

## **UC Davis**

### **The Proceedings of the International Plant Nutrition Colloquium XVI**

#### **Title**

Impact of Foliar Fertilizer Containing Iodine on “Golden Delicious” Apple Trees

#### **Permalink**

<https://escholarship.org/uc/item/8bp5w7z7>

#### **Author**

Szwonek, Eugeniusz

#### **Publication Date**

2009-06-29

Peer reviewed

## Introduction

Physiological iodine instabilities symptoms are mostly reported in relation to humans and animals disorders (Suzuki 1965, Eskin et al.1975, Lund, Bonaa 1993, Venturi, Venturi 1998, 1999, 2004). There are rather fragmentary data on linkage between plants reaction on iodine deficiency. In 1958 studies connected with iodine impact growth and yielding have been initiated within horticultural plants. Lehr, Wybenga, Rosanov (1958) described an effect of potassium iodide on increase of tangential growth but simultaneously decrease of plant weight of tomato plants. They also concluded that iodide improved the fruit weight by increasing the number of fruits, but also partly by increasing fruit weight. In some cases it was due to appreciably higher dry matter percentage. Pauwels (1961) reported however “up until now it has not been possible from a study of the literature to draw definite conclusions concerning the effect of iodine on plant growth”. Some year later (Portianko, Kudria (1966) observed stimulation of pollen germination by iodine. Neretina (1969) and also Golovnieva (1970) noticed that iodine stimulated especially transformation of simple sugars into oligosaccharides and than their accumulation in plant tissue. A new wave of studies on iodine role in plants in different aspects have been undertaken since years of 1990 and it takes place till now (Burte et.al. 1991, Mackowiak, Grossl 1999, Zhu 2004, Dai et al. 2004, Mackowiak, Grossl, Cook 2005, Dai et al. 2006, Blasco et al. 2008, Hong et al. 2008, Weng, et al..2008

## Materials and methods

The experiment was carried out in 2008 under field conditions with nine years old “Golden Delicious/M.9” apple trees. Trees were spaced at 2 m x 4 m. An organic-mineral liquid fertilizer Biojodis : **N** 0.85-1.5, **P** 0.9-1.5, **K** 0.82-1.5 **CaO** 0.4-2.0, **MgO** 0.25-2.0, **Fe** 0.08-0.2, **Mn** 0.002-0.05, **Cu** 0.008-0.01, **Zn** 0.002-0.01, **Co** 0.002-0.005, **Mo** 0.002-0.005, **B** 0.008-0.02 [%] and **I** 1.50-2.40 (1) or 3.00-4.80 (2) [mg.L<sup>-1</sup>] **pH** 7.1-7.8 was used for foliar treatments. Trees sprayed with water served as control. The first spraying (5 L.ha<sup>-1</sup> diluted in 600 L.ha<sup>-1</sup> of water) was applied after 10 -15 % flowers buds being developed and the second one at the same rate after ca 80 % flowers being developed. The trial was set using a randomized complete block design with four replicates by five trees in each. Single branch of tested trees was selected for evaluation of fruit buds (April 20) and fruit lets setting (June 03) as well as final fruits setting (July 20). Total fruit yield was measured separately for each tree. There was also structure of the yield estimated, firmness of fruits and their extract content after harvest and after storage evaluated.

## Results

Tab. 1 - Effect of Biojodis treatment on Golden Delicious/M.9 flower buds setting fruit lets setting and fruits setting on selected branch

Treatment	Flower buds setting April 20	Fruits lets setting June 03	Fruits setting July 20	Fruits at harvest
			[No]	
Biojodis (2)	127.8 a	84.9 b	24.2 b	22.5 b
Biojodis (1)	129.8 a	80.8 b	19.1 a	16.1 a
Control	128.2 a	36.6 a	20.3 a	16.6 a

Tab. 2 - Effect of Biojodis treatments on “Golden Delicious/M.9” apple tree yield and fruit firmness as well as their solids content after harvest and after storage

Treatment	Total yield [kg.tree <sup>-1</sup> ]	Fruit firmness		Fruit soluble solids	
		after harvest	after storage	after harvest	after storage
		[kg.cm <sup>-2</sup> ]		[°Brix]	
Biojodis (2)	40.2 c	11.9 b	8.1 b	14.2 b	13.6 a
Biojodis (1)	37.8 b	12.2 b	7.3 a	13.7 b	13.9 a
Control	23.5 a	10.7 a	8.6 c	12.2 a	12.9 a

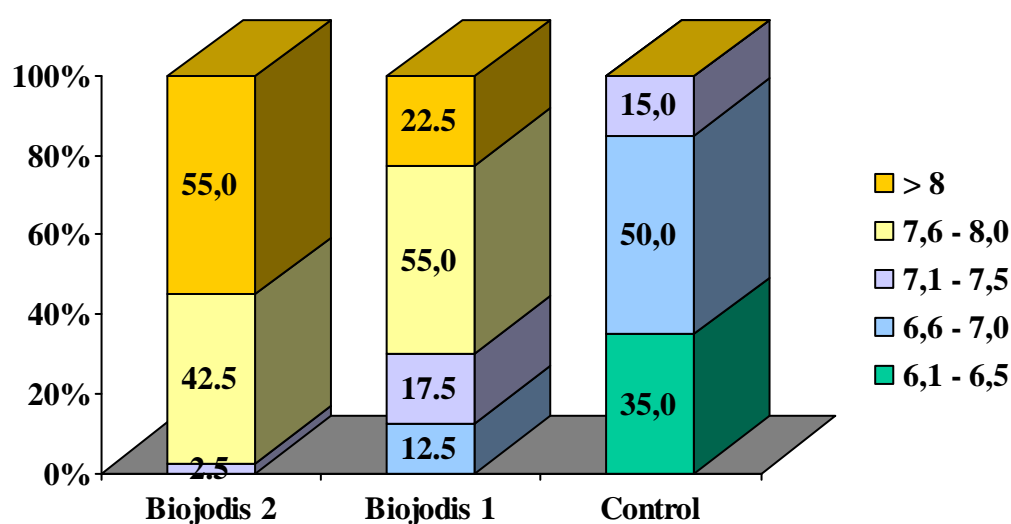


Fig. 1 – Effect of Biojodis treatments on marketable yield structure of Golden Delicious apples

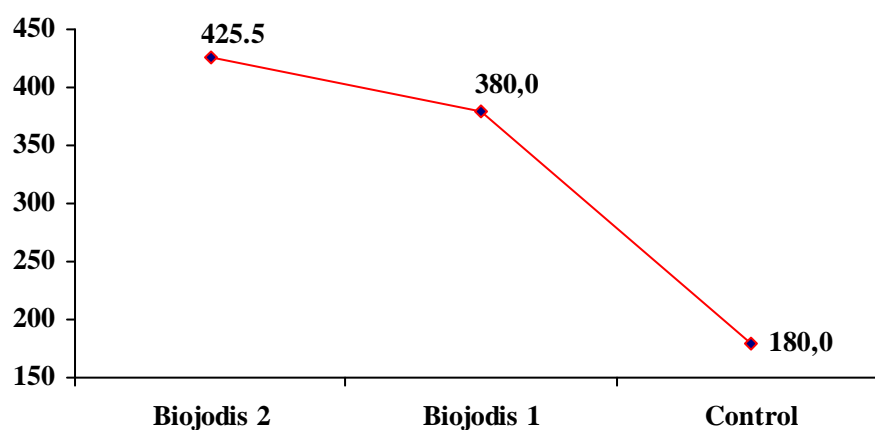


Fig. 2 – Effect of Biojodis treatment on uniformity index of Golden Delicious apples

As indicated (Table1) Biojodis respectively to applied forms enhanced fruit lets setting and stimulated remaining fruits on the trees until harvesting. Apples marketable yield (Table 2) increased by ca 61 after Biojodis (1) and 71 % after Biojodis (2) foliar treatments. As compared to control, application of foliar fertilizers containing iodine improved structure of yield toward increase of larger fruits diameter and apples uniformity index (Figure 1 and 2).

## Discussion

Global iodine distribution has been strongly differentiated from moderate deficiency to excess (Venturi, Grossi, Marra, Venturi, Venturi 2004). According to world and countries diversification an average content of iodine in top horizons of soils varies from 1.1 to 45 [ppm d.m.] Most of all its level in the soil keeps range of 1.1- 4.5 [ppm d.m.] (Kabata-Pendias, Pendias 1999). Respectively to plants iodine has been quite often described as harmful element of active chlorides group. Barker, Mapson (1964) observed e.g. negative influence of iodine acetate on respiration and carbohydrates metabolism of plant tissue. Pais, Jones (1997) have mentioned that iodine level at 0.1 [mg.L<sup>-1</sup>] in nutrient solution have shown some stimulatory effects for plants. The nature of the crop is important in so far as various investigators have shown that some crops are more favorably influenced than others (Pauvels 1961). One year later (Pauvels 1962) have written that beneficial effect of iodate, can be explained by assuming that the differences during initial stages of growth are still perceptible at later stages of development. There are not available data in bibliography connected with foliar application of fertilizer containing iodine on fruit trees.

During vegetation season of 2008 the temperatures were not much diversified as compared to 1979-2007 period. In case of rainfalls its setting, both at the spring as well as summer time, was relatively less typical than within mentioned long years period. Taking into consideration Biojodis as applied at normal (1) and doubled (2) iodide concentration the trial carried out has shown its positive effects on apple trees Golden Delicious/M.9 trees. Since Biojodis was applied just at blooming time an influence of iodine on pollen has to be basically taken into consideration (Portianko, Kudria 1966). Comparatively to control trees, better fruit lets as well as fruits setting and also total yield fruit increase by about 61% or 71 % and its structure underlined profitable effect of applied iodine containing fertilizer on marketable Golden Delicious/M.9 apple production. At the same time positive influence of iodine containing fertilizer on apple fruits firmness and their soluble solids enhance just after harvest indicated that it was valuable treatment.

## References

- Barker J.L., Mapson W. 1964. Studies in the respiratory and carbohydrate metabolism of plant tissues. XIV The effect of certain enzymatic poisons on respiration, sugar and ascorbic acid of detached leaves. J.Exp. Bot.15:284.
- Blasco B., Rios J.J., Cervilla L.M., Sanchez-Rodriguez E., Ruiz J.M., Romero L. 2008. Iodine biofortification and antioxidant capacity of lettuce: potential benefits for cultivation and human health. Ann.of Appl. Biology 152:289-299.
- Burte P.P., Nair A.G.C., Manohar S.B., Parkash S., 1999. Iodide and iodine uptake in plants. J. Radioanal. Nucl. Chem. Letters 155:391-402.
- Dai J.L., Zhu Y.G., Zhang M., Huang Y.Z., Song J.L. 2004. Selecting iodine-enriched vegetables and residual effectiveness of iodate application to soil. Biol. Trace Elem. Res. 101:265-276.
- Dai J.L., Zhu Y.G., Huang Y.Z., Zhang M., Song J.L. 2006. Availability of iodide and iodate to spinach (*Spinacia oleracea* L.) in relation to total iodine in soil solution. Plant Soil 289:301-308.

- Eskin B.A., Shuman R., Krouse T. Merion J.A. 1975. Rat mammary gland atypia produced by iodine blockade with perchlorate. *Cancer Res.* 35:2332-2339.
- Golovnieva N.T. 1970. Wlijanie ioda na obrazovanie podvizhnyh form ugljevodov I osnovnyh komponentov stjenki u rastenij jacshtmjenja w ontogeneze. Avtoref. kandid. Diss. Minsk.
- Hong C.L., Weng H.X., Qin Y.C., Yan A.L., X L.L., 2008. Transfer of iodine from soil to vegetables by applying exogenous iodine. *Agron. Sustain. Dev.* 28:575-583.
- Kabata-Pendias A., Pendias H. 1999. *Biogeochemia pierwiastków śladowych*. PWN Warszawa pp.398.
- Lehr J.J., Wybenga J.M., Rosanov M. 1958. Iodine as a micronutrient for tomatoes. *Plant Physiol.* 33:421-427.
- Lund E., Bonaa K.H. 1993. Reduced breast cancer mortality among fishermen's wives in Norway. *Cancer Causes Control* 4(3):283-287.
- Mackowiak C.L., Grossl P.R. 1999. Iodate and iodide effects on iodine uptake and partitioning in rice (*Oryza sativa* L.) grown in solution culture. *Plant and Soil* 212:135-143.
- Mackowiak C.L., Grossl P.R., Cook K.L. 2005. Iodine toxicity in a plant-solution system with and without humic acid. *Plant and Soil* 269:141-150.
- Neretina N.W. 1969. Fizjologtheskaja reakcija rastjenij na podkormku jodom. Avtoreferat kand. Diss. Alma Ata.
- Pais I., Jones Jr. J.B. 1997. *The handbook of trace elements*. St. Lucie Press, Boca Raton Florida. pp.223.
- Pauwels G.W.F.H. Borst Pauwels 1961. Iodine as a micronutrient for plants. *Plant and Soil* XIV, 4:377-392.
- Pauwels G.W.F.H. Borst Pauwels 1962. An investigation into the effects of iodide and iodate on plant growth. *Plant and Soil* XVI, 3:284-292.
- Portianko W.F., Kudria L.M. 1966. Galogeny – stymulatory prorastanija pylcy. *Fizjol. Rastjenij* 13 (6):1086.
- Suzuki H., Higuchi T. Sawa K. 1965. Endemic coast goitre in Hokkaido. *Japan Acta Endocr.* 50:161-170.
- Venturi S., Venturi M. 1998. Does iodide in the gastric mucosa have an ancient antioxidant role? *IDD-Newsletter* 14 (4):61-62.
- Venturi S., Venturi M. 1999. Iodide, thyroid and stomach carcinogenesis: evolutionary story of a primitive antioxidant? *Europ. J. Endocrinol.* 140(4):371-372.
- Venturi S., Grossi L., Marra G.A., Venturi M., Venturi A. 2004. *Iodio ed Evoluzione* [www.dimi.marche.it/](http://www.dimi.marche.it/)
- Weng H.X., Weng J.K., Yan A.L., Hong C.L., Yong W.B., Qin Y.C. 2008. Increment of Iodine content in vegetable plants by applying iodized fertilizer and the residual characteristics of iodine in soil. *Biol. Trace Elem. Res.* 123:218-228.
- Zhu Y.G., Huang Y.Z., Hu Y., Liu Y., Christie P. 2004. Interactions between selenium and iodine uptake by spinach (*Spinacia oleracea* L.) solution culture. *Plant and Soil* 261:99-105.