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Research Article

THE EFFECT OF ANTITRANSPIRANT ON THE CONTENT OF MICROELEMENTS AND TRACE ELEMENTS IN SWEET CHERRY LEAVES AND FRUITS

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ABSTRACT

The conducted study was aimed at evaluation of the effect of antitranspirant produced with natural resins under the trade name Vapor Gard on the content of microelements and trace elements in sweet cherry leaves and fruits. A single-factor experiment was conducted in the randomised block design, with five replications, in 2010–2011. Examinations were performed on 13-year-old sweet cherry trees of the cultivar 'Burlat', being grafted on the 'PHL-A' rootstock. Tree spraying with antitranspirant Vapor Gard, at a 0.75% concentration, was applied at the stage of fruit colouration. The total content of manganese, zinc, copper, nickel, lead and cadmium in the leaves and fruits was determined by the AAS method. Antitranspirant Vapor Gard had an effect on increasing significantly the manganese, copper, zinc, nickel and cadmium quantities and decreasing the content of lead in the sweet cherry leaves. The antitranspirant being applied did not have any effect on the quantity of microelements and trace elements in the sweet cherry fruits of the cultivar 'Burlat'.

Keywords: sweet cherry, anti-transpirant, Vapor Gard, microelements.

INTRODUCTION

In the recent years, sweet cherry has gained popularity in Poland. Despite higher requirements and greater risk to this species' cultivation, the percentage of sweet cherry orchards has increased at the cost of sour cherry ones. One of the more important problems found in sweet cherry cultivation is fruit cracking. This phenomenon depends on many biological and climatic factors. Many authors have conducted research works on the possibilities to decrease yield losses induced by cracking of sweet cherry fruits. In order to reduce this unfavourable phenomenon, fertilisation with preparations containing calcium is used most frequently [Fernandez and Flore 1998, Sitarek and Grzyb 1999, Chełpiński et al. 2007, 2009] and recently also with those containing silicon [Gembara 2009]. Mikiciuk et al. [2011] also showed a high efficiency of the application of antitranspirant spraying in the reduction of sweet cherry cracking.

The applied treatments may reduce fruit cracking but also modify the course of physiological processes and affect fruit chemical composition. For this reason, the carried out study aimed at the evaluation of the effect of antitranspirant produced with natural resins under the trade name Vapor Gard on the content of microelements and trace elements in sweet cherry leaves and fruits.

MATERIAL AND RESEARCH METHODS

A single-factor experiment in the randomised block design with five replications was carried out in Karwowo near Szczecin in 2010–2011. Examinations were performed on 13-year-old sweet cherry trees of the cultivar ‘Burlat’, being grafted on the ‘PHL-A’ rootstock, growing in 4×3 m spacing. The orchard was set up on the soil formed from medium clay of glacial origin. Tree spraying with antitranspirant Vapor Gard, at a 0.75% concentration, was applied at the stage of fruit colouration. Leaves and fruits were collected for analyses at the stage of sweet cherry fruit harvest maturity. The total content of manganese, zinc, copper, nickel, lead and cadmium in leaves and fruits was determined with the method of atomic absorption spectrometry on a Perkin Elmer AAS 300 spectrometer. The stock solution was obtained after the wet mineralisation of plant material according to the Polish standards PN–ISO 11466 and PN-ISO 11047.

The obtained numerical data were subject to one-factor analysis of variance in the randomised block design. In order to determine the significance of differences between mean values, the Duncan’s confidence half-intervals were calculated at the significance level $\alpha = 0.05$.

RESULTS AND DISCUSSION

The content mineral components in sweet cherry leaves and fruits depends on many factors, among other on genetic traits (cultivar) or the rootstock being applied [Ugolik and Hołubowicz 1990, Ystaas 1990, Rozpara et al. 1998, Sitarek et al. 1998, Chełpiński et al. 2004a, 2004b, Jiménez et al. 2004]. The quantity of macro- and microelements in sweet cherry leaves undergo changes during vegetation as well [Nagy et al. 2007].

Antitranspirants in sweet cherry cultivation are used first and foremost to reduce fruit cracking. However, no reports have been found in the literature on their effect on accumulation of mineral components in leaves and fruits. As reported by Latocha et al. [2009], Vapor Gard preparation has a significant effect on the improvement of physiological status of the photosynthetic apparatus of actinidia and the chlorophyll content in leaves. The above authors also notice that different actinidia cultivars responded differently to the spraying with the said antitranspirant.

As reported by Jiménez et al. [2004], the leaves of sweet cherry cultivar ‘Sunburst’ grown on different rootstocks accumulate manganese in the amount of 34.0 to 74.8 $mg \cdot kg^{-1}$ DM. According to the authors mentioned, copper content in sweet cherry leaves ranges from 8.0 to 13.4 $mg \cdot kg^{-1}$ DM, while that of zinc from 31.8 to 51.3 $mg \cdot kg^{-1}$ DM. Similar manganese and copper contents were characteristic for the leaves of the cultivar being examined; only in case of zinc, its smaller quantity was observed in the cultivar ‘Burlat’ than in the cultivar ‘Sunburst’. The application of antitranspirant caused a significant increase in the content of manganese, copper, zinc, nickel and cadmium and a decrease in the quantity of lead in the leaves of sweet cherry cultivar being examined (Table 1).

In the experiment carried out, the application of Vapor Gard preparation did not have any significant effect on the quantity of microelements and trace elements analysed in the fruits of the cultivar ‘Burlat’ (Table 1). However, alike in case of leaves, more manganese, copper, zinc and nickel and less lead was found in the fruits from the trees sprayed with the antitranspirant. The content of heavy metals in the fruits of sweet cherry cultivar being examined did not exceed the acceptable standards [Official Journal of Laws No. 37, item 326 of 2003]. It should

Table 1. Content of mineral elements in leaves and fruit of sweet cherry cv. ‘Burlat’

Parameter	Mn	Cu	Zn	Ni	Cd	Pb
	$mg \cdot kg^{-1}$					
Leaves						
Control	35.60 a	13.00 a	13.53 a	3.87 a	0.01 a	2.13 b
Anti-transpirant	38.90 b	14.20 b	14.90 b	4.10 b	0.02 b	1.67 a
Fruit						
Control	3.00 a	3.85 a	3.79 a	1.64 a	0.02 a	1.25 a
Anti-transpirant	3.18 a	4.22 a	3.99 a	1.80 a	0.02 a	1.27 a

Comments: Means assigned identical letters do not differ significantly at the level of significance $\alpha = 0,05$.

be added that tree spraying with the preparation under examination is being applied only several hours prior to harvest, therefore its effect on fruits is of relatively short duration.

CONCLUSIONS

Vapor Gard had an effect on increasing the content of manganese, copper, zinc, nickel and lead and decreasing the content of lead in sweet cherry leaves.

The antitranspirant being applied did not have any effect of the content of microelements and trace elements in the fruits of the cultivar 'Burlat'.

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