Quality of organic and integrated 'Topaz' apples growing in selected orchards in Poland

K. P. Rutkowski[1]*, A. Matulska, J. Markowski, A. Miszczak, M. Mieszczakowska-Frąc, A. Wawrzyńczak, D. E. Kruczyńska, W. Popińska

Abstract

In 2009 and 2010 ten orchards in various regions of Poland were chosen for the experiment; three of them were organic. At harvest the following quality parameters were measured: fruit weight, percentage of blush, background and skin colour, fruit firmness, total soluble solids content (TSS), titratable acidity (TA), ascorbic acid and polyphenols content. The content of macro nutrients (N, Ca, Mg, P and K) in fruits was also determined. As maturity indicators internal ethylene concentrations, starch and Streif indices were used. Pesticides residues, nitrites and nitrates, heavy metals contamination in fruits were also analyzed to assess the risk to human health. The quality of 'Topaz' fruit depended more on orchard location and season than growing system. The pesticides residues were not detected in organic fruits (as expected), and also in some integrated orchards.

Keywords: organic farming, fruit quality, pesticide residues, healthy components

Introduction

Organic fruit production is among others characterized by the absence of synthetic herbicides and pesticides. Nowadays the choice of apple cultivars suitable for organic fruit production becomes very important. The breeding of apple cultivars resistant to scab started more than 70 years ago and the first scab-resistant cultivar was introduced in 1967 (Crosby *et al*., 1992). However, the taste of many of them was not widely accepted by the consumer. A modern scab resistant apple cultivar 'Topaz' is highly recommended for both organic and integrated fruit production.

The aim of the study was to compare the quality of 'Topaz' apples grown under organic and integrated conditions (IFP).

Material and Methods

In 2009 and 2010 ten orchards in various regions of Poland were chosen for the experiment; three of them were organic. At harvest the following quality parameters were measured: fruit weight, percentage of blush, background and skin colour, fruit firmness, total soluble solids content (TSS), titratable acidity (TA), ascorbic acid and polyphenols content. The content of macro nutrients (N, Ca, Mg, P and K) in fruits was also determined. As maturity indicators internal ethylene concentrations, starch and Streif indices were used. Pesticide residues, nitrites and nitrates, heavy metals contamination in fruits were analyzed to assess the risk to human health. Background and skin colour were measured using MiniScan XE Plus (Hunter Lab, USA). Fruit firmness was measured on the opposite sides (blushed and unblushed surfaces) of fruit using an EPT-1R Pressure Tester (Kelowna, Canada), equipped with an 11-mm diameter tip. Soluble solids were determined using ATAGO PR-101 refractometer (ATAGO, Japan). Results were expressed in %.

[1] Research Institute of Horticulture, Konstytucji 3 Maja 1/3, 96-100 Skierniewice, Poland, krzysztof.rutkowski@inhort.pl

Titratable acidity was determined by standard titration method using automatic titration unit DL 50 Graphix (Mettler Toledo, Switzerland), by titration with 0.1N NaOH to the end point at pH=8.1. The results were expressed as malic acid in %. Malic and ascorbic acid contents were determined by an HPLC method. HP Agilent 1200 chromatograph was used, equipped with two Supelco LC-18 25cm columns connected in series. Detection was carried out at 210 nm for malic acid and 244 nm for ascorbic acid. Total phenolics were measured by modified Folin-Ciocialteau spectrophotometric method and were expressed as mg gallic acid equivalents per 100 g of fruits.

Pesticides residues in fruits were analyzed according QuEChERS method using gas chromatography with mass detector (GC/MS) and liquid chromatography tandem mass spectrometry (LC/MS-MS) for 170 pesticides. Extraction and determination of nitrites from plant material were conducted according to method described in PN-EN 12014-2: „Foodstuffs – Determination of nitrate and/or nitrite content – Part 2: HPLC/IC method for the determination of nitrate content of vegetable and vegetable products".

Content of calcium, phosphorus, potassium, magnesium, boron, copper, iron, manganese, zinc and sulphur, was determined after drying fresh plant material and microwave mineralization using inductively coupled plasma optical emission spectrometry (ICP-OES).

Results and Discussion

The quality parameters of examined apples were not closely related to production system and ripening stage, but depended on orchard location. The percentage of blush varied from 40% to 90%, TSS from 11.2% to 14.8%, and titratable acidity from 1.29% to 0.76%. The content of macro nutrients also depended on orchard location but not on orchard management system. It confirms data presented by Peck *et al.* (2006).

Ascorbic acid content varied from 9 up to 20 mg/100 g. Total phenolic compounds content determined by Folin-Ciocialteau spectrophotometric method was from 80 to 110 mg/100 g. Health-promoting compounds content (ascorbic acid and phenolics) strongly depended on orchard location. It is opposite to the data presented by Wojdyło *et al*. (2010) and Worington (2001), who concluded that organic fruits contained significantly more vitamin C than fruits from conventional farming.

Residues of Captan and Trifloxystrobin were found in apples obtained from some (but not all) IFP orchards. However, the pesticide residues in all tested fruits were below Maximum Residue Level (MRL). Apples from organic production were free from the residues.

Conclusion

The quality of 'Topaz' fruit depended more on orchard location and season than the growing system. The pesticides residues were not detected in organic fruits (as expected), and also in some IFP orchards.

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