

## Researches Regarding the Influence of Irrigation on Vitamins Content at Celery (*Apium graveolens var. rapaceum*)

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**Abstract.** The paper includes some results of the investigations held between 2009 and 2011 in the conditions Nicula - Gherla, Cluj county, the influence of factors of production (irrigation regime, fertilization, biological material) on the content of vitamins (B6, B9 and C ) at the celery culture. It was found that the best results, respectively a higher vitamin content was obtained in irrigated variants at a humidity threshold of 80% of active moisture interval (AMI).

**Keywords:** celery, quality, vitamins, irrigation regime, fertilization, variety

### INTRODUCTION

Celery is one of the oldest cultivated root plants used in medicine (Butnariu, 1992; Bojor, 2005; Tamas, 2012). The chemical composition of the celery is complex: protides, carbohydrates, many minerals including sodium, magnesium, potassium, calcium, phosphorus, zinc, essential oil rich in triterpenic compounds, vitamins A, B1, B2, B3, B5, B6, B9, C, E, K, PP (Tamas, 2012).

The role of production factors such as irrigation regime, fertilization and biological material can be very important both in achieving higher production levels as well as increased content in some component of production (Luca, *et al.*, 2008; Tamas, 2012).

### MATERIALS AND METHODS

Experiences underlying this paper were performed in Nicula village, located 3 km from the city of Gherla, 52 km from Cluj-Napoca and 17.6 km from Dej, Cluj county. To express the thermal regime and, respectively, rainfall for the experimental field of Nicula, in 2009-2011, was performed using data recorded by the Meteorological Station Dej and Transilvania Nord Meteorological Center.

In the experiments was pursued the behavior of three varieties of celery, Giant Prague, Diamant and Anita, both under irrigation and irrigation conditions and the application of two different levels of fertilization.

By tracking production levels of the three varieties of celery in unirrigated crop, respectively, irrigated one, and research on water consumption celery determining the conditions in Transylvania were performed in a trifactorial experience.

Experimental factors studied and their graduations were: A factor - irrigation regime, with graduations - a<sub>1</sub> - irrigated at the minimum humidity threshold of 50% of active moisture interval (AMI), a<sub>2</sub> - irrigated at the minimum threshold of 80% moisture of active moisture interval (AMI), B factor - fertilization with graduations - b<sub>1</sub> - basic fertilization, b<sub>2</sub> - basic fertilization plus additional fertilization, C factor - cultivated variety, with graduations - c<sub>1</sub> - Giant Prague, c<sub>2</sub> - Diamant, c<sub>3</sub> - Anita.

The technology culture applied in the experimental field of Nicula during 2009 - 2011 was the vegetable recommended by researchers.

For each comparative culture were ensured three repetitions. To realize the irrigation was chosen watering through furrows with the isolation spaces made to eliminate possible influences that might have arisen between the neighboring plants. The land used for the study was limited by a containment area to prevent impact between plots (nutrients transport, moisture influence).

## RESULTS AND DISCUSSIONS

Analysis results on vitamin C content in cellery highlighted the following issues for the three varieties studied:

*Giant Prague* variety. In the variant considered as control- irrigated at the minimum threshold of 50% humidity in the range of humidity basic active x fertilization x *Giant Prague* ( $a_1 \times b_1 \times c_1$ ) were determined amounts of 1.5496 mg/ kg, at the irrigated variant at the minimum threshold of 50% relative humidity in the active humidity range x basic fertilization plus an additional fertilization x *Giant Prague* ( $a_1 \times b_2 \times c_1$ ): 1.6116 mg/ kg irrigated at the minimum threshold of 80% of moisture content active humidity range x basic fertilization x *Giant Prague* ( $a_2 \times b_1 \times c_1$ ): 1.5961 mg / kg, and the version irrigated at 80% from the active humidity range x basic fertilization plus additional fertilization x *Giant Prague* ( $a_2 \times b_2 \times c_1$ ): 1.6271 mg / kg, from which results that the basic fertilization plus additional fertilization had a significant influence.

Variety *Diamant*. Analyzing compared to the variant chosen as control  $a_1 \times b_1 \times c_2$ , which has obtained the value of 3.1739 mg / kg, using irrigation and fertilization are obtained values 4.76% higher for the experimental variant  $a_2 \times b_2 \times c_2$  (meaning 3326 mg/ kg).

Variety *Anita*. The control is  $a_1 \times b_1 \times c_3$  containing 2.5430 mg/ kg vitamin C, it can be seen that the applied irrigation and fertilization during the growing season will get a vitamin C content of 2.6702 mg / kg, which represents a percentage increase of 4.76% over the control.

Figure 1 presents the results of cellery content in vitamin C, culture achieved on average over the studied period, 2009-2011.

Figure 2 shows the results on the content of vitamin B9 in celery root, culture studied during 2009-2011.

Thus the following conclusions can be drawn:

*Giant Prague* variety. We determined the content of 0.0189 mg / kg for the control chosen for this experiment, graduation  $a_1 \times b_1 \times c_1$ . The highest content of vitamin B<sub>9</sub>, or 0.0199 mg / kg, was determined at variant  $b_2 \times a_2 \times c_1$ . From Table 2 it appears that the best results were obtained with the variants which was used basic fertilization and irrigation plus additional fertilization.

*Diamant* variety. At this sight the control chosen is  $a_1 \times b_1 \times c_2$ , containing vitamin B<sub>9</sub> of 0.0140 mg / kg applying irrigation threshold of 50% of AMI with basic fertilization and additional fertilization are obtained 0.0146 mg / kg content in vitamin B<sub>9</sub>; best content in vitamin B<sub>9</sub> is obtained at graduation  $a_2 \times b_2 \times c_3$ , respectively 0.0147 mg/ kg.

*Anita* variety. The content of vitamin B<sub>9</sub> in celeriac variety Anita range of 0.0230 mg / kg to the experimental variant chosen as the control  $a_1 \times b_1 \times c_3$  and 0.0242 to variant  $a_2 \times b_2 \times C_3$  (irrigation 80% AMI and basic fertilization + additional fertilization). Between the variants 50% irrigated with basic fertilizer + additional fertilizer and irrigated variant at 80% with basic fertilization, the difference is only of 0.83%.

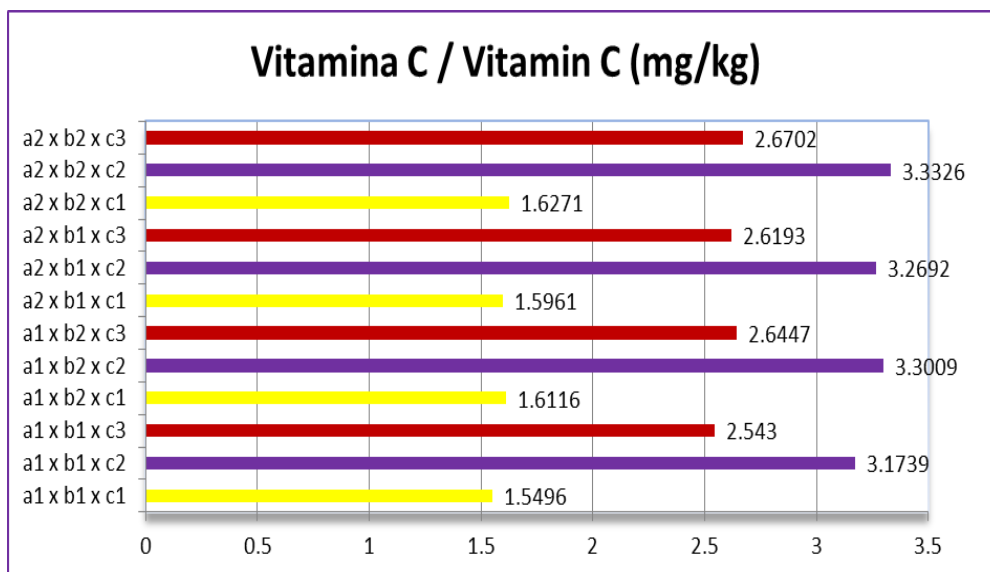


Fig. 1. Vitamin C content in celeriac, the average of the years 2009-2011, realised in the conditions of Nicula (Cluj county)

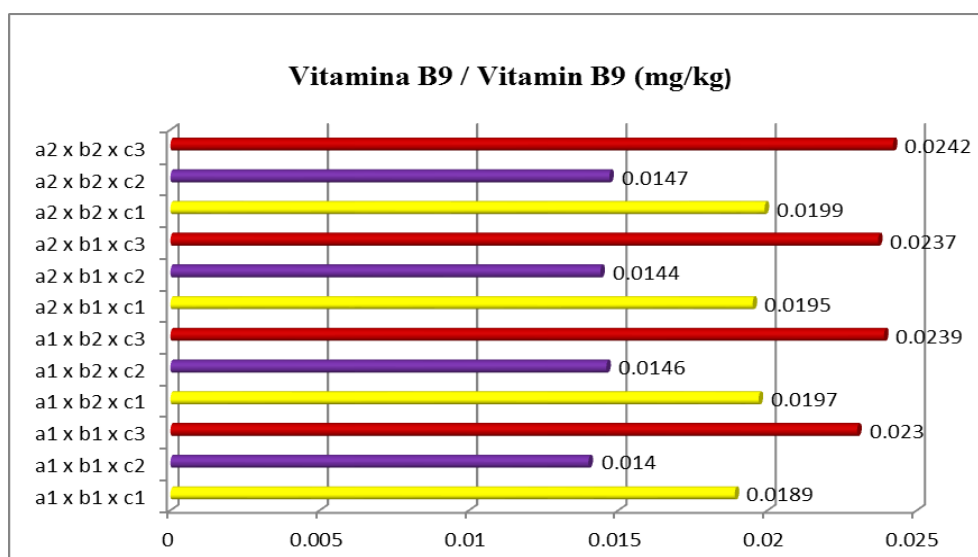


Fig. 2. Vitamin B<sub>9</sub> content in celeriac, the average of the years 2009-2011, realised in the conditions of Nicula (Cluj county)

Figure 3 shows the results obtained on the content of vitamin B<sub>6</sub> resulted in celeriac, the average production in the experimental years 2009, 2010, 2011.

Vitamin B<sub>6</sub> content in celeriac presented the following evolution:

*Giant Prague* variety. The highest content of vitamin B<sub>6</sub> was obtained for graduation a<sub>2</sub> x b<sub>2</sub> x c<sub>1</sub>, respectively 0.1495 mg/ kg, while the variant a<sub>1</sub> x b<sub>1</sub> x c<sub>1</sub> chosen as a control received 0.1424 mg/ kg vitamin B<sub>6</sub> content.

*Diamant* variety. The content of vitamin B<sub>6</sub> for the Diamant variety ranged from 0.1202 mg/ kg for the control a<sub>1</sub> x b<sub>1</sub> x c<sub>2</sub> and 0.1262 mg / kg for the version with 80% of the AMI irrigation and application of basic fertilizer + additional fertilization.

*Anita* variety. For graduation  $a_2 \times b_2 \times c_3$  was obtained the highest content of vitamin B<sub>6</sub> (0.9303 mg / kg), a result which is 4.77% higher than the content for control version ( $a_1 \times b_1 \times c_3$ ), respectively 0.8859 mg / kg.

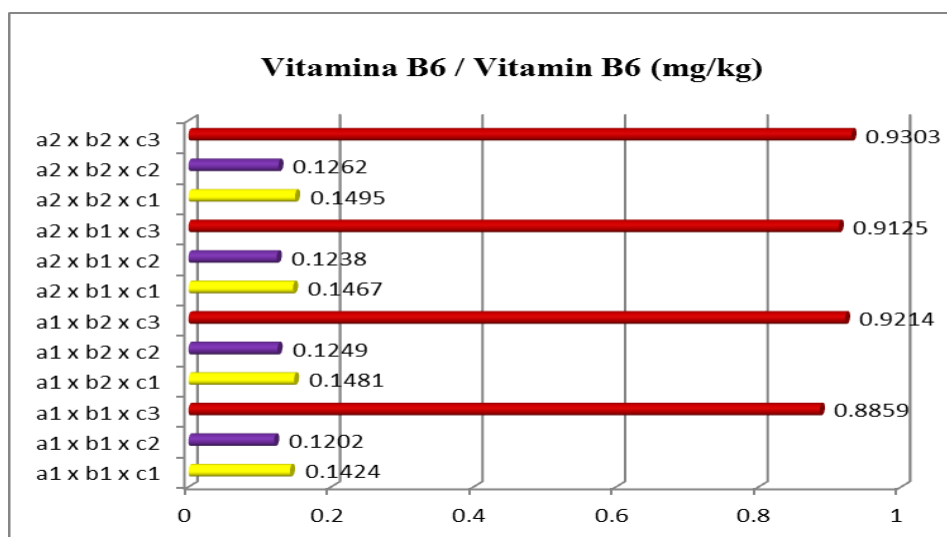


Fig. 3. Vitamin B<sub>6</sub> content in celeriac, the average of the years 2009-2011, realised in the conditions of Nicula (Cluj county)

## CONCLUSION

Experiences held between 2009 - 2011 in conditions of Nicula - Gherla, Cluj County, the influence of factors of production (irrigation regime, fertilization, biological material) on the content of vitamins (B<sub>6</sub>, B<sub>9</sub> and C) at the celery culture demonstrates the important role of the those factors.

Each of the three varieties tested, *Giant Prague*, *Diamant* and *Anita* content in vitamins B<sub>6</sub>, B<sub>9</sub> and C – of the celery, is influenced by the irrigation and fertilization of the culture.

The highest content in vitamins B<sub>6</sub> and B<sub>9</sub> was developed by *Anita* variety for experimental variant  $a_2 \times b_2 \times c_3$  (80% AMI irrigation regime x basic fertilization + additional fertilization x *Anita* variety).

The highest intake of vitamin C is found in *Diamant* variety for experimental variant  $a_2 \times b_2 \times c_2$  (80% AMI irrigation regime x basic fertilization + additional fertilization x *Diamant* variety).

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