SOME ASPECTS REGARDING THE SOLUBLE DRY SUBSTANCE IN TWO VARIETIES OF CARROTS SOWN IN TRANSILVANIA AFTER DEHYDRATION

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Abstract

A good source of elements which are a component of the carrots roots highlight its daily consumption, regardless the age. The food importance of the carrot is given by the energetic value, which is higher than other vegetables, thus, for 100 g of fresh substance it assures a quantity within 39.2-46.4 kcal. Dehydration is the technological process in which the vegetables and the fruits lose a certain quantity of water, leading to a phisico chemical phase proper for maintaining the nutritional values and the qualitative aspects, being good for consumption.
The range of variation of the soluble dry substance was within 8.22 (Nantes variety, April, organic) – 13.04 (Flakker variety, April, chemical). The content of s.u.s./fresh product was influenced by the period of harvest. S.u.s., after rehydration, registered the highest values for Nantes variety, regardless the fertilization method and the harvesting period, being a variety prone to rehydrate.

Key words: Crop, carrots, dehydration, dry substance

The vegetables are, without any doubt, a valuable source of fiber, C vitamin, A provitamin and antioxidants (Barański R. *et al,* 2003). Due to their antioxidant properties, the consumption of food rich in carotenoids could prevent some forms of cancer (Pavia B., Concepcion R., 2006).

As a nutritional aspect, the carrot has a big importance as a main source of A provitamin, accessible all year round. The fine cellulose tissue and the presence of the pectic substances make the carrot being irreplaceable in the gastrointestinal disorders (Măniuțiu N D., 2008).

A rich source of elements which are components of the carrots roots, highlight its daily consumption, regardless the age.

The food importance of the carrots is given by the energetic value which is highest than the other vegetables, thus, for 100 g of fresh substance, it assures a value within 39.2-46.4 kcal (Iordăchescu C., 1978).

The food value of the carrot is given by the chemical composition and the intake of the vitamis and the mineral salts, which cause the chemical coordination of the energy and morphological vital processes; the study was carried out quoting different authors and it is presented in *table 1*.

Table 1

The chemical composition of the carrots roots

The chemical components		The value limits
Water g/100g		86.7-88
s.u. g/100g	dried in drying stove at 105^0C	12.4-13.6
	with refractometric method	11.4-20.42
Carbohydrates g/100g		6.0-9.0
Protide g/100g		0.7-1.5
Lipids g/100g		0.2-0.3
Cellulose g/100g		0.58-1.6
Calories kcal/100g		44.7-70
Vitamins (mg/100 g s.p.)		
A vitamin (carotene)		5.0-24
C vitamin		2.0-7.0
B_1 vitamin		0.08-0.16
B_2 vitamin		0.05-0.10
B_5 vitamin		0.2-2.0
PP vitamin		0.3-0.5
E vitamin		2.5-3
Mineral salts (mg/100 g s.p.)		
P		35-70
K		290
Mg		18-20
Fe		0.3-4.0
Ca		30-50

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MATERIAL AND METHOD

The experiences were made in 2015, as a trifactorial experience.

- A factor - ***variety with two graduations***
  - **a_1** Nantes
  - **a_2** Flakker
- B factor - ***seeding with two graduations***
  - **b_1** early (March)
  - **b_2** late (April)
- C factor - ***fertilization with two graduations***
  - **c_1** organic
  - **c_2** chemical

Chemistries: – refractometric method (*Bota,T M., 2013*)

- soluble dry substance befor dehydration;
- soluble dry substance after rehydration

Processing was carried out using ANOVA program (Duncan test and Analysis of variance).

In the dehydration process of the horticultural products, there are three successive stages: (Marca Gh., 2004)

Heating step or period (preheating) – this step is the one in which the heat from the dehydration space is consumed almost entirely for heating the product subject to dehydration. The step lenght is short. It depends of the characteristics of the warm air and it is not a step of dehydration.

Dehydration step or period with constant speed – in this step there occurs free water removal from the product and it lasts until reaching the critical moisture of the product, when is does not diffuse enough water from inside out. In this period, the evaporation rate does not depend on the product nature and it depends on the method of dehydration and the agent used for this method. Misdirection of the product during this period favor the migration of salts, sugars and surface acids, which when the product has reached a critical moisture content, form a crust on the surface and prevents or delays dehydration (*figure 1*).

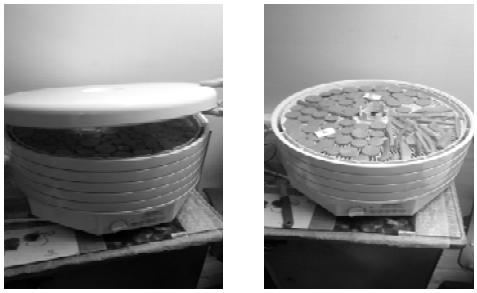

Figure 1 **Dehydration process development**

Dehydration step or period with decreasing speed – during this spet, the dehydration rate only depends on the properties of the product (structure and chemical composition) and there is removed from the product a part of the bound water, the colloidal water and partly the absorption water. To this period is given an important attention, because there is a possibility of qualitative degradation (fleshy structure, decreasing the capacity of rehydration). Thus, the temperature of the warm air, in the final phase, must be reduced.

RESULTS AND DISCUSSIONS

Analysing the combined influence of the three studied factors upon the weight of the carrots befor dehydration (*table 2*), it is found that Flakker variety, sown in March and chemical fertilized, registered the highest weight (46.09 g), with a distinct significant difference of 6.46 g in comparison with the average of the experience.

In decreasing order follows the same variety crop, lately sown and phasial fertilized with chemical fertilizers and the organic fertilized early sown crop.

Regarding Nantes variety, the highest weight is obtained in the early seeding period with organic fertilization, the weight being equal with the average of the experience.

Table 2

Results regarding the synthesis of the measurements upon the weight of the roots before dehydration according to fertilization/seeding period/cultivar

Fertilization Seeding period Cultivar	The weight of the roots before dehydration		Difference± (t/ha)	Dif. signif.
	g	%		
C1 b1 a1 (Mt)	40.90	100	0	Mt
C2 b1 a1	38.81	94.9	-2.09	-
C1 b1 a2 (Mt)	46.09	100	0	Mt
C2 b1 a2	45.27	98.2	-0.82	-
C1 b2 a1 (Mt)	41.82	100	0	Mt
C2 b2 a1	38.52	92.1	-3.30	0
C1 b2 a2 (Mt)	44.46	100	0	Mt
C2 b2 a2	40.61	91.3	-3.86	0
DL (p 5%)			3.07	
DL (p 1%)			4.58	
DL (p 0,1%)			7.21	

The values obtained upon the weight of the roots after dehydration according to the experimental factors in the experimental year can be seen in *table 2*.

The results regarding the effect of the cultivar show that Flakker variety had, in average, the highest weight, 15.34 g, the differences being significant compared to Nantes variety (*table 2*), thus Flakker variety is superior Nantes variety.

Table 2

The results regarding the synthesis of the measurements upon the weight of the roots before after dehydration according to the fertilization/seeding period/cultivar

Fertilization Seeding period Cultivar	The weight of the bulbs before dehydration		Difference ± (t/ha)	Difference significance
	g	%		
C1 b1 a1 (Mt)	12.72	100	0	Mt
C2 b1 a1	11.41	98.7	-1.31	-
C1 b1 a2 (Mt)	15.42	100	0	Mt
C2 b1 a2	15.34	99.5	-0.08	-
C1 b2 a1 (Mt)	14.94	100	0	Mt
C2 b2 a1	11.54	77.2	-3.40	-
C1 b2 a2 (Mt)	17.06	100	0	Mt
C2 b2 a2	15.74	92.3	-1.32	-
DL (p 5%)			3,79	
DL (p 1%)			5,96	
DL (p 0,1%)			10,25	

The carrots roots (*Daucus carota* L.) are widely used for industrial processing. The carrots produced for the food industry, especialyy those wich are used for the food for kids, must meet strict quality requirements.

The population choice to consume carrots is based on the perceptions regarding their qualities, wich include organoleptic, sensory and nutritive factors (Rubatzky V.E. *et al*, 1999).

In *table 3* it is presented the influence of the experimental factors upon the content of soluble dry substance before dehydration. The values were within 8,22% (Nantes/April/organic) and 13,04% (Flakker/April/chemical), existing statistically differences between the experimental variants.

Table 3

The combined influence of the experimental factors upon s.u.s. before dehydration

Variant	s.u.s before dehydration	Significance
	%	
Flakker/Aprili/chemical	13.04	A
Flakker/March/organic	12.99	A
Nantes/April/chemical	12.00	B
Nantes/March/organic	11.41	BC
Flakker/March/chemical	11.23	BC
Flakker/April/organic	10.80	BC
Nantes/\march/chemical	8.42	C
Nantes/April/organic	8.22	C
DS	1.92-2.11	

Analysing the combined influence of the studied factors upon the quantity of soluble dry substance after rehydration accumulated in the carrots roots (*table 4*) there are distinguished the following:

⇒ the variants in the bottom of Duncan league, which have low values of the content of soluble dry substance after rehydration are found in Flakker variety.

⇒ the best variant, regarding this aspect, is Nantes/April/chemical, followed by Nantes/March/organic, with a statistically significant difference

⇒ Flakker variety, lately sown and organic fertilized, accumulates the highest amount of soluble dry substance after rehydration with significant differences compared with the other variants.

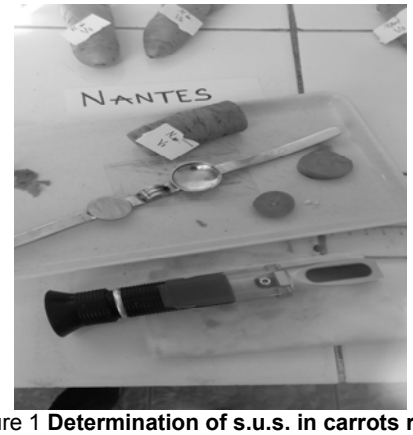

Figure 1 **Determination of s.u.s. in carrots roots before dehydration**

Table 4

The combined influene of the experimental factors upon s.u.s. after rehydration

Variant	s.u.s after rehydration	Significance
	%	
Flakker/April/chemical	8.84	A
Flakker/March/organic	8.54	AB
Nantes/Aprili/chemical	7.05	BC
Nantes/March/organic	7.00	BCD
Flakker/Aprili/organic	6.70	CD
Flakker/March/chemical	5.90	CD
Nantes/Aprili/chemical	4.45	D
Nantes/Aprili/organic	3.07	D
DS	2,33-2,56	

CONCLUSIONS

- The dehydration process is influenced by the cultivar and the content of s.u.s.;
- The studied varieties behave differently in the dehydration process according to the chemical composition (the content of soluble dry substance) of the raw material and of the dehydration factors.
- In the carrots crop with autumn harvesting, for direct consumption, long preservind or industrialization, it is recomenden Flakker variety, sown in first period (March);
- The phasial fertilization for Flakker variety in the early sown crop can be made efficienlty with chemical fertilizers. It is recomended, for phasial fertilizations with fertilizers, Complex III

(16:16:16) applied in total dose of 256 kg/ha, in May-June, every two weeks.

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