Scientific Papers, Series B, Horticulture, Vol. LVI, 2012
ISSN Online 2286-1580, ISSN-L 2285-5653

RESEARCHES ON THE IMPACT OF CHEMICAL FRUIT THINNING WITH ETHREL UPON MINERALS' CONTENT IN FRUITS OF SOME PEACH AND NECTARINE VARIETIES CULTIVATED IN PERIAM, TIMIS COUNTY

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Abstract

Peaches have a complex chemical composition, among all known components they contain 0.30-0.65 g total minerals, of which magnesium, calcium and iron being predominant, but also manganese, copper and zinc. The high content of vitamins, organic acids, manganese and potassium salts, which help in cardiac, vascular and renal diseases, and the richness of monosugars, compounds of copper, cobalt and calcium, which help in anaemia, liver diseases and obesity, all these make peaches and nectarines very important and special fruits. This article deals with the impact of chemical thinning with Ethrel in different concentrations upon the content of minerals in fruits, meaning: magnesium, iron, cobalt, manganese, copper and zinc. Data were collected in 2006 from an orchard in Periam locality, Timis County, where there are cultivated 2 varieties of peach – Spring Lady and Maja, and 2 nectarine varieties – Caldesi 2000 and Nectaross. The trees were planted at a distance of 4.0 x 2.5 m, having a density of 1000 trees/ha and the crown system is Palm Spindelbusch. The soil was maintained clean by mechanical hoes and Roundup 360 SL herbicide. Chemical thinning with Ethrel was done at 25 days after fruit binding, moment when the ovule (the future stone) had 10-12 mm, being done in four different concentrations: 125 ppm, 250 ppm, 350 ppm and 500 ppm. The results obtained showed that the content of metals in fruits varied from one variant to another, but the values did not surpass the maximum limits. The best results for each variety were obtained in those variants where thinning was done in concentrations of 250 ppm, 350 ppm and 500 ppm, but these values correlated with other physical-chemical features and the productions obtained, determine us to recommend for chemical thinning the use of Ethrel in concentrations of 250 ppm or 350 ppm.

Key words**:** *chemical thinning, chemical composition, metals, nectarine, peach*

INTRODUCTION

Peaches have a complex chemical composition, among all known components they contain 0.30-0.65 g total minerals, of which magnesium, calcium and iron being predominant, but also manganese, copper and zinc. The high content of vitamins, organic acids, manganese and potassium salts, which help in cardiac, vascular and renal diseases, and the richness of monosugars, compounds of copper, cobalt and calcium, which help in anaemia, liver diseases and obesity, all these make peaches and nectarines very important and special fruits [2].

In the category of minerals, or metals, there take part several elements, which by over passing the maximum admissible limits can be very toxic to organisms. Under this limit, minor minerals like copper, cobalt, iron, zincous, manganese or magnesium, which can be found in aliments, fruits and vegetables are essential components of some proteins involved in metabolism, having a favourable impact upon human organism. Otherwise, one can suffer of nutritional deficiencies [4].

Fruit thinning, as mentioned before, is necessary to obtain superior quality fruits, which are uniform as size and well coloured [3]. This operation is done after 15-30 days from fruits binding with the substance Ethrel (ethephon) 120-180 mg/l or 250-500 ppm completed by manual thinning before stone's strengthening, the effect being satisfying after 2-3 weeks. Thinning's intensity depends on the

fruit load, the planting system, the variety and fruits' size [6].

MATERIAL AND METHOD

This experiment was placed in a private orchard at about 60 km far from Timisoara, in Periam locality, Timis County. This area is very know in the western part of Romania as being favourable for peach culture and it has a long tradition in this culture. So, we can affirm that the culture area is favourable for this species considering its' climatic and soil's features.

The biological material consisted of two peach varieties: *Spring Lady* and *Maja* and two nectarine varieties: *Caldesi 2000* and *Nectaross*, planted at the distance of 4 x 2.05 m, giving a density of 1000 trees/ha. The crown system adopted for these trees was simple palmet, which has the spindle easily inclined on the tree row direction and garnished with middle branches and fructification branches. This crown system also has two main branches directed on the tree row, also garnished with middle branches and fructification branches.

In the orchard the soil was maintained clean by ploughing in autumn or early spring at 18-22 cm depth between the tree rows, and in the vegetation period there were done 3-4 disc tillages. On the tree row the soil was kept clean of weeds with Roundup (3-4 l/ha) and fertilised with chemical fertilizers in approximate doses of: 90-100 kg/ha N, 60-80 kg/ha P_2O_5 and 100-120 kg/ha K_2O. Water supply was assured by 2-4 watering, according to the rainfall quantities and the phytosanitary treatments were done according to the prognosis of pests and diseases attacks, normally being done 8-12 treatments/year.

In this article we present the chemical thinning with Ethrel done in 2006 for all four varieties using four concentrations:

V1 – 125ppm
V2 – 250ppm
V3 – 350ppm
V4 – 500ppm
V5 – Not thinned, control variant

The treatment was done 25 days after fruit binding, when the ovule (next stone) had 10-12 mm.

Fruits' quality was determined under two aspects: the physical features (big diameter – D, small diameter – d, height – H, size index – Is and weight of peaches) and the chemical features (dry soluble substance, sugars content, acidity and sugar-acidity index, metals' content).

Minerals were determined by calcinations of 3g of pulp at 600^{o}C, the ash being cooled afterwards at room temperature, and then treated with HCl 10% [1].

By spectrophotometry there were determined: cobalt, manganese, copper, zinc, magnesium and iron.

RESULTS AND DISCUSSIONS

Iron and copper have a beneficial role for the human body, in participating in the synthesis of normal blood cells roandi. Iron is an essential nutrient for living organisms, needed to make hemoglobin, the myoglobin, and enzymes. Copper, cobalt, manganese and vitamin C are necessary for iron to be assimilated in plant products (fruits, vegetables, grains), because this metal is essential for the metabolism of vitamin B. Copper is the basic component of the exterior of epithelial nerve fibers, collagen, the most important element of protein structure greatly influences the body and skin pigment production.

Zinc helps in stimulation of nerve and muscle, but and the immune system. Has the particularity to participate in the formation of over 200 different types of enzymes. Zinc vegetable protein can be used properly by the body compared to that of animal protein.

Manganese participates in many functions in human body. In the first phase acts as a coenzyme, and this facilitates many metabolic processes in the body. Benefits of manganese in the body are numerous. It is involved in bone formation, participates in thyroid functions in connective tissue formation, and is involved in the functions of sex hormones in calcium absorption, in normalizing blood sugar levels in immune function and the metabolism of fat and carbohydrates [5].

In 2006, for Spring Lady variety, metals' content for each mineral did not surpass the maximum admissible limit. For manganese, this

mineral ranged from 0.005% in the control variant and V1 up to 0.008% in variant 4. Iron varied from 4.00 ppm (V5- control variant) to 4.80 ppm (variant 4), while the content of cobalt was of 0.09 ppm in the control variant and of 0.14 ppm in variant 4 (Table 1 and Fig. 1).

Table 1. Fruits' metals content (ppm) for Spring Lady variety

Variant	Mg %	Fe ppm	Co ppm	Mn ppm	Cu ppm	Zn ppm
V1-125ppm	0.005	4.20	0.10	0.27	0.18	0.10
V2-250ppm	0.006	4.50	0.11	0.29	0.22	0.12
V3-350ppm	0.006	4.60	0.12	0.33	0.23	0.13
V4-500ppm	0.008	4.80	0.14	0.35	0.21	0.12
V5-Not thinned - control	0.005	4.00	0.09	0.18	0.19	0.10

Manganese ranged from 0.18 ppm (variant 5 – not thinned) and 0.35 ppm (variant 4) and copper from 0.18 ppm (variant 1) up to 0.23 ppm in variant 3. Zinc's content in Spring Lady peaches varied from 0.10 ppm (variants 1 and 5 – control) and 0.13 ppm (variant 3) (Table 1 and Fig. 1).

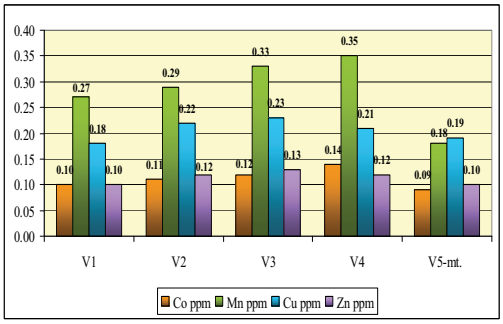

Fig.1. Fruits' metals content (ppm) for Spring Lady variety

For Maja peach variety, the same as for Spring Lady, metals' content for each mineral did not surpass the maximum admissible limit. For manganese, the values ranged from 0.003% in variant 1 up to 0.007% in variants 2 and 4. Iron varied from 4.10 ppm (V5- control variant) to 4.61 ppm (variant 4), while the content of cobalt was of 0.10 ppm in the control variant and of 0.14 ppm in variant 4 (Table 2 and Fig. 2).

Table 2. Fruits' metals content (ppm) for Maja variety

Variant	Mg %	Fe ppm	Co ppm	Mn ppm	Cu ppm	Zn ppm
V1-125ppm	0.003	4.22	0.12	0.24	0.19	0.11
V2-250ppm	0.007	4.40	0.11	0.26	0.20	0.13
V3-350ppm	0.006	4.61	0.13	0.29	0.20	0.12
V4-500ppm	0.007	4.60	0.14	0.33	0.22	0.12
V5-Not thinned - control	0.004	4.10	0.10	0.20	0.19	0.09

Manganese ranged from 0.20 ppm (variant 5 – not thinned) and 0.29 ppm (variant 3) and copper from 0.19 ppm (variant 1 and control variant) up to 0.22 ppm in variant 4. Zinc's content in Maja peaches varied from 0.09 ppm in variant 5 – control and 0.13 ppm in variant 2 (table 2 and Fig. 2).

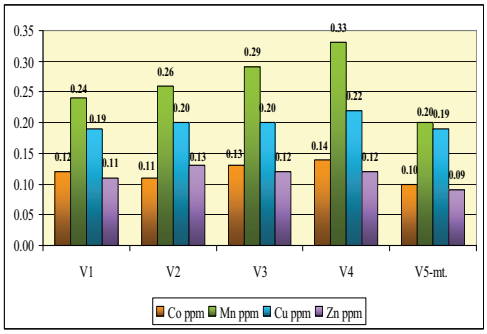

Fig.2. Fruits' metals content (ppm) for Maja variety

Considering minerals' content in nectarines, we can also affirm that for Nectaross variety, the same as for the other two peaches varieties, for each mineral the values did not surpass the maximum admissible limit. The content of manganese ranged from 0.004% in variant 5 up to 0.008% in variant 2, iron varied from 4.10 ppm (variant 1) to 4.40 ppm (variant 3), while the content of cobalt was of 0.11 ppm in the control variant and of 0.13 ppm in variant 4 and variant 1. Manganese ranged from 0.22 ppm (variant 5 – not thinned) and 0.29 ppm (variant 4) and copper from 0.19 ppm (control variant) up to 0.22 ppm in variant 4. Zinc's content in Nectaross nectarines varied from 0.10 ppm in variant 5 – control and in variant 3 and 0.12 ppm in variant 2 (Table 3 and Fig. 3).

Table 3. Fruits' metals content (ppm) for Nectaross variety

Variant	Mg %	Fe ppm	Co ppm	Mn ppm	Cu ppm	Zn ppm
V1-125ppm	0.005	4.10	0.13	0.23	0.20	0.11
V2-250ppm	0.008	4.30	0.12	0.26	0.21	0.12
V3-350ppm	0.006	4.40	0.12	0.28	0.20	0.10
V4-500ppm	0.007	4.30	0.13	0.29	0.22	0.11
V5-Not thinned - control	0.004	4.10	0.11	0.22	0.19	0.10

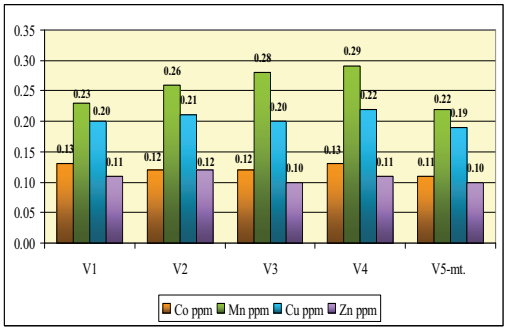

Fig.3. Fruits' metals content (ppm) for Nectaross variety

Metal's content was similar for Caldesi 2000 variety, in the sense that for each mineral the values did not surpass the maximum admissible limit. So, the content of manganese ranged from 0.004% in variant 5 up to 0.006% in variants 2 and 3, iron varied from 4.20 ppm (variant 5) to 4.40 ppm (variant 3), while the content of cobalt was of 0.12 ppm in the control variant and in variant 2 and of 0.14 ppm in variants 3 and 4. Manganese ranged from 0.22 ppm (variant 5 – not thinned) and 0.27 ppm (variants 3 and 4) and copper from 0.19 ppm (control variant) up to 0.21 ppm in variants 1, 2 and 4. Zinc's content varied from 0.09 ppm in variants 1 and 5 – control and 0.11 ppm in variant 4 (table 4 and figure 4).

Table 4. Fruits' metals content (ppm) for Caldesi 2000 variety

Variant	Mg %	Fe ppm	Co ppm	Mn ppm	Cu ppm	Zn ppm
V1-125ppm	0.005	4.30	0.13	0.24	0.21	0.09
V2-250ppm	0.006	4.30	0.12	0.26	0.21	0.10
V3-350ppm	0.006	4.40	0.14	0.27	0.20	0.10
V4-500ppm	0.005	4.30	0.14	0.27	0.21	0.11
V5-Not thinned - control	0.004	4.20	0.12	0.22	0.19	0.09

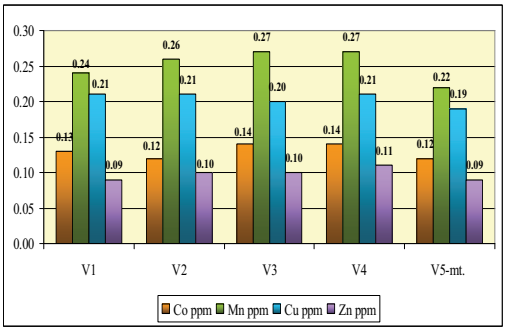

Fig.4. Fruits' metals content (ppm) for Caldesi 2000 variety

The results obtained showed that the content of metals in fruits varied from one variant to another, but the values did not surpass the maximum limits. The best results for each variety were obtained in those variants where thinning was done in concentrations of 250 ppm, 350 ppm and 500 ppm, but these values correlated with other physical-chemical features and the productions obtained – not presented in this article, determine us to recommend for chemical thinning the use of Ethrel in concentrations of 250 ppm or 350 ppm.

CONCLUSIONS

The differences between the four varieties are due to their genetical nature and maybe due to some phonological differences insufficiently approximated, while applying the thinning treatments.

Minerals content in peaches belonging to *Spring Lady* and *Maja* varieties and in nectarines of *Nectaross and Caldesi 2000* varieties did not over pass the maximum admissible limits, so that they are good and recommendable for organism.

By observing the two varieties of peach we can affirm that both of them are valuable for peaches cultivation, but in conditions of the culture area *Maja* variety remarked with higher contents of minerals (even though the values were close) than *Spring Lady*, while among nectarine varieties, the values obtained for each mineral was almost the same for *Nectaross* and *Caldesi 2000*, the differences being very small

Developing a research upon chemical thinning with Ethrel (ethephon) in different concentrations, determined us to recommend for commercial orchards the use of this substance in concentrations of 250 ppm (variant 2 in our experiment) or 350 ppm (variant 3 in our experiment).

This recommendation is done basing on the fact that using a lower concentration for chemical thinning the values obtained are almost similar to the ones from the not thinned fruits, even if the fruit load is smaller than in the not thinned trees – there is maintained a good balance in the tree so that it doesn't deplete and it is able to produce and carry fruit loads in the coming years. The sever thinning with 500 ppm ethephon is not recommended in commercial orchards because, even though the fruits are of superior quality, the productions are very damaged, being smaller with 2-3 times than the ones obtained in the not thinned variant.

ACKNOWLEDGEMENTS

This research work was carried out for the PhD Thesis entitled: *Researches on Fruits' Load Standardization of some Peach and Nectarine Varieties in Peariam Culture Area*.

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