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THE EFFECT OF FOLIAR FERTILIZING ON THE CHEMICAL COMPOSITION OF LEAVES OF *PRIMORSKI* ALMOND CULTIVAR GROWN IN VALANDOVO

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ABSTRACT

The effect of foliar fertilizing on the chemical composition of leaves of *primorski* almond cultivar grown in Valandovo region in the period from 2012 to 2013 was determined. The experiment was set in four variants and three repetitions. The variants were: Control (untreated); NPK+Ever green co Me (55% organic matter, 2% w/w Mg, 2% w/w Fe, 2% w/w Zn, 2% w/w Mn, 0.5 % w/w Cu, 0.5% w/w B); NPK+Biolinfa (34% organic matter 3% N, 5.80% K_2O) and NPK+Oligomix (1.20% B, 0.10% Cu, 4% Fe, 1.50% Mn, 0.10% Mo, 2% Zn).

The distance of fruit planting was 4.5 m row by row and 3.5 m in the rows. In each variant and repetition were included 60 plants, and total in all experiment were involved 720. Three foliar treatments were applied with given above fertilizers at a concentration of 0.4%. In the end of the November, soil fertilizing with the fertilizer Polyfeed 11-44-11 in quantity amount of 450 kg ha^{-1} was done.

The foliar fertilizing had a positive influence on the chemical composition of almond leaves. The highest average nitrogen content (2.32%), phosphorus (0.35%) and potassium (2.29%) were determined in the leaves from variant 3 Biolinfa (34% organic matter, 3 % N; 5.80 % K_2O)

The highest average content of calcium (2.61%) and magnesium (1.22%) were determined in the leaves from variant 2 NPK+Ever green with Me (55% organic matter, 2%w/w Mg, 2%w/w Fe, 2%w/w Zn, 2% w/w Mn, 0.5 %w/w Cu, 0.5 %w/w B).

The highest average content of micro elements iron (240 mg kg^{-1}), manganese (175 mg kg^{-1}), boron (38.70 mg kg^{-1}), zinc (14.52 mg kg^{-1}), and copper (25.90 mg kg^{-1}) were determined in leaves from variant 4. NPK+Oligomix (1.20 % B, 0.10 %Cu, 4 % Fe, 1.50 % Mn, 0.10 % Mo, 2 % Zn).

INTRODUCTION

The aim in the modern agriculture is to get higher yield that will characterize with better quality. Plant nutrition is one of the most important agro technical measures, that together with the others have to allow uninterruptible, high and economically production (Kester and Ross, 1996; Datnoff *et al*., 2007). The right plant nutrition regime is necessary for normal growth, yield and getting quality product (Marschner, 1996; Domagalski *et al*., 2008). It means availably of all macro and micro biogenic elements in appropriate phenophase of plant growth. Each biogenic element has its specific influence on different parts of the plants. Plant nutrition has an influence on numerous physiological – biochemical processes, that affecting growth, development and yield (Dzamič and Stevanović, 2000; Glintic and Krstic, 1990). Plants that have timely and right nutrition are getting fruits with characteristic shape, color, size and with typical organoleptic properties. Limited of the nutritious elements is happened because of the different reasons. Intensive agriculture and use of high productivity cultivars led to a continuous decrease in soil micronutrient content (Jekić snd Brković, 1986; Sarić *et al*., 1989).

Using of foliar fertilizers in the fruit cultures nutrition, has a big importance in getting higher yields as well as products with better quality (Holevas *et al*., 1985; Weinbaum *et al*., 1984). Foliar fertilizers allow direct supplying of leafs, flowers and fruits with nutritious elements in a period when they are necessary. Foliar spray with fertilizers is necessary to further activity in the whole system of optimal mineral nutrition of plants (Taiz and Zeiger, 2002; Kostadinov and Kostadinova, 2014). It provides more economical water regime of plants and allows overcoming the physiological disturbances caused by

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adverse soil conditions that hamper mobility and nutrients absorption.

In unregularly soil conditions, unregularly pH value, low or high soil temperature, fixation in different nutrients, the root cannot adopt the nutrients at all (Sarić *et al*., 1986; Šaćiragić and Jekić, 1988). In such cases, the foliar nutrition has an important influence. It is an additional nutrition and measure that allow rapid and efficiency effect of correction of the plant nutrition (Brown *et al*., 2004; Velićković, 2002).

The almond, *Amygdalus communis*, is kernel fruit that bellows at the family of *Rosaceae*, and under family *Prunoidae*. It is old fruit culture that is counts in economically importance kernel fruit and has numerous positively characteristic, too.

The importance of almond is because of the kernel, which is very reach in fats, proteins, mineral matters, sugars, cellulose, vitamins and amino acids (Bulatović, 1985; Bybordi and Malakouti, 2006). On the other hand, the almond has a big value for human nutrition, pharmaceutics, cosmetic industry and so.

The leaf is an organ in which the synthesis of organic matter takes place at most. The composition of leaf tissue and symptoms that occur in it are the best indicators for determining the level of nutrients in the soil, and thus the need for fertilizing (Jekic and Brkovic, 1986, Saciragic and Jekic, 1988). The chemical composition of the leaves is variable. The presence of certain nutrients in the leaves depends on the stage of taking a leaf samples, the type of plant, mineral nutrition, conditions of cultivation.

In foliar nutrition, nutrients quickly come to chloroplasts where photosynthesis takes place and other physiological and biochemical processes. With faster foliar nutrition prevents deficiency in certain elements that occurs in the leaves.

The aim of this exploration was to obtain the influence of soil and foliar fertilizing on the chemical composition of leaves by almond cultivar *primorski*, grown in Valandovo region.

MATERIALS AND METHODS

The field experiment with almonds was set in Valandovo region, during the 2012 and 2013. During the field experiment setting, the fruits were 7 years old. The material of work was almond cultivar *primorski*.

The planting distance was 4.5 m row by row and 3.5 m in the rows. The nutritional area were 15.75 m^2, i.e. 635 fruits/ha.

In the exploration were included 4 variants in 3 repetitions. In each variant and repetition were included 60 plants, or total in whole experiment the number of plants was 720.

The field experiment was set in terms of watering in system drip. During the almond vegetation period were applied all basic agricultural measures.

Variants in experiment were

1. Control (untreated);
2. NPK+Ever green with Me (55% organic matter, 2% w/w Mg, 2% w/w Fe, 2% w/w Zn, 2% w/w Mn, 0.5 % w/w Cu, 0.5 %w/w B);
3. NPK+Biolinfa (34% organic matter, 3 % N, 5.80 % K_2O);
4. NPK+Oligomix (1.20 % B, 0.10 % Cu, 4 % Fe, 1.50 % Mn, 0.10 % Mo, 2 % Zn).

The soil fertilizing was applied in the end of November and the fertilizer Polyfeed NPK11-44-11 was used in the quantity amount of 450 kg ha^{-1}.

Each variant and repetition was treated foliar with 0.4% solution of the tasted fertilizers. The application of fertilizers was done with manually spraying the played leaves. The treatments were made in the evening hours. During the vegetation period were conducted 4 foliar treatments. The first treatment was made 10-15 days before flowering, and the other treatments was made after flowering at a distance of 15-20 days.

The harvesting was carried out separately by variants and repetitions.

Before setting up the experiment soil samples were taken for agrochemical analyses and were performed on the following parameters:

- pH value - determined potentiometric with pH meter (Bogdanović *et al*., 1966);
- Content of easy available nitrogen – determined by method of Tjurin and Kononova;
- Content of easy available phosphorus – determined by AL method and reading of spectrophotometer (Bogdanović *et al*., 1966);
- Content of easy available potassium – determined by AL method and reading of spectrophotometer (Bogdanović *et al*., 1966);
- Content of humus – determined by permanganese method of Kotzman (Bogdanović *et al*., 1996);
- Content of carbonates– determined with Schaiblerov Calcimeter (Bogdanović *et al*., 1966).
- In the leavess were determined the following parameters:
- Content of nitrogen (N) - determined using Kjeldal method (Sarić *et al*., 1989);
- Content of phosphorus (P_2O_5) - determined using atomic emission spectrometry with inductively coupled plasma (ICP - AEC) (Sarić *et al*., 1989);
- Content of potassium (K_2O) - determined by incineration of the material with concentrated H_2SO_4 and phlamenphotometar (Sarić *et al*., 1989);
- Content of calcium (Ca), magnesium (Mg), iron (Fe), manganese (Mn), boron, (B), zinc (Zn) and copper (Cu) - determined by applying atomic emission spectrometry with inductively coupled plasma (ICP - AEC) (Sarić *et al*., 1989).

  Statistical data processing was performed using LSD test represented at the levels of probability of 0.05 and 0.01.

RESULTS AND DISCUSSION

Climate is one of the most important environmental factors which affect the success of cultivation of all fruit kinds without excluding the almonds (Šoškić, 1996). The influence of climate elements manifest through the time of vegetation of fruit as well as through the separate phenophases.

Valandovo region is known as region with lot of shiny days. Temperature requirements of almond for growth and development in the period of standby are large. It is enough in sequel of 100 hours, temperature variations from 0 to 6°C for almond awakening.

The average year temperature of the air in the Valandovo region is 15°C. Sensibility of low temperatures is variety characteristic. Almond varieties that blooming early are more sensitive than others. Bulatović (1989) found that unopened blossoms can be damaged on -3°C to -4°C, opened on -1.5 to -2.8°C, and just planted fruit on - 1 to -1.5°C.

Almonds are sensitive on very high atmospheric humidity, suffer from diseases and in that ways don't give good yields. The average year relative humidity in Valandovo region is 71 % with maximum of 80 % in November, December and January.

Soil conditions have an especially importance for growing, developing and fruits quality. The almond has the best growth and yield in deep, alluvial - diluvial, loamy - sandy, humus carbonate soils with significant content of lime (Ubavić *et al.*, 2001).

Particularly suitable are soils with neutral reaction and good penetration of water and air. Salty and acidic soils or wet and clay are unsuitable for growing almonds.

Table 1 Agrochemical analyses of soil

Lab. No.	Depth cm	pH KCl	pH H_2O	Available mg/100g soil N	P_2O_5	K_2O	Humus %	$CaCO_3$ %
1	0-20	7.14	7.62	14.70	6.60	20.00	1.86	1.30
2	20-40	7.19	7.98	15.26	6.20	17.00	1.90	1.02
3	40-60	7.05	7.86	11.48	5.00	17.00	1.80	2.50
	Average 0-60	**7.13**	**7.83**	**16.20**	**5.93**	**18.00**	**1.85**	**1.61**

Table 2 Content of macro elements in leaves in % of dry matter (average 2012/2013)

Variant	N	P_2O_5	K_2O	CaO	MgO
1	2.11	0.23	2.03	2.42	1.11
2	2.22	0.27	2.13	2.61	1.22
3	2.32	0.35	2.29	2.49	1.15
4	2.28	0.29	2.25	2.59	1.19

LSD (0.05) = 0.09 LSD (0.05) = 0.04 LSD (0.05) = 0.04 LSD (0.05) = 0.04 LSD (0.05) = 0.07
LSD (0.01) = 0.12 LSD (0.01) = 0.06 LSD (0.01) = 0.06 LSD (0.01) = 0.06 LSD (0.01) = 0.09

Table 3 Content of micro elements in leaves in mg kg^{-1} of dry matter (average 2012/2013)

Variant	Fe	Mn	B	Zn	Cu
1	228	143	35.38	12.47	24.60
2	236	166	38.00	13.25	25.20
3	233	152	36.10	13.18	24.67
4	240	175	38.70	14.52	25.90

LSD (0.05) =6.10 LSD (0.05) =3.48 LSD (0.05) = 0.09 LSD (0.05) = 1.27 LSD (0.05) = 2.04
LSD (0.01) =8.47 LSD (0.01) = 4.83 LSD (0.01) =0.12 LSD (0.01) =1.76 LSD (0.01) = 2.83

From data shown in Table 1, can be concluded that soil in which the field experiment was set, had neutral pH value, good fertility with available nitrogen, low fertility with available phosphorus and medium fertility with available potassium. It had medium fertility with humus, too. There was low presence of carbonates.

From data shown in Table 2 and Table 3, can be concluded that soil and foliar fertilizing had a positive influence on the chemical composition of leaves. In all of the variants treated with different kinds of fertilizers, analyzed parameters had higher value compared with the control, untreated variant.

The highest average nitrogen content (2.32%), phosphorus (0.35%), and potassium (2.29%) was determined in leaves from variant 3. The highest average content of calcium (2.61%) and content of magnesium (1.22%) was determined in the leaves from variant 2. For the all macro elements content, statistically significance differences were determined in all of the variants at both levels.

According to Dinesh and Ahmed (2014) the average content of nitrogen in almond leaves is 2.10 - 2.40% and the average content of potassium is 1.85 - 2.15%. On the other hand, Youssefi *et al.* (2000) found that the average nitrogen content in almond leaves is 2.20 - 2.50%. Basile *et al.* (2003) obtained that the average content of potassium is between 1.72 - 2.10%. But, according to David (2014) the content of phosphorus in leaves of almond cultivar *nonpareil* is 1.30 - 1.70 %. Brown and Uriu, (1996) determined that the average content of calcium in almond leaves is 2.55% and the average content of magnesium is 1.30 - 1.38 %.

The highest average content of micro elements iron (240 mg kg^{-1}), manganese (175 mg kg^{-1}), boron (38.70 mg kg^{-1}), zinc (14.52 mg kg^{-1}) and copper (25.90 mg kg^{-1}) was determined in leaves from variant 4. According to Meyer (1996) the average content of boron in almond leaves is 50.30 mg kg^{-1}.

For the content of manganese and copper content statistically significance differences were determined in all of the variants at both levels. For the iron content statistically significance differences were determined at variant 2 and 4 at both levels.
At both levels, there were no statistical differences for the content of zinc and copper.

Higher content of tested elements in all of the variants, compared with the control variants was a result of the chemical composition of used foliar fertilizers as well as their absorption in the plant organs i.e. leaves.

Macro and micro biogenic elements in the content of used fertilizers had an influence on numerous physiological – biochemical processes that are of vital importance in plant vegetation cycles.

CONCLUSION

Based on the obtained results for the influence of foliar fertilizing on the chemical composition of almond leaves from *primorski* cultivar grown in Valandovo region can be concluded that using of foliar and soil fertilizing has an important influence on increasing the content of all tested elements at all variants with different fertilizers compared to control variant. The highest average nitrogen content (2.32%), phosphorus (0.35%), and potassium (2.29%) was determined in leaves from variant 3 NPK+ Biolinfa (34% organic matter, 3

%N, 5.80 % K_2O). The highest average content of calcium (2.61%) and content of magnesium (1.22%) was determined in the leaves from variant 2 NPK+Ever green with Me (55% organic matter, 2%w/w Mg, 2%w/w Fe, 2%w/w Zn, 2%w/w Mn, 0.5 %w/w Cu, 0.5 %w/w B). The highest average content of micro elements iron (240 mg kg^{-1}), manganese (175 mg kg^{1}), boron (38.70 mg kg^{-1}), zinc (14.52 mg kg^{-1}) and copper (25.90 mg kg^{-1}) was determined in leaves from variant 4 NPK+ Oligomix (1.20 % B, 0.10 % Cu, 4 % Fe, 1.50 % Mn, 0.10 % Mo, 2 % Zn). For the all macro elements content, statistically significance differences were determined in all of the variants at both levels. For the content of manganese and copper content statistically significance differences were determined in all of the variants at both levels. For the iron content statistically significance differences were determined at variant 2 and 4 at both levels.

References

Basile, B., Reidel, E.J., Weinbaum, S.A., DeJong, T.M., 2003. Leaf potassium concentration, CO_2 exchange and light interception in almond trees (Prunus dulcis (Mill) D.A. Webb). Scientia Horticulturae 98, 185–194.

Bogdanović, M., Velkonija, N., Racz, Z. 1966. Chemical methods of soil analysis. Book I, *sine loco*, 68- 125.

Brown, P.H., Uriu, K., 1996. Nutrition deficiencies and toxicities: Diagnosing and correcting imbalances. In: Micke, W.C. (Ed.) Almond Production Manual. University of California, Division of Agriculture and Natural Resources, Publication 3364. pp. 179-188.

Brown, P.H., Zhang, Q., Stevenson, M., Rosecrance, R. 2004. Nitrogen fertilizing recommendation for almond. University of Californa, 18- 27.

Bulatović, C. 1989. Modern fruit production. Belgrade, Republic of Serbia: Nolit, 75- 87.

Bulatović, S. 1985. Walnut, hazelnut, almond. Belgrade, Republic of Serbia: Nolit, 90- 98.

Bybordi, A, Malakouti, MJ 2006. Effects of foliar applications of nitrogen, boron and zinc on fruit setting and quality of almonds. Acta Hortic. 726:351-357.

David, D. 2014. Almond Orchard Nitrogen and Potassium Nutrition. SSJV Almond Symposium, University of California.

Datnoff, L.E., Elmer, W.H., Huber, D. M. 2007. Mineral nutrition and plant disease. American Phytopathological Society. St Paul, M.N. (278), 89- 93.

Dinesh, K., Ahmed, N. 2014. Response of nitrogen and potassium fertigation to “Waris” almond (*Prunus dulcis*) unred Northwestern Himalayan region of India. The scientific World Journal. Vol. 2014, Article ID 141328, 1-6.

Domagalski, J.L., Ator, S., Coupe, R. 2008. Comparative study of transport processes of nitrogen, phosphorus and herbicides to streams in five agricultural basins. USA. J Environ Qual, Vol. 37 (1158), 69- 72.

Glintic, M., Krstic, Z. 1990. Plant nutrition and protection. Belgrade: Nolit, 80- 94.

Holevas, C., Stylianides, D.K., Michaelides, Z. 1985. Nutrient element variability in the leaves of almond trees in relation to variety, rootstock and the vegetative part of the tree. Paris: CIHEAM, 111-120.

Jekić, M., Brković, M. 1986. Agrochemistry and plant nutrition. Prishtina: Faculty of agriculture, 47- 59.

Kester, D.E., Ross, N.W. 1996. History. In: Micke, W.C. (Ed.) Almond Production Manual. University of California, division of agriculture and natural resources. Publication 3364, 1- 3.

Kostadinov, K., Kostadinova, S. 2014. Nitrogen efficiency in eggplants (*Solanum Melongena L.*) depending on fertilizing. *Bulgarian Journal of Agricultural Science*. Vol. 20, 287- 292.

Marschner, H.C. 1996. Mineral Nutrition of Higher Plants. 2nd Ed, Academic Press Limited, Text Book, 172- 175.

Meyer RD. 1996. Potassium fertilization/foliar N/P/K/B studies. In: Almond Board of California. 1972-2003. Years of Discovery. pp 291-292.

Sarić, M., Stanković, Z., Krstić, B. 1989. Plant physiology. Science book. Novi Sad: Faculty of argiculture, 130-136.

Sarić, M., Kastori, R., Pertovic, M., Krstic, B., Petrovic, N. 1986. Practical book of physiology. Science book. Belgrade: Faculty of agriculture, 110- 112.

Taiz, L., Zeiger, E. 2002. Plant physiology, Sinauer Associates Inc., Sunderland, MA, 15- 18.

Ubavić, M., Kastori, R., Oljaća, R., Marković, M. 2001. Fruit nutrition. Banja Luka, Republic of Serbia: Faculty of agriculture, 22- 25.

Velićković, M. 2002. Fruit production. Belgrade, Republic of Serbia: Faculty of agriculture, 80- 83.

Weinbaum, S.A., Klein, I., Broadbent, F.E., Micke, W.C., Muraoka, T.T. 1984. Effects of time of nitrogen application and soil texture on the availability of isotopically labeled fertilizer nitrogen to reproductive and vegetative tissue of mature almond trees. J. Amer. Soc. Hort. Sci. 109:339- 343.

Youssefi, F., Weinbaum, S.A., Brown, P.H. 2000. Regulation of nitrogen partitioning in field-grown almond trees: effects of fruit load and foliar nitrogen applications. Plant Soil 227:273- 281.

Šaćiragić, B., Jekić, M. 1988. Agrochemistry. Saraevo, Bosnia and Herzegovina: Faculty of agriculture, 180-185.

Šoškić, M. 1996. Modern fruit production. Belgrade, Republic of Serbia: Partenon, 93- 97.

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