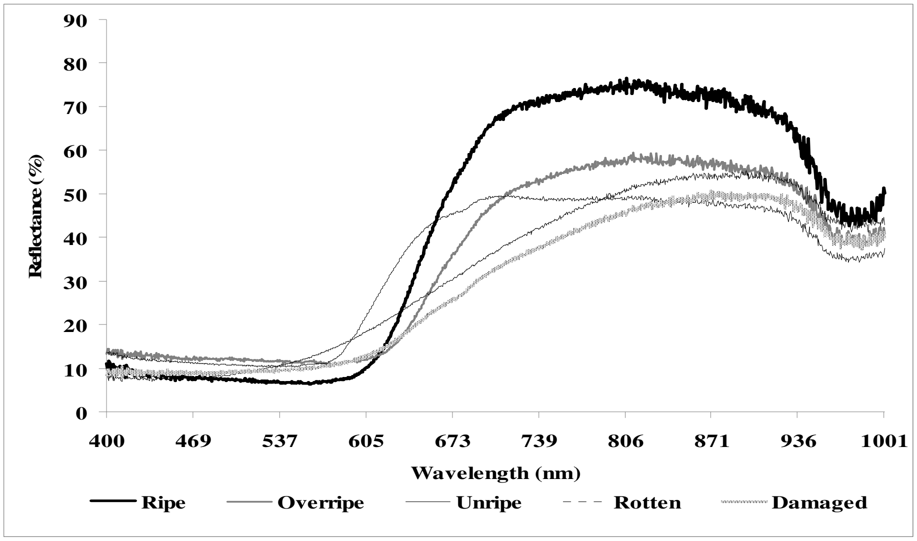

Figure 2. Spectral properties of cherry fruits regarding ripe and health status

CONCLUSIONS

Thus reflectance measurements can also support more precise and automated fruit selections. The methods for the differentiation of species could also be viable at a concerned habitat; however, the climate, habitat and soil conditions strongly affect the yield quality. Concerning the fast determination of water content, WBI could be a reliable method for the assessment

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