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**POTATO (*Solanum tuberosum* L.) TUBERS SENSORY PROPERTIES OF DIFFERENT FARMING SYSTEMS**

**R.Asakaviciute\* and A.Razukas**

Voke Branch of Lithuanian Research Centre for Agriculture and Forestry, Zalioji a. 2, TrakuVoke, LT-02232 Vilnius, Lithuania

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**ABSTRACT**

The objectives of this two-year research were to study the impact of two different farming types: conventional and organic for the sensory properties of five Lithuanian varieties potato tubers. The farming type had no significant impact for the sensory properties of the boiled potato tested varieties. Potatoes grown in organic and conventional farming types had conventional odour, typical taste and moderate crumbliness.

**Keywords:** Potatoes, Conventional And Organic Farming, Sensory Properties.

**1. INTRODUCTION**

Potatoes are able to adapt easily to different growing conditions, produce high yields, are of high nutritional value, so they are very widespread and considered as the most important non-grain agricultural plants in the world. According to the data of United Nations Food and Agriculture Organization (FAO), potatoes are the fourth-most-consumed food crop in the world, after rice, wheat, and corn [4].

Potatoes are not only nutritive crop -- their health improving properties are being studied widely. Potato tubers are beneficial for human health as they are rich in vitamins, minerals and significant quantities of phenolic compounds. Recently, both in Lithuania and around the world a lot of attention has been given to food safety and quality. The preference of organic food may be justified by the fact that this kind of food is healthier, safer and tastier than conventionally produced food [5, 7]. In order to prove it, contents of various compounds (pesticides, nitrates, minerals, vitamins, phenolic compounds and other substances) accumulated in organically and conventionally grown food are often compared [3]. Particular attention is paid to sensory properties of fruit and vegetables.

Books on the assessment of farming type effect on vegetables Hoefkens co-workers [8] state that from the nutritional and toxicological point of view, organic vegetables are not extremely superior than the conventional, but in terms of specific substances found in vegetables, in certain cases organic vegetables are much better while in other cases – on the contrary [11, 16]. Hajslova co-workers [7] states that meteorological conditions, geographical differences and variety features should not be ignored or are even more important determinants of potato quality. The lack of comparative (organic and conventional) analyses of farming types limits the correct evaluation of the effects of farming types on vegetables quality [6].

There is a vast amount of literature comparing the sensory quality of organically farmed and conventionally produced potatoes [6, 14, 15]. However, very little attention has been given to the comparative sensory properties of boiled organic and conventional potatoes. Therefore, the objectives of this study were to determine any differences in the sensory properties of organic and conventional boiled potatoes.

## **2. MATERIALS AND METHODS**

### **Plant material**

Tubers of twelve potatoes (*Solanum tuberosum* L.) varieties differing in maturity were tested: very early – ‘VB Venta’, early – ‘Goda’ and ‘VB Liepa’, late – ‘VB Rasa’ and very late – ‘VB Aista’.

### **Organic and conventional farming conditions**

The potatoes have been grown in Lithuania, Voke Branch of Lithuanian Research Centre for Agriculture and Forestry in breeding plots with sandy loam soil on carbonated fluvio-glacially eluviated gravel (JDp), according to FAO UNESCO classification – Haplic Luvisol (LVh) [2], with the following agrochemical characteristics:  $\text{pH}_{\text{KCl}} - 5.9$ , the content of absorbed bases – 105 mEq/kg of soil, organic matter content – 2.1%, available phosphorus ( $\text{P}_2\text{O}_5$ ) – 230 mg/kg and available potassium ( $\text{K}_2\text{O}$ ) – 310 mg/kg.

In the conventional farming type potatoes were grown in a breeding plot. The autumn field was sprayed with herbicide Kernel 480 SL 3 L/ha (active substance glyphosate 480 g/L), then the soil was deeply ploughed. In spring, the field was cultivated twice, with a rotary cultivator to a depth of 0.25 m. The field was furrowed before the potato planting; potatoes were planted by hand. Potatoes were fertilized with universal complex fertilizer (KemiraCropcare  $\text{N}_{10}\text{P}_{10}\text{K}_{20}$ ). At the time of planting, 80 kg/ha of nitrogen, 80 kg/ha of phosphorus, and 160 kg/ha of potassium were added. After planting, the interrows were twice hilled up using a rotary hiller. When potatoes grew to 10 cm, the field was sprayed with herbicide mixture (Titus 50 g/ha (active substance rimsulfuron 250 g/kg) and with Mistral 500 g/ha (active substance metribuzin 700 g/kg)). After that the potatoes were twice earthed up. At inflorescence formation and flowering period, plants were sprayed with fungicide Acrobat Plus 2 kg/ha (active substances dimethomorph 90 g/kg and mancozeb 600 g/kg) in combination with an insecticide Proteus OD 0.7 L/ha (active substances thiacloprid 100 g/L and deltamethrin 10 g/L). After two weeks, fungicide Ridomil Gold 2.5 kg/ha (active substances metalaxyl-M 40 g/kg and mancozeb 640 g/kg) in combination with an insecticide Proteus OD 0.7 L/ha were used. Two weeks before harvesting, the potato field was sprayed with fungicide Shirlan 500 SC 0.4 L/ha (active substance fluazinam 500 g/L).

In the case of organic farming, potatoes were grown in a separate field. In autumn the soil was deeply ploughed. In spring, the field was cultivated twice, with a rotary cultivator to a depth of 0.25 m. The field was furrowed before potato planting, potatoes were planted by hand. During planting, 60 kg ha<sup>-1</sup> of nitrogen (Provita), 60 kg/ha of phosphorus (phosphorite powder), and 90 kg/ha of potassium (Patentkali) were applied. Potatoes were earthed up and twice harrowed. After planting, the interrows were hilled up using a rotary hiller twice a week. In the organic farming, mechanical actions were used to fight weeds, the larvae of Colorado beetles were collected manually and destroyed.

### **Sensory analysis**

The samples for sensory analysis were prepared by the method described by Pardo co-workers [13]: potatoes were washed and rinsed with tap water, then dried with a paper towel. The unpeeled potato samples were boiled for 30 min in unsalted water. The boiled potatoes were cut into cubes 2.0 x 2.0 cm, placed in warmed individual boxes marked with three digit numbers, covered with plastic lids and cooked for 5–10 min at 55 °C temperature prior to serving to the panellists.

A quantitative descriptive analysis [9] was carried out to compare potato samples grown using conventional and organic farming types. A tasting panel consisted of 7 assessors selected and trained to international standards, and experienced in sensory evaluation of different food products. The panel assessed the overall odour and taste intensity, and crumbliness of the boiled potato samples. A structured numerical scale was used for evaluation of the intensity of each attribute. The left side of scale corresponding to the lowest intensity of attribute was given value of 1, and the right side corresponding to the highest intensity was given value of 15. All sessions were conducted in a climate-controlled sensory science laboratory equipped with individual booths at the Kaunas University of Technology Food Institute. The panellists were instructed to clean the palate with water or weak warm tea between evaluations of each sample. The samples were presented to the panellists monadically. A data collection system for automatic acquisition of the assessor scores was used (FIZZ, Biosystems, France).

#### **Statistical analysis**

Data are mean values ( $\pm$  SD) of thirty organic and thirty conventional boiled potatoes. Values bearing different superscripts are significantly different ( $P < 0.05$ ) for each attribute.

### **3. RESULTS AND DISCUSSION**

Overall odour and taste intensity of the samples was not affected by farming type (Table 1, 2). Significant ( $p < 0.05$ ) differences in odour intensity were found between varieties ‘VB Venta’ and ‘VB Aista’ grown organically. Tubers of ‘VB Aista’ had more intense odour in comparison with ‘VB Venta’ ( $p < 0.05$ ). The potatoes of both farming types were described as having typical odour and taste. The crumbliness was perceived as moderate regarding what is typical for potatoes boiled without peeling (Table 3). Despite the fact that no significant effect of farming type was determined for potato crumbliness, some significant differences between varieties can be mentioned. Conventional ‘VB Liepa’ and ‘Goda’ tubers had higher crumbliness ( $p < 0.05$ ) than ‘VB Aista’ grown organically or conventionally. This result is sufficient to conclude that there was no statistically significant difference for preference between the organic and conventional boiled potatoes among the consumer panel in this study.

As reported for other potato varieties, no effects of farming type on sensory properties were determined for boiled tubers of early cultivars [1, 10], unpeeled tubers boiled in steam [7], or raw samples of potato [5]. Still, potato skin probably has a significant property [12, 17], as usually panellists were able to detect sensory differences between sample containing skin, but for samples without skin such differences were not determined.

### **4. CONCLUSION**

The farming type had no significant impact on the sensory properties of the potato varieties tested. Potatoes grown in organic and conventional farming types had conventional odour,

typical taste and moderate crumbliness. No significant effect ( $p > 0.05$ ) of farming type to dry matter and starch content was found.

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**Table 1. Overall odour intensity of the organic and conventional boiled potatoes**

Potato varieties	Maturity	Organic potatoes	Conventional potatoes
‘VB Venta’	Very early	11.83 ± 0.30 <sup>a</sup>	12.67 ± 0.23 <sup>ab</sup>
‘Goda’	Early	12.17 ± 0.47 <sup>ab</sup>	12.08 ± 0.34 <sup>ab</sup>
‘VB Liepa’	Early	12.50 ± 0.50 <sup>ab</sup>	12.75 ± 0.37 <sup>ab</sup>
‘VB Rasa’	Late	13.08 ± 0.23 <sup>ab</sup>	12.67 ± 0.33 <sup>ab</sup>
‘VB Aista’	Very late	12.50 ± 0.42 <sup>b</sup>	12.83 ± 0.39 <sup>ab</sup>

**Table 2. Overall taste intensity of the organic and conventional boiled potatoes**

Potato varieties	Maturity	Organic potatoes	Conventional potatoes
‘VB Venta’	Very early	11.08 ± 0.61 <sup>a</sup>	11.42 ± 0.51 <sup>a</sup>
‘Goda’	Early	11.33 ± 0.58 <sup>a</sup>	11.08 ± 0.57 <sup>a</sup>
‘VB Liepa’	Early	12.17 ± 0.44 <sup>a</sup>	12.58 ± 0.38 <sup>a</sup>
‘VB Rasa’	Late	12.17 ± 0.44 <sup>a</sup>	12.17 ± 0.46 <sup>a</sup>
‘VB Aista’	Very late	11.08 ± 0.56 <sup>a</sup>	11.25 ± 0.45 <sup>a</sup>

**Table 3. Crumbliness of the organic and conventional boiled potatoes**

Potato varieties	Maturity	Organic potatoes	Conventional potatoes
‘VB Venta’	Very early	6.75 ± 0.96 <sup>ab</sup>	6.33 ± 1.03 <sup>ab</sup>
‘Goda’	Early	5.83 ± 0.90 <sup>ab</sup>	7.33 ± 1.01 <sup>b</sup>
‘VB Liepa’	Early	6.42 ± 0.87 <sup>ab</sup>	7.25 ± 0.91 <sup>b</sup>
‘VB Rasa’	Late	4.83 ± 0.68 <sup>ab</sup>	5.25 ± 0.76 <sup>ab</sup>
‘VB Aista’	Very late	4.17 ± 0.85 <sup>a</sup>	4.33 ± 0.68 <sup>a</sup>