THE EFFECT OF GROWING SYSTEM AND GROWING MEDIA ON THE MORPHOLOGICAL, BIOLOGICAL AND SENSORY QUALITY OF SWEET PEPPER (CAPSICUM ANNUUM L.)

UTICAJ PODLOGE I SISTEMA GAJENJA NA MORFOLOŠKI, BIOLOŠKI I SENZORNI KVALITET PAPRIKA BABURA (CAPSICUM ANNUUM L.)

Zita BIRKÁS*, Gábor BALÁZS†, Zsuzsanna FÜSTÖŠ*, Atila RUSZTHI**, Zoltán KÓKAI***
*Szent István University, Faculty of Horticultural Science, 1118 Budapest, Menestét 44, Hungary
†DUNA-R Ltd., 1224 Budapest IX. Utca 17
**Szent István University, Faculty of Food Science, 1118 Budapest, Villányiút 35-43, Hungary
e-mail: zita.birkas@phd.uni-szie.hu

ABSTRACT

Sweet pepper (Capsicum annuum L.) production is relevant today in Hungary. Due to the importance of the subject, the aim of the study was to evaluate morphological, biological and sensory quality of sweet pepper. The growing experiment was set up at DUNA-R company in Szentes. Three different type of fresh pepper hybrid (Zalkod F1, Gogorez F1, Kapitány F1) were evaluated in unheated plastic house and open field conditions using intensive technology. The fruits were blended and measured with manual digital refractometer (PAL-1, ATAGO). The vitamin C content was determined by the Spanyár-method. Sensory profile analysis was applied with 10 assessors. Based on our results it can be concluded that in forcing the three varieties produced larger fruits in soil culture than in soilless. However in all cases we measured better refraction values in soilless production than in soil culture. Based on the sensory profile analysis the type of growing technology affected mostly morphological parameters.

Key words: sweet pepper, coconut fibre, morphological parameters, sensory evaluation.

INTRODUCTION

Sweet pepper (Capsicum annuum L.) production is relevant today in Hungary. In the year 2014 sweet pepper was planted on 1500 ha with 170 thousand tons of production. Furthermore, its open field production with 1000 ha is also significant. During the production season the chemical or physical parameters. However the sensory quality of the crop is also relevant, since a large proportion of horticultural commodities are sold in retail chains to consumers. Consumer perception strongly relies on sensory quality, so it is important to measure sensory differences among experimental factors (Thybo, A.K., Bechmann, I. E., Brandt, K. 2005). Since the available crop
quantity for sensory testing is usually limited, thus the
application of trained panellists can be recommended to reveal
significant differences. In a similar study on tomatoes (Gajc-
Wolska et al., 2015) the authors have studied the influence of
growth conditions and grafting on the yield, chemical
composition and sensory quality. In case of the tomato study
sensory quality was mainly influenced by the harvest date, the
effect of growing system was less relevant.

Due to the importance of the subject, the objective of the
study was to evaluate morphological, biological and sensory
quality of sweet pepper. Besides measuring the morphological
and biological parameters, the perceptible sensory differences
could be evaluated due to the different production systems.

MATERIAL AND METHOD

The field tests were done at DUNA-R company in Szentes.
Three different type of fresh pepper hybrid (Zalkod F1, Gogorez
F1, Kapitány F1) were evaluated in unheated plastic house and
open field conditions using intensive technology (soil mulch,
dripping tube/dripping irrigation system, training system). In
culture of forced pepper plants were tested in soil and soilless
culture (coconut fiber) as well. For soil culture the plastic house
was used, and for the soilless culture coconut fiber slabs were
used. Table 1 shows some technological parameters.

<table>
<thead>
<tr>
<th>Growing system</th>
<th>Sowing date</th>
<th>size of soil block</th>
<th>planting</th>
<th>Planting space</th>
<th>plant/m²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soil culture</td>
<td>20.04.2016</td>
<td>5x5x5</td>
<td>31.05.2016</td>
<td>80+30*30</td>
<td>6</td>
</tr>
<tr>
<td>Soil less culture</td>
<td>20.04.2016</td>
<td>10x10x6</td>
<td>06.06.2016</td>
<td>110+40*25</td>
<td>5.3</td>
</tr>
<tr>
<td>Open field</td>
<td>19.04.2016</td>
<td>5x5x5</td>
<td>08.06.2016</td>
<td>60+30*30</td>
<td>7.4</td>
</tr>
</tbody>
</table>

The variety Zalkod F1 has hanging, tapered white fruits of
120-140 g weight. The fruits of Kapitány F1 variety has the
variation of color from red to dark green, while variety Gogorez
F1 has the mass of single fruit of 300 g and the shape as tomato.

After the picking the samples were measured at the
Department of Vegetable and Mushroom Growing and at the
Department of Sensory Science and Postharvest, Szent István
University, Budapest, Hungary.

From all combination 20 fruit weight, size and its water-
soluble dry material content was measured at the analytical
laboratory of the department. The fruits were blended and
measured with manual digital refractometer (PAL-1, ATAGO).
The results granted in °Brix units. In this study the vitamin-C
content was determined by the Spanyár-method, which was
also applied by Orbán and co-workers (2011) in a research
about Capsicum samples.

Sensory profile analysis was applied according to ISO
13299. A panel of 10 assessors were evaluated the sweet
peppers in 3 sessions: a) white pepper; b) kápia and c) tomato-
shaped. Attributes were analysed on unstructured line scales
with the support of ProfiSens, a sensory analysis software
(Kókai et al., 2003). Attributes involved: size, shape, colour
homogeneity, surface gloss, freshness of colour, flesh thickness,
the size of placenta, crispiness, skin chewiness, juiciness, odour
intensity and sweet taste intensity. Tests were performed in
standardized, computerized sensory booths (ISO 8589). Data
was analysed with one-way ANOVA and Fisher LSD for testing
significant differences.

RESULTS AND DISCUSSION

The calculated length/ diameter ratios are presented in Fig. 1.
Due to the tomato- shaped fruits of Gogorez F1 variety has the
lowest rates. In case of Zalkod F1 variety in the forced soil
culture, whilst in Kapitány F1 the soilless culture resulted in
highest value, which means, that the fruits of this two cultivation
technology had the longest fruit length compared to their
diameters.

![Fig. 1. The fruit length/diameter ratio of the varieties (26.09.2016, Budapest)](image1)

Figure 2 shows the average weight of the measured fruits in
grams. In forcing the soil production of all three varieties have
heavily fruits compare to soilless technology. The cultivation of
Kapitány F1 variety on the open field results in even heavier fruits compared to forcing one.

The average refraction values are presented in Figure 3. All three varieties showed the same tendency in soilless production showed the highest. The production in soil culture of two varieties Gogorez F1 and Zalkod F1 an average refraction exhibit the lowest values, compared to variety Kapitány 1F while in case of variety this low value is measured within the open field production.

![Fig. 3. The average refraction value of fruit (26.09.2016, Budapest)](image1)

The results of the Vitamin C content measurements are presented in Table 2. During this survey the contradictory results were observed. Orbán and co-workers (2011) reported that in greenhouse conditions of production, the level of Vitamin C level was higher. The white type of fruits has the content of this vitamin of 72 mg/100 g, in the shape kapia this content was 145 mg/100 g and in tomato shaped 71 mg/100 g. Figure 4. shows the sensory profiles of the Zalkod F1 variety’s treatments. The significant differences in case of two varieties Kapitány F1 and Gogorez F1 are summarized in Table 3. In the case of Zalkod F1 variety the growing on coco resulted in the narrowest fruit with the most intense red surface colour and flesh colour. The placenta was the smallest among the treatments, and the flesh was the least crispy. In Thybo and co-workers study (2005) the soilless culture resulted in crispier fruits in case of tomatoes. Their results suggested that the sensory effect of soil media depends on the species. Kapitány F1 variety on the coco has produced the smallest and narrowest fruits.

![Fig. 4. Sensory profile of the Zalkod F1 sweet peppers](image2)

**Legend:** scattered lines: Zalkod F1 soil culture, dotted lines: Zalkod F1 open field, continuous line: Zalkod F1 soilless culture

(* = p<0.05, ** = p<0.01)

Table 3. Significant sensory differences among treatments in case of the tested cultivars

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Zalkod F1</th>
<th>Kapitány F1</th>
<th>Gogorez F1</th>
</tr>
</thead>
<tbody>
<tr>
<td>size of fruit</td>
<td>**</td>
<td>**</td>
<td></td>
</tr>
<tr>
<td>shape</td>
<td></td>
<td>*</td>
<td>**</td>
</tr>
<tr>
<td>colour hue</td>
<td>**</td>
<td></td>
<td>**</td>
</tr>
<tr>
<td>gloss</td>
<td></td>
<td>**</td>
<td></td>
</tr>
<tr>
<td>colour of internal flesh</td>
<td></td>
<td>**</td>
<td>**</td>
</tr>
<tr>
<td>flesh thickness</td>
<td></td>
<td></td>
<td>**</td>
</tr>
<tr>
<td>size of placenta</td>
<td></td>
<td>*</td>
<td>**</td>
</tr>
<tr>
<td>crispiness</td>
<td></td>
<td>**</td>
<td></td>
</tr>
<tr>
<td>chewiness of skin</td>
<td></td>
<td></td>
<td>**</td>
</tr>
<tr>
<td>juiciness</td>
<td></td>
<td>**</td>
<td></td>
</tr>
<tr>
<td>odour intensity</td>
<td></td>
<td>**</td>
<td></td>
</tr>
<tr>
<td>sweet taste intensity</td>
<td></td>
<td>**</td>
<td>*</td>
</tr>
</tbody>
</table>

Significant differences: * p<0.05, ** p<0.01

Table 2. Vitamin C content of fruits (mg/100g)

<table>
<thead>
<tr>
<th></th>
<th>Gogorez F1</th>
<th>Zalkod F1</th>
<th>Kapitány F1</th>
</tr>
</thead>
<tbody>
<tr>
<td>soilcult</td>
<td>47.67</td>
<td>30.23</td>
<td>39.04</td>
</tr>
<tr>
<td>soilless</td>
<td>45.51</td>
<td>55.48</td>
<td>34.88</td>
</tr>
<tr>
<td>openfield</td>
<td>56.64</td>
<td>28.24</td>
<td>36.38</td>
</tr>
</tbody>
</table>

Journal on Processing and Energy in Agriculture 21 (2017) 2

99
CONCLUSIONS

Based on these results of study, it can be concluded that in soil culture production type all three varieties have larger dimension of fruits compare to soilless production. However in all cases it was observed the better refraction values in soilless production than in soil culture. In case of soilless forcing of Kapitány F1 the sensory profile proved that the thin of the fruits were significantly lower, thus the fruit weight was lower as well.

Based on the sensory profile analysis the type of growing technology effected mostly morphological parameters. In Gogorez F1 the fruits grown on coco fibre were larger; in case of the other two varieties the fruits were smaller. Colour of the fruits is usually more intense. The placenta is usually the smallest. The sweet taste of Kapitány F1 and Gogorez F1 were the most intense on coco fibre. In order to better understand the effects of soilless cultures in case of Capsicum annuum further studies are necessary.

REFERENCES


ISO 8589: 2007 Sensory analysis -- General guidance for the design of test rooms.

ISO 13299: 2016 Sensory analysis -- Methodology -- General guidance for establishing a sensory profile


Received: 20. 03. 2017. Accepted: 06. 04. 2017.