FOOD QUALITY ATTRIBUTES OF MELON (*CUCUMIS MELO L.*) INFLUENCED BY GRAFTING

Dzsenifer Németh[1], Noémi Kappel[2], Balázs Gábor[3]

[1,2,3] Department of Vegetable and Mushroom Growing, Szent István University
Ménesi str.44., Budapest, H- 1118, Hungary
E-mail: nemeth.dzsenifer@kertk.szie.hu

Abstract

Melon (*Cucumis melo L*.) is an important and valuable vegetable crop that nowadays has a 550 ha cultivated area in Hungary (FuitVeb, 2016). Using graftlings for cucurbits is very popular today. Nevertheless for melons the practice of grafting is not widespread, in contrast grafted seedlings are widly used by the watermelon growers. However fusarium wilt (*Fusarium oxysporum f. sp. melonis*), yield growing, and crop safety justify to use more grafted melon seedling. On the other hand it should be mentioned that the food quality attributes can change, due to the grafting (Balázs, 2013). Globally there are not many scientific articles avaliable in this topic. The goal of our research is to process the scientific foundings and make the measurment of the grafted melon's inner content values easier. Over the last few years, the NIR (near infrared spectroscopy) method became popular to measure the food attributes. We would like to work out an easy measuring methode of the inner content values using NIR in the case of melons.

Keywords

grafting, melon, food quality, NIR

Introduction

Grafting was first used in the late 1920s in Japan and Korea, the method was used to aid the watermelon from soilborne pathogens, and to avoid various diseases caused by *Fusarium* species (Ashita, 1927). The grafting of vegetables belonging to the family of cucurbits is not only important in terms of pest control, it also boosts yield of the plant, and the quality, inner content values and shelf-life of the fruit (Sakata et. al., 2006, 2007, 2008).

Ripening and postharvest behavour

It has been observed that melons with climactoric respiration tend to have a shorter shelf-life, but their aromatic compound content is increased. The reason behind these changes might be that the production of some aroma compounds is limited to the ethylene dependent pathways. Melons with climactoric respiration usually have orange flesh, and high aromatic content. Typically they have a short shelf-life due to quick softening. Melons with non-climacteric respiration, have mostly green flesh, they tend to have lower aromatic compound content, but they soften slower so they have a longer shelf-life (Wang et al., 2011). Researches show that grafting may decrease flash firmness of the fruit, this results in a shorter storage life. This may not be the case in every rootstock. Grafting on the right rootstock may result in nearly identical flesh firmness, to melons grown on their own root or grafted on themself (Zhao et.al.,2011).

Physiological disorders

The developement of vitrescence in Melons is usually mentioned as the effect of grafting (Jang et.al.,2014, Rouphael et.al., 2010, Colla et.al., (2017). Softening and vitrescence can usually be observed due to forcing in fall, and in cultivation in summer when a variety with lower flesh firmness traits is grafted to Shintosa rootstock. Jang et al., in 2014 revealed that plants grafted to Shintosa rootstock developed vitresence in 89%, in contrast only 50 % of plants growing on their own roots showed this problem. Plants grafted on melon rootstock showed and even lower vitresence developement rate. Low calcium content may contribute to softening and the developement of vitresence too (Johnstone et. al., 2008). A lower phosphorus, calcium and magnezium content can be detected in case of plants grafted to Shintosa rootstock, than in case of plants growing on their own roots, or plants grafted to melon rootstock.

Aroma voletiles

Grafting does change the taste and the aromatic compound content of the fruits, in case of Honey Dew melon a more robust fruity taste and aroma can be tasted. The compounds responsible for the taste of melon are amino acid-derived compounds, lipid-derived compounds, phenol-derived compounds, mono-, and sesquiterpens (Schwab et al., 2008). The isolation of these compounds usually happens with solid phase microextraction technique (SPME). For identification and quantification gas chromatography coupled on line with mass spectrometry (GC–MS) is used.

NIR- Near Infrared Spectroscopy

Food science and food industry predilectly use analitical instruments wich enable fast and cost-effective examinations. NIR is a method wich enables the qualitative and quantitative analisys of food inner contents. The method is used mainly in the Pharmaceutical industry, in Food industry antioxidant, sugar, carotine, vitamin C, and coffein content is measured with NIR. The quantity and physical parameters of components being present in low concentration can be determined too using NIR. NIR demand low sample, and chemical amount, and is relatively fast (Rácz, 2016).

Lu et al., (2015) measured SSC (Soluble Solids Content) and firmness using NIR in 4 different melon varietys, and also used traditional methods, SSC on a digital refractometer and firmness with hand-held penetrometer to measure these parameters. K-BA100R type Spectrophotometer was determined to be the most suitable for NIR (500-1010nm, 2 nm spectral interval), this can measure the required spectrum without injuring the sample. The measurement is based on transferring the volt energy into absorbance spectrum by mathematics method. Finally the reference range becomes visible with the help of the calibration modell. 4 different algoritms (UVE, UVE-SPA, GA, UVE-GA) were tried out for the PLS (Partial Least Squares) regression. The best results were acieved using the GA-PLS model, this enabled the most wavelength combination, and the wide search range also helped the reliability of the model.

Long (2005) also measured SSC content in melon using NIR. He studied how the variety the the calibration models and the place of sampling affect the trait. He came to the conclusion that the calibration modell was more reliable on the samples taken from the outer tissues of the mezocarpium. He also concluded that the performance of the model depended on the variety.

Moghimi et.al., (2010) engaged in the developement of the NIR method to measure SSC and pH in case of kiwi. For the establishment of the calibration modell Standard normal variate transformation (SNV), and multipli-cative scatter correction (MSC) were tried out. He determined that SNV was the more suitable. The correlation coefficient was 0,943, and RMSEP=0,076, these results proved to be better compared with other literatures.

McGlone et. al., (1998) examined firmnes, SSC and DM (dry-matter content) in kiwi using NIR. He concluded that NIR is perfectly suitable for the food industry of kiwi since it enable

reliable evaluation of all 3 traits. This ensures that only fruits in the rippening stage most suitable for costumer needs get into the stores.

The measuerement of more and more inner content values is researched using NIR. NIR used properly proves to be a cost-sufficient, and precise method.

References

1. Ashita E. (ed) (1927): Grafting of Watermelons kores (Chosun). Agricultural Newsletter 1, 9 (in Japanese)
2. Balázs G. (2013): Az oltás hatása, szerepe és jelentősége a magyarországi sárga-és görögdinnye termesztésben. Doktori értekezés. Budapest.
3. Colla G., Pérez-Alfoecea F., Schwarz D. (2017): Vegetable Grafting principles anf practices.
4. FruitVeb, 2016
5. Jang Y., Huh Y-C., Park D-K., Mun B., Lee S., Um Y. (2014): Greenhouse Evaluation of Melon Rootstock Resistance to Monosporascus Root Rot and Vine Decline as Well as of Yield and Fruit Quality in Graftes 'Inodorus'Melons. Hort. Sci. Technol. 32.(5):614-622.
6. Johnstone P.R., Hartz T.K., May D.M. (2008): calcium fertigation ineffective at increasing fruit yield and quality of muskmelon and honeydew melons in California. Hort. Technology 18:685-689.
7. Lee Y.M. (2003): Advences in vegetable grafting. Cronica Horticulturae, 43. (2): 13-19.
8. Long, R.L. (2005): Improving fruit soluble solids content in melon (Cucumis melo L.) (reticulatus group) in the Australian production system. Doctoral dissertation, Central Queensland University, pp. 72–96, 121–135.
9. Lu J., Qi S., Liu R., Zhou E., Li W., Song S., HanD. (2015): Nondescructive determination of soluble solids and firmness in mix-cultivar melon using near- infrared CCD spectroscopy. Journal of Innovative Optical Health Sciences. Vol 8, No.6. 1550032 (8 pages).
10. McGlone V.A., Kawano S. (1998): firmness, dry-matter and soluble-solids assessment of postharvest kiwifruit by NIR spectroscopy. Postharvest Biology and Technology 13.(1998): 131-141.
11. Moghimi A., Aghkhani M.H., Sazgarnia A., Sarmad M. (2010): Vis/NIR spectroscopy and chemometrics for the prediction soluble solids content and acidity (pH) of kiwifruit. Biosystems Engineering 106.(2010):295-302.

12. Rácz A. (2016): Kemometria ás FT-NIR spektroszkópia alkalmazása az élelmiszeranalitikában. PhD. értekezés. Budapest.
13. Rouphael Y., Schwarz D., Krumbein A., CollaB. (2010): Impact of grafting on product quality of fruit vegetables. Scientia Horticulturae 127:172-179.
14. Sakata Y., Ohara T., Sugiyama M., (2007): The history and present state of the grafting of cucurbitaceous vegetables in Japan. Acta Horticultutae 731:159-170.
15. Sakata Y., Ohara T., Sugiyama M., (2008): The history of melon and cucumber grafting in Japan. Acta Horticulturae 767:217-228.
16. Sakata Y., Sugiyama M., Ohara T., Morishita M. (2006): Influence of rootstock on the resistance of grafted cucumber (Cucumis sativus L.) scions to powdery mildew (Phodosphaera xantii U. Braun & N. Shishkoff). Journal of Japanaese Society for Horticultural Sciences 75: 135-140.
17. Schwab W., Davidovich-Rikanati R., Lewinsohn E. (2008): Biosynthesis of plant-derives flavor compounds. Plant Journal 54: 712-732.
18. Verzera A., Dima G., Tripodi G., Condurso C., P.Crinò, Romano D., Mazzaglia A., Lanza C.M., Restuccia C., Paratore A.: Aroma and sensor yquality of honeydew melon fruits (Cucumis melo L. subsp. melo var. inodorus H.Jacq.) in relation to different rootstocks. Scientia Horticulturae 169. (2014): 118-124.
19. Wang, Y.H., Behera, T.K., Kole, C., 2011. Genetics, Genomics and Breeding of Cucurbits. CRC Press.
20. Zhao X., Guo Y., Huber D.J., Lee J. (2011): Grafting effects on postharvest ripening and quality of 1-methylcyclopropene-treated muskmelon fruit. Scientia Horticulturae 130. (2011): 581–587