STUDY OF FRUIT QUALITY IN PEPPER CULTIVATED IN CONVENTIONAL AND ORGANIC AGRICULTURE

STUDIUL CALITĂŢII FRUCTELOR DE ARDEI CULTIVATE ÎN AGRICULTURĂ ECOLOGICĂ ŞI CONVENŢIONALĂ

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Abstract. *Research and experimental farming of peppers grown in organic and conventional agriculture have been performed in Vegetable Research and Development Station Bacau, from 2008 to 2010. Fruit composition was analyzed by The Faculty of Horticulture - U.S.A.M.V. Bucharest. Analyses were performed in order to identify the differences that may exist in the composition of vegetables grown in conventional and organic agriculture. The content of soluble solid substances of peppers was higher in organic agriculture. % of glucose was higher in organic farming and % of fructose was higher in conventional agriculture to all cultivars. The content of pepper's ascorbic acid was higher in organic agriculture.*

Key words: study, fruit quality, pepper, conventional, organic agriculture

Rezumat. *Cercetările şi experimentările de cultivare a plantelor de ardei în agricultură ecologică şi convenţională s-au efectuat la SCDL Bacău, în perioada 2008 – 2010. Determinările privind compoziţia fructelor s-au efectuat la USAMV Bucureşti, Facultatea de Horticultură. Analizele efectuate au relevat diferenţe între compoziţia legumelor cultivate în agricultură ecologică şi agricultură convenţională. Astfel substanţa uscată solubilă la cultivarele de ardei a fost mai mare în agricultură ecologică. % de glucoză a fost mai mare în agricultură ecologică, iar % de fructoză a fost mai mare în agricultură convenţională. Conţinutul în acid ascorbic la ardei a fost mai mare în agricultură ecologică.*

Cuvinte cheie: calitatea fructelor, ardei, agricultură ecologică, convenţională

INTRODUCTION

The crop technologies can influence the nutritive quality of the pepper fruits (Hallmann and Rembiałkowska, 2008). The fresh organic red pepper contains more bioactive compounds than the one grown in conventional agriculture

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(Hallmann and Rembiałkowska, 2007). Sweet pepper (*Capsicum annuum* L.) is reach in ascorbic acid and has an important quantity of carotenoids as beta-carotene, (Haytowitz and Matthews 1984). There is a wide range of pigments in the fruits of pepper plants (Carvajal et al. 1997). In addition the fruits of pepper have flavonoids (Lee et al.1995) and other phytochemicals (Duke 1992).

In Romania, in the last years we noticed an increase of the surface cultivated with pepper in organic agriculture. As a result, at V.R.D.S. Bacau during 2006-2010 a lot of studies regarding the growth and composition of pepper in organic agriculture have been conducted (Calin and al., 2010).

This study was realized according with the legal communitarian frame from the European Community Regulation no. 834/2007. The purpose of researches is the establishment a differences in quality between organic and conventional agriculture.

MATERIAL AND METHOD

The researches and experimentation of pepper plants cultivation in ecologic and conventional agriculture were accomplished at VRDS Bacau, during 2008-2010. The determinations regarding the fruit composition were realized at USAMV Bucuresti, Faculty of Horticulture.

The following parameters were determined:

- total dry matter, wate, mineral subtances (ash),
- mineral elements *K, P, Mg, Ca, Na, Mn, Fe, B, Al, Ba, Cr, Cu, Ni, Pb* and *Zn,*
- total sugars and type of sugars (glucose, fructose, saccharose),
- total soluble proteins,
- soluble dry substance,
- titrable acidity,
- vitamin C (ascorbic acid),
- content in carotene at tomatoes and peppers.

The following methods of analysis were employed:

- gravimetrical methods for total dry substance, water, ash,
- spectrometry ICP-AES, for mineral elements,
- method HPLC for sugars (glucose, fructose, saccharose),
- biurette method for total soluble proteins,
- refractometric method for soluble dry substance,
- method HPLC for vitamin C,
- spectrophotometric method for carotene.

RESULTS AND DISCUSSIONS

For the determination of food resources and products quality according with the requirements of food and nutrition assurance and EU reglementations, at the variants experimented during 2008 and 2010 the following analysis were performed: total dry matter, water, mineral substances (ash), total sugars and type of sugars (glucose, fructose, saccharose), soluble dry substance, titrable acidity, vitamin C (ascorbic acid), content in carotene.

The results obtained are presented in tables 1, 2, 3 and fig. 1.

The content in mineral substances (table 1) varies according with the culture system, type of pepper and utilized cultivar. On observe that the values were higher at the variants from ecologic agriculture. Also, a higher content in mineral substances had the fruits cultivated in organic agriculture.

Table 1

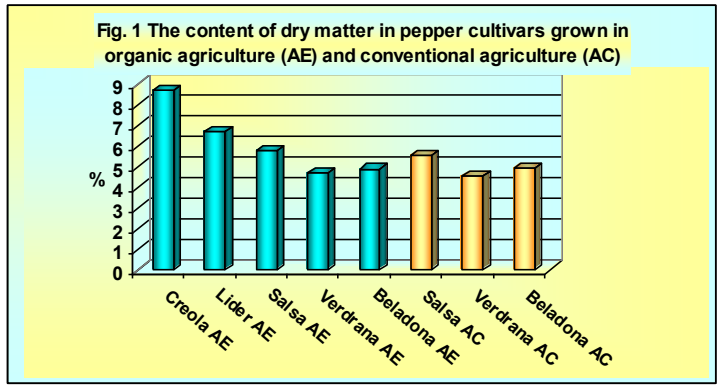
The biochemical analysis of intensity of respiration, content in water, dry substance, mineral elements and organic substances

Biochemical analysis in variant	Intensity of respiration	Water	Total dry matter	Mineral substances	Organic substan-ces
	mg CO_2/kg/h	%	%	%	%
Round pepper in organic agriculture - 2008					
Creola	X	91,27	8,73	0,80	7,93
Lider	x	93,28	6,72	0,44	6,28
Sweet pepper in organic agriculture - 2010					
Salsa	25,70	94,25	5,75	0,47	5,28
Verdrana	22.50	95,29	4,71	0,41	4,30
Beladona	13,90	95,12	4,88	0,43	4,41
Round pepper in conventional agriculture - 2010					
Salsa	18,00	94,45	*5,55*	0,42	5,13
Verdrana	21,74	95,44	4,56	0,38	4,18
Beladona	20,70	95,09	4,91	0,45	4,46

The dates presented in the previous table show that: the intensity of respiration vary depending on the cultivar, at pepper ranged between 13,9 and 25,7 mg CO_2/kg product. Depending on the type of culture it was higher at organic peppers: Salsa and Verdana, pleading for the pretability for cultivation in organic agriculture only for certain cultivars. The content in water was different, varying in function of culture system, type of pepper and studied cultivar. Thus, it was higher at sweet pepper cultivated in conventional agriculture (94,45 – 95,44%), comparing with 94,25 - 95,29% at round pepper cultivated in organic agriculture. The round pepper had a smaller content in water (91,27 – 93,28%). The smallest content in water in organic agriculture was determined at Creola variety (91,27%), followed by the variety Lider 93,28%. At sweet pepper the lowest content in water was registered at Salsa cultivar (94,25%), followed by Beladona (95,12%) and Verdana (95,44%).

The dry matter was obtained as a difference, being in a negative proportion with the water content (fig. 1).

The content in organic substances ranged between: 4,18 and 7,93 %, being higher at round pepper (Creola - 7,93%, Lider - 6,28%) and at sweet pepper cultivated in ecologic agriculture (Salsa - 5,28%, Verdrana- 4,30%, Beladona - 4,41%).



The biochemical analysis of dry substances, soluble sugars and titrable acidity is presented in table 2.

Table 2

The biochemical analysis of dry substances, soluble sugars and titrable acidity

Biochemical analysis in variant	Dry soluble substance %	Soluble sugars mg/100g			Titrable acidity mg malic acid	Rapport 10 x IR / titrable acidity
		Glucose	Fructose	Saccharose		
Round pepper in organic agriculture						
Creola	7,9	1,71	1,49	0,14	0,30	263
Lider	5,2	1,77	1,26	0,21	0,16	325
Sweet pepper in organic agriculture						
Salsa	3,4	1,05	0.85	0,19	0,058	586
Verdrana	3,7	0,74	0,79	0,06	0,096	385
Beladona	3,0	0,85	0,81	0.12	0,083	361
Pepper in conventional agriculture						
Salsa	3,5	0,84	0,73	0,49	0,064	546
Verdrana	3.5	0,90	0,85	0,32	0,083	422
Beladona	3,3	0,81	1,00	0,12	0,077	428

The dates presented show that the dry soluble substance varies between:

- 5,2 and 7,9% at round pepper;
- 3,0 and 3,7% at sweet pepper, being higher in organic agriculture;

% glucose ranged between:

- 1,71 and 1,77 % at round pepper;
- 0,74 and 1,05%, at sweet pepper, being higher in organic agriculture;

% fructoses vary between:

- 0,21 and 0,14%, at round pepper;
- 0,73 and 1,0%, at sweet pepper, being higher in conventional agriculture;

% saccharose was:

- 0,14 and 0,21%, at round pepper;

- 0,06 şi 0,49%, at sweet pepper, being higher in conventional agriculture;

Titrable acidity mg malic acid was higher at round pepper and lower at round pepper.

The rapport 10 x IR titrable acidity was lower at round pepper and higher at sweet pepper.

The dates regarding the main antioxidants (table 3) proved that:

- the content in ascorbic acid varies:

- at round pepper between 83,2 and 116,2 mg/100 g;
- at sweet pepper between 38,36 and 126,57 mg/100 g, being higher in organic agriculture;
- the content in carotene varied at round pepper between: 4,69 and 22,43 mg/100g.

Table 3

The biochemical analysis of ascorbic acid, carotene and chlorophyll

Biochemical analysis in variant	Ascorbic acid	Carotene	Chlorophyll
	mg/100g	mg/100g	mg/100g
Round pepper in organic agriculture			
Creola	116,2	22,43	-
Lider	83,2	4,69	-
Sweet pepper in organic agriculture			
Salsa	126,57	-	11,16
Verdrana	38,36	-	7,58
Beladona	58,93	-	-
Sweet pepper in conventional agriculture			
Salsa	110,12	-	21,80
Verdrana	61,52	-	-
Beladona	44,51	-	-

CONCLUSIONS

1. The accomplished analysis revealed differences between the compositions of vegetables cultivated in organic agriculture and conventional agriculture.

2. The intensity of respiration varied upon the cultivar, the values registered being between 13,9 and 25,7 mg CO_2/kg product, being higher at ecologic pepper: Salsa and Verdana.

3. The water content was different, being higher at sweet pepper in conventional agriculture (94,45 – 95,44%), comparing with 94,25 - 95,29% at sweet pepper cultivated in organic agriculture. The round pepper had a lower content in water (91,27 – 93,28%). The lowest content in water in ecologic agriculture was registered at Creola variety (91,27%), followed by Lider variety 93,28%. At sweet pepper a smaller content in water had the cultivar Salsa (94,25%), followed by Beladona (95,12%) and Verdana (95,44%).

4. The content in mineral substances varied depending on the culture system, type of pepper and cultivar. The values were higher at variants in organic agriculture. Also, a higher content in mineral substances was registered at fruits cultivated in organic agriculture.

5. The content in organic substances ranged between: 4,18 and 7,93 %, being higher at round pepper (Creola - 7,93%, Lider - 6,28%) and sweet pepper cultivated in ecologic agriculture (Salsa - 5,28%, Verdrana- 4,30%, Beladona - 4,41%).

6. The content in ascorbic acid varied also: at round pepper between 83,2 and 116,2 mg/100 g, while at sweet pepper between 38,36 and 126,57 mg/100 g, being higher in organic agriculture;

7. The content in carotene vary at round pepper between: 4,69 and 22,43 mg/100g.

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