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CHARACTERISATION OF SELECTED APPLE CULTIVARS IN THE ASPECT OF JUICE PRODUCTION IN THE CONDITION OF A FARM

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ABSTRACT
Pressing is the most common method of fruit juice acquisition. Not all apple cultivars are suitable for juice pressing. The use of suitable fruit cultivars for juice pressing may reduce the cost of pressing and at the same time guarantee high quality of the juice produced. The scope of the study comprised the determination of pressing efficiency and of the quality parameters of apple juice obtained, such as acidity and the content of extract. The results of the study indicate that the efficiency of pressing and the quality of the juice obtained are significantly affected by the varietal traits of the apples. The choice of suitable cultivars allows to achieve a high pressing efficiency and to obtain juice characterised by a high content of extract and high acidity.

INTRODUCTION

Pressing is the most common method of apple juice acquisition (Markowski, Baron, Le Quéré, Płocharski, 2015). At present, juice pressing under industrial conditions is performed most frequently with the use of presses for periodic operation (mainly basket-type) and for continuous operation (screw-type presses, roller presses or belt presses) (Bump, 1989). Fruit processing methods employed on the industrial scale may significantly alter the nutritional properties of the fruits (De Paepe, Valkenborg, Coudijzer, Noten, Servaes, De Loose, Voorspoels, Diels, Van Droogenbroeck, 2014). Therefore, it is necessary to develop such methods of fruit processing that will minimise the negative effects of the processing on the health-promoting properties of the fruits (Rothwell, Medina-Remón, Pérez-Jiménez, Neveu, Knaze, Slimani, Scalbert, 2015). In certain countries orchard farms are equipped with complete lines for the pressing and delicate preservation of fruit juices. Recently one can observe a development of juice pressing services with the use of mobile presses, which means that juices are produced on site at the fruit producer's farm (http://mobilejuicefactory.com/mobile-juicing/).

As can be seen from the literature data, not all apple cultivars are suitable for juice pressing. The efficiency of the pressing process and the quality of the juice obtained depend on numerous factors, among which the technological properties of raw material play an important role (Renard, Le-Quéré, Baudin, Symoneaux, Le Bourvellec, Baron 2011). In Poland, more than 60 apple cultivars are entered in the National List of Varieties. However, there is a lack of complete knowledge on their applicability for juice pressing. The use of suitable fruit cultivars for juice pressing may reduce the cost of pressing and at the same time guarantee high quality of the juice produced (Eiselea, Drakeb, 2005; Sedov, Levgerova, Salina, Serova, 2010). This justifies research on various apple cultivars in the aspect of estimation of their applicability for juice pressing, especially in farm conditions (orchards), i.e. without the use of specialised preliminary processing of the fruits prior to pressing.

The objective of the study was the estimation of selected apple cultivars for their suitability for the acquisition of natural juices with the method of pressing. The pressing was performed in a single cycle, with the use of a laboratory basket-type press. The scope of the study comprised the determination of pressing efficiency and of the quality parameters of apple juice obtained, such as acidity and the content of extract (°Bx).

MATERIAL AND METHODS

The study was conducted on 12 cultivars of apples purchased from the Producer Group "Lubsad". The following apple cultivars were selected for the study: Boiken, Gala, Gloster, Golden Delicious, Elise, Idared, Jonagold, Jonagored, Ligol, Pinova, Rubin and Szampion. The tests were conducted on healthy material, without mechanical damage. Prior to the pressing, the apples were washed, excess water was removed, and then the apples were shredded into shavings using a shredder type MKJ250 (Spomasz, Nakło, Poland) with a standard shredding disc with apertures of 8 mm in diameter. Juice was pressed by means of a laboratory basket-type press of an oiriginal design, with diameter of 120 mm and volume of approx. 150 cm³ (Nadulski, Kobus, Wilczyński, Zawiślak, Grochowicz, Guz, 2016). Each measurement was made in six replicates. Material batches of 500 g were placed in fabric bags that were put into the press basket, and then loading was applied by means of a piston. After attaining a load of 40±1 kN the pressing process was interrupted. The expressed juice was collected in a container. After each measurement, the mass of the obtained juice was determined. Extract content in the juice was determined with the refractometric method (Polish standard PN-90/A-75101/02) using an Atago refractometer, and juice pH (PN-EN 1132:1999) was determined using a CP-411 pH-meter (Elmetron, Poland).

The pressing efficiency was calculated from the formula:

$$W = \frac{M}{M_p}$$

where:

W – pressing efficiency, %,
M – mass of juice obtained during pressing, kg,
M_p – initial mass of pulp, kg.

Statistical analysis of the results was conducted with the use of factorial analysis of variance ANOVA. The significance of differences was verified with the use of Tukey's LSD test.

RESULTS

The statistical analysis of the results demonstrated an effect of varietal traits on the efficiency of the process of juice pressing. It addition, differences were found in the content of extract and in the acidity of juices obtained from the particular apple cultivars.

The efficiency of juice expression from the studied apple cultivars varied considerably and amounted to 42.1 – 53.1% (Fig. 1). The levels of pressing efficiency achieved in the experiment are lower than values obtained in industrial conditions (72-83%). This is related to the fact that under the conditions of the experiment no enzymatic treatment was applied. In the course of the study it was noted that certain cultivars are resistant to juice pressing. During juice pressing from cultivars Boiken and Pinova it was observed that solid particles passed through the fabric and, as a result, the juice obtained had the

consistence of a pulp. The highest efficiency of juice pressing was obtained in the case of cultivars Idared, Gloster and Jonagold and the lowest in the case of cultivars Boiken and Pinova.

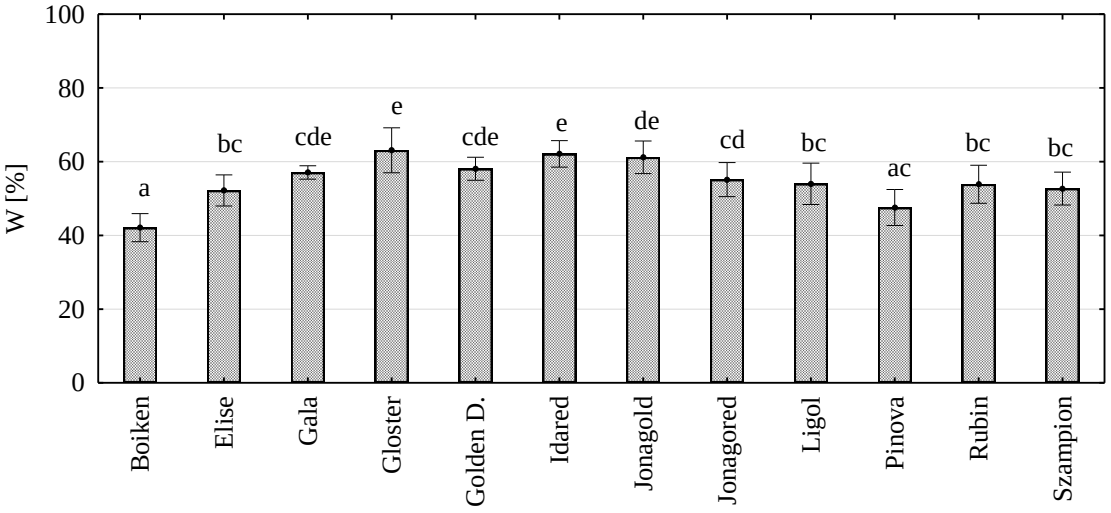

Fig. 1. Efficiency W (%) of the pressure extraction from the pulp depending on apple variety
a, b, c … – values marked with the same letter are not statistically significantly different (p>0.05)

The soluble solids content (°Bx) in the analysed apple juice varied from 10.2°Bx to 13.3°Bx and depended on the cultivar from which the juice was obtained (Fig. 2). The highest soluble solids content (°Bx) was noted in juice obtained from cv. Jonagored and the lowest in juice from cv. Ligol. All the juices were characterised by soluble solids content (°Bx) above 10°Bx, which means that in this respect they met the criterion of suitability for pressing.

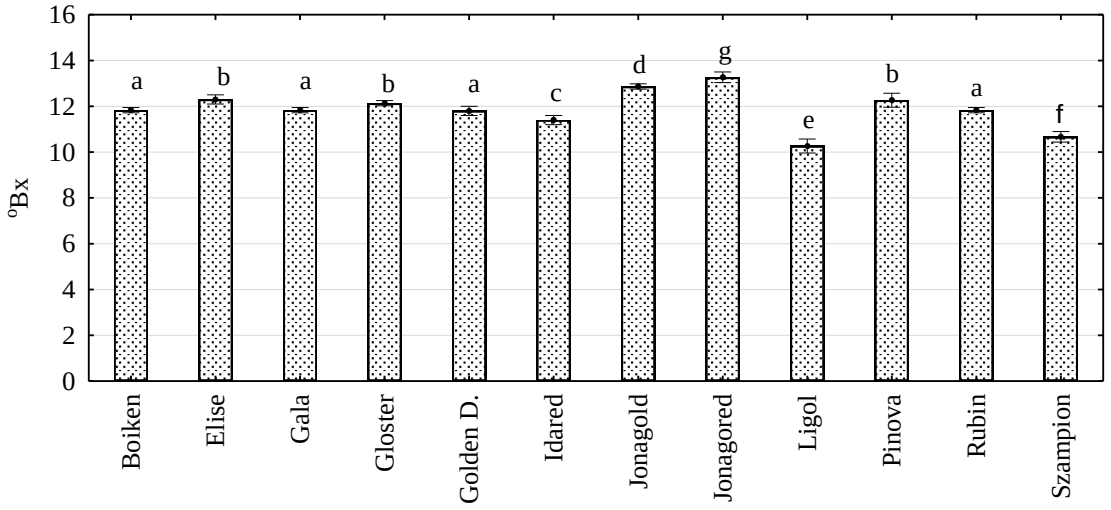

Fig. 2. The soluble solids content (°Bx) in the obtained juices depending on apple variety
a, b, c … – values marked with the same letter are not statistically significantly different (p>0.05)

The juices obtained in the scope of the experiment were characterised by varied acidity (Fig. 3).

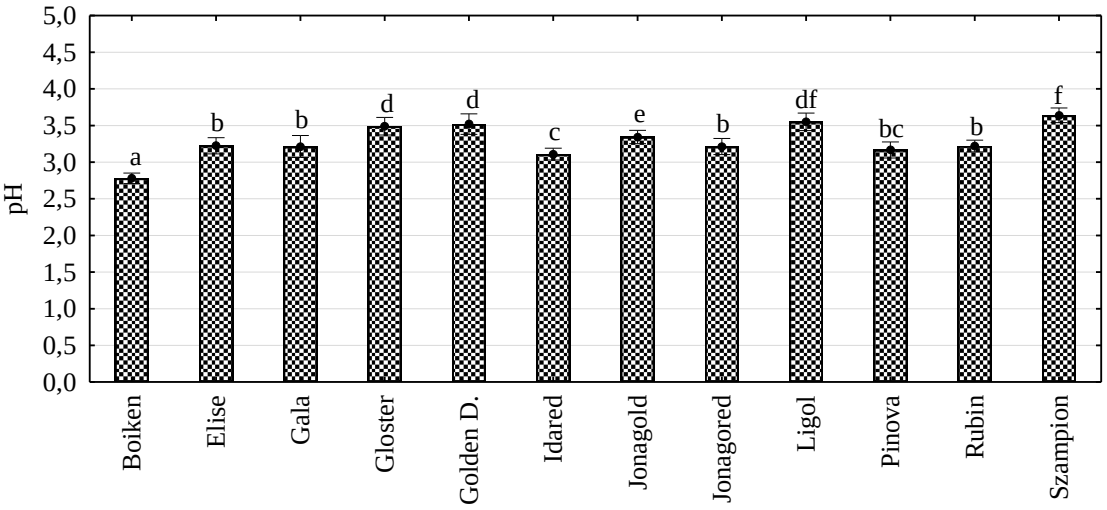

Fig. 3. Acidity (pH) of the obtained juices depending on apple variety
a, b, c … – values marked with the same letter are not statistically significantly different (p>0.05)

The lowest pH value was obtained in the case of juice from cv. Boiken and the highest pH was obtained for cultivars Ligol, Golden Delicious, and Gloster.

CONCLUSIONS

The results of the study indicate that the efficiency of pressing and the quality of the juice obtained are significantly affected by the varietal traits of the apples. The choice of suitable cultivars allows to achieve a high pressing efficiency and to obtain juice characterised by a high content of extract and high acidity. The highest efficiency of juice pressing was obtained in the case of cultivars Idared, Gloster and Jonagold and the lowest in the case of cultivars Boiken and Pinova. The highest soluble solids content (^{o}Bx) was noted in juice obtained from cv. Jonagored, and the lowest in juice from cv. Ligol. All the juices were characterised by soluble solids content (^{o}Bx) above 10^{o}Bx. The lowest pH value was obtained in the case of juice from cv. Boiken, and the highest pH was obtained for cultivars Ligol, Golden Delicious and Gloster.

The choice of suitable apple cultivars for processing can significantly reduce the costs of juice acquisition in farm conditions, where generally no treatments augmenting the process of pressing (e.g. enzymatic treatment), typical in industrial fruit juice production, are applied.

The experiment performed within the scope of the study indicates that it is worthwhile to undertake further research in the aspect of estimation of the suitability of particular apple cultivars for juice pressing in farm conditions.

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