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Effect of the nutrient solution electrical conductivity (EC) on the nitrate content in endive leaves (*Cichorum endivia* L.) depending on the plant growth stage

INTRODUCTION

Endive is a leaf vegetable with high taste and nutritious values. Botanically it is related Endive is a leafy vegetable, used in fresh throughout the year. It is a plant accumulating large quantities of nitrate, which is a feature undesirable by consumers. The nitrate content in the plants is dependent on many factors, including the genetic traits and growing conditions. It is known that the quality of some vegetables may be improved by increasing the salinity of substrate.

The study was aimed to the determine the effect of the nutrient solution electrical conductivity (EC) on the nitrate content in endive leaves in relation to the plant growth stage.

MATERIALS AND METHODS

Crispum leaf 'Galanti' and 'Barundi' endive cultivars were cultivated according to the hydroponic system NFT in a greenhouse with constant microclimatic conditions. The level of about 8 mS cm^{-1} of nutrient solution EC was obtained by: 1. threefold increase of ions in the fertigation solution (Control 3-fold), as compared to the control fertigation condensation (Control), 2. adding of 30 mmol NaCl to the control fertigation solution (Control+NaCl). The control nutrient solution contained the following amounts of macro- and microelements in mg dm^{-3}: N 140; P 50; K 300; Mg 40; Ca 200; Fe 2; Mn 0.6; B 0.3; Cu 0.15; Zn 0.3; Mo 0.05. Plants at the stage of seedlings were transplanted to the NFT growing system under the control fertigation conditions. Then one part after two weeks and second one after four weeks of growing in such conditions (younger and older plants - 2 and 4 weeks) were subjected to the settled stress conditions. After 1, 2, 4 and 17 days of stress conditions the plants were examined to the content of nitrates using the spectrophotometric flow method in the Fiastar apparatus. There were 8 plants investigated in each treatment in 4 replications.

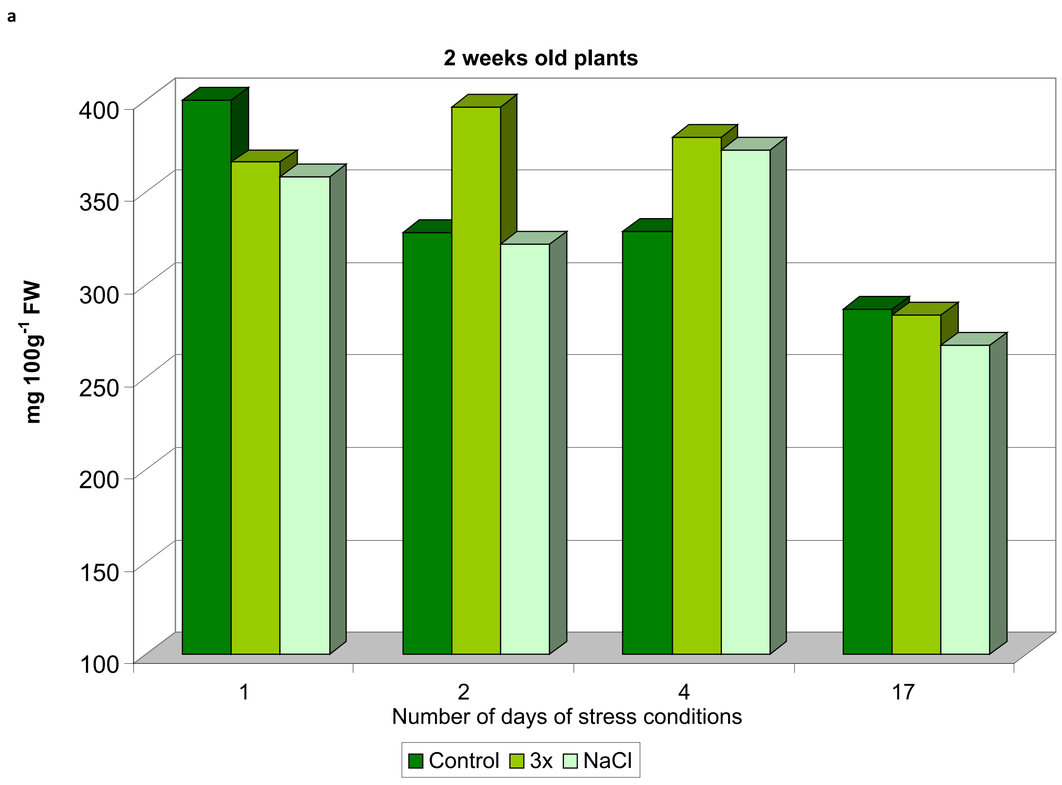
Statistical analysis was elaborated using two-way analysis of variance. Detailed comparison of means was performed by the Tukey's test at the significance level of $\alpha=0.05$.

RESULTS

The stress factor used in the experiment did not cause any significant changes in the appearance or growth of plants. Leaves of the plants at the age of 2 weeks, fertigated with a threefold concentrated nutrient solution, showed an increase in nitrates as compared both to control plants or the those supplied with NaCl, irrespectively the cultivar (Tab. 1). In the case of four-week-old plants an increase in the content of nitrates in response to a three-fold concentrated nutrient solution, was observed only for 'Barundi'. Adding NaCl to the nutrient solution used for two-week- and four-week old plants resulted in the decrease of nitrates' content in endive leaves of the cultivar 'Galanti'. The effect was particularly evident after 17 days of administering the nutrient solution with NaCl (Fig. 1 a and b). No such relationship was observed for the cultivar 'Barundi'. 'Barundi' accumulated a smaller amount of nitrates comparing to 'Galanti' (Tab. 1).

Table. 1 Content of nitrates in endive leaves (mg 100 g^{-1} FW)

Cultivar	Nutrient solution	Stage of the plant growth			
		2 weeks		4 weeks	
'Galanti'	Control	377.8	367.2	392.6	371.9
	Control 3 fold	393.5		389.6	
	Control+NaCl	330.4		333.4	
'Barundi'	Control	294.6	314.5	281.4	298.2
	Control 3 fold	319.2		305.8	
	Control+NaCl	329.6		307.4	
LSD $_{0,05}$ cultivar x nutrient solution		12.90		21.80	
LSD $_{0,05}$ cultivar			7.45		12.59



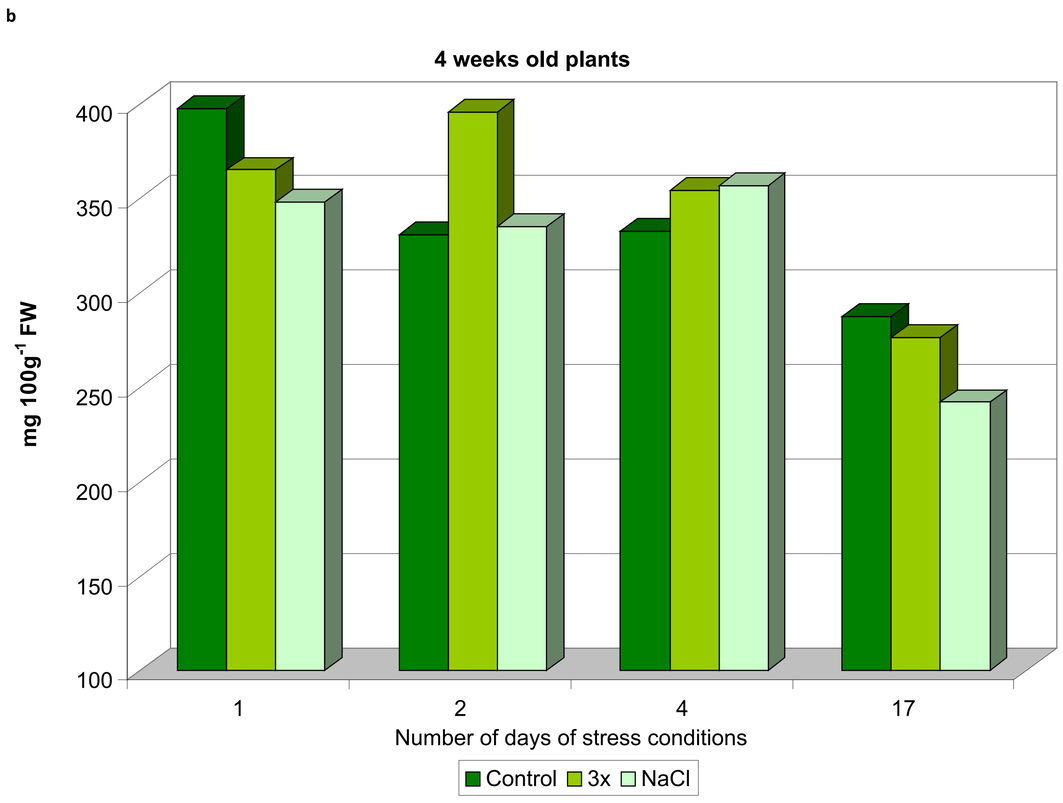


Figure 1 a) and b). Content of nitrates in endive leaves after 1; 2; 4 and 17 days of stress conditions

CONCLUSIONS

- **Fertigated with a threefold concentrated nutrient solution, showed an increase of nitrates' content in endive leaves**
- **Adding NaCl to the nutrient solution resulted in the decrease of nitrates' content in endive leaves after 17 days of administering the nutrient solution with NaCl**
- **'Barundi' accumulated a smaller amount of nitrates comparing to 'Galanti'**

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