RESPONSE OF SOME PLANT GROWTH BIOREGULATORS ON LEAVES CONTENT OF MACRONUTRIENTS IN APRICOT CULTIVARS

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Abstract

The effect of some plant growth bioregulators on the macronutrients content in leaves of six years old 'Gönci magyar kajszi' and 'Mandulakajszi' apricot trees (Prunus armeniaca L) on the different phenological stages were studied. The experiment was conducted in Central-Hungary on mature cv. 'Gönci magyar kajszi' and 'Mandulakajszi' grafted on myrobalán rootstock in 2007. Trees spaced 6 x 4 m, and growing in a chernozem soil at Sóskút in Central-Hungary.

Trees were foliar-fertilized with Bioplasma and Naturkomplex as fertilizers and their combination. Foliar sprays were performed: (1) at the stage of white bud, (2) at full bloom and (3) at the stage of intensive shoot growing. In each of spring spray treatments, fertilizers were applied at a rate of 5L ha^{-1}. Trees untreated with fertilizers served as a control.

Treatments had no effect on leaf nitrogen. All applied treatments increased leaf phosphorous compared to the control. Consequent effect of treatments was not observed during examined period neither at 'Gönci magyar kajszi' nor 'Mandulakajszi' regarding leaf potassium. However, treatments increased leaf Ca significantly at all sampling time at 'Gönci magyar kajszi'.

Treatments had no influenced N, P, K and Ca uptake of different cultivars. Moreover, treatments affected Mg uptake differently at examined cultivars.

Keywords: Apricot, foliar fertilization, leaf mineral composition, growth regulators

INTRODUCTION

Although, the apricot growing is very common and traditionally in Hungary there are only few information about the newest nutritional aspects and results of it.

We suggest that Hungarian fruit growing sector is fallen behind the international trend to test new and newer chemicals as nutrients. Today's several new nutrient products are presenting from week to week. To tell the truth, it is very difficult to find one's way among them.

The newest trend of plant nutrition is to apply combined fertilizers as "growth regulators". These fertilizers contain nutrients, hormones, vitamins sometimes amino acids simultaneously in complex forms like chelates. These fertilizers are applied both in organic and integrated orchards.
These fertilizers are favourable for fruit growing because macro- and micronutrient contents of them help the pass of physiological and biochemical processes. Inner properties are better in treated fruit and these fruits are tasteful and colorful as well.
In the near past several publications appeared in which the effects of these fertilizers were discussed (Leal et al., 2000; Racskó et al., 2006; Elfving and Visser 2006; Drén 2007).

But we suppose that the real scientific testing of these fertilizers is seldom and it seems to be that the results of them is a marketing trick sometimes.

The aim of our present study is to provide further information about the effects of fertilizers on nutrient uptake, were used and tested by us.

MATERIAL AND METHOD

The study was conducted in 2007 in Central-Hungary, near the capital on cv. 'Gönci magyar kajszi' and 'Mandulakajszi' grafted on myrobalán rootstock. Trees were planted in the autumn of 2001. Trees spaced 6 x 4 m, and growing in a chernozem soil at Sóskút in Central-Hungary. Orchard was not irrigated in 2007.

For the purpose of the experiment, 20 trees were randomly selected from a population of trees with uniform characteristics. The applied foliar applications are presented in *Table 1*.

For spraying, Bioplasma (BPL) Naturkomplex (NK) and their combination (BPL+NK) were applied. All treatments were used three times. Firstly at the stage of bud, secondly at full bloom and finally at the stage of intensive shoot growing. The doses were the same at every spraying time.

Table 1.

Applied foliar fertilization system

Applied nutrient	Dose (L/ha)	Time of applications	Code of treatment
Control	-	-	C
Bioplasma	5	1) at the stage of bud 2) at full bloom 3)at the stage of intensive shoot growing	BPL
Naturkomplex	5		NK
Bioplasma and Naturkomplex	5+5		BPL+NK

SOIL SAMPLING AND PREPARATION

Soil samples were collected from three layers (0-20, 20-40 and 40-60 cm) of each treatment by using manual soil sampling equipment following (MSZ 20135:1999) and according to (Nagy et al., 2006). Sampling was performed before treatments, at the beginning of the vegetation period in March 2007. Sample preparation of the soil samples was performed according to Hungarian guideline (MSZ 20135:1999). The following parameters were measured: pH, K_A, content of humus, AL soluble P and K according to Hungarian guidelines. The easily soluble mineralized nitrogen forms of soil were measured (Houba et al., 1986).

PLANT SAMPLING AND PREPARATION

Plant (leaf) samples were taken, from April to June (25 April, 14 May, 30 June) in 2007. Leaves were taken from all trees according to international conception and Hungarian sampling guidelines (Stiles and Reid 1966; MI-08 0468-81).

RESULTS AND DISCUSSION
RESULTS OF SOIL ANALYSIS

Besides conventional soil testing procedures (using AL extractant and determination of humus content) the 0.01 M $CaCl_2$ was used to give further information about the easily soluble and available nutrient forms of soil. Obtained results of soil analysis are represented in *Table 2*.

Table 2.

Results of soil analysis (before set up (March 2007))

	Depth (cm)			
Parameters	0-20	20-40	40-60	0-60
Humus (%)	2,75	2,63	2,38	*2,59*
K_A				*45**
pH (KCl)	6,16	6,04	6,11	*6,10*
pH (H_2O)	6,53	6,78	6,29	*6,57*
$CaCO_3$ (%)	<0,1	<0,1	0,5	*0,5*
P_2O_5 (mg/kg) (AL)	164,11	89,12	42,7	*98,64*
K_2O (mg/kg) (AL)	263,93	160,69	88,65	*171,09*
NO_3^--N (mg/kg) (0,01 M $CaCl_2$)	13,05	8,29	5,25	*8,86*
NH_4^+-N (mg/kg) (0,01 M $CaCl_2$)	1,05	0,76	0,19	*0,67*

* - Plasticity index according to Arany (It was established in the 0-60 cm layer, only.)

The physical category of soil was clay loam. The pH of soil was near the neutral value slightly acidic with low carbonate content. According to results of AL solution the P- and K of examined soil was medium, while the soil N (based on the data of humus) was medium also. However the amounts of 0.01 M $CaCl_2$ soluble N forms were low and occur mainly as

nitrate. The mineralized nitrogen content of soil was low and decreased according to depth.
Similarly the mineralized N forms the amount of AL soluble phosphate and potassium decreased according to depth also.

RESULTS OF LEAF ANALYSIS

Leaf N continuously decreased during examined period in all treatments till ripening. The amount of it was high in spring and declined before ripening. Treatments had no effect on leaf N. We couldn't find differences between cultivars regarding the effect of fertilizers (*Table 3*).

Table 3.

Results of leaf N

	N (% dry matter)					
	'Gönci magyar kajszi'			'Mandulakajszi'		
	25 April	14 May	30 June	25 April	14 May	30 June
C	4.11	4.61	2.6	4.72	4.64	2.45
BPL	4.2	4.13	2.55	4.72	4.73	2.56
NK	4.24	4.24	2.64	4.62	4.24	2.66
BPL+NK	4.12	4.22	2.62	4.49	4.69	2.76
Average	*4.17*	*4.30*	*2.60*	*4.64*	*4.58*	*2.61*
$SzD_{5\%}$	*0.06*	*0.21*	*0.04*	*0.11*	*0.22*	*0.13*

Similar tendency was observed regarding seasonal pattern of leaf P. Moreover it was found that leaf P was slightly influenced by treatments. All applied treatments increased leaf P compared to the control (*Figure 1*).

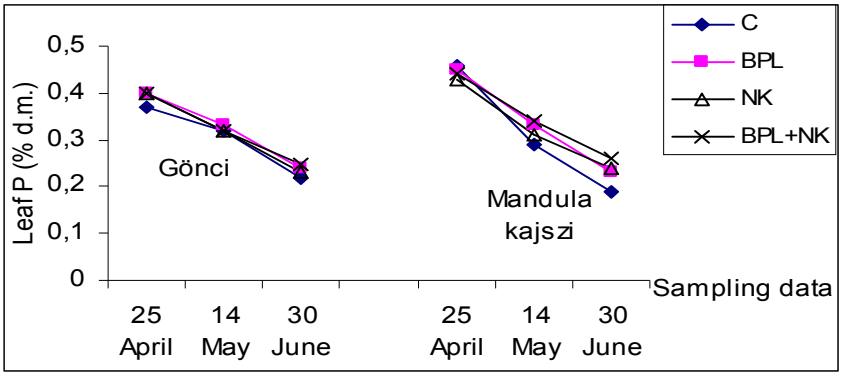

Figure 1. Seasonal pattern of leaf P

Results of leaf K were showed in *Table 4*. Leaf K was slightly increased from April to June according to the reference data. Consequent

effect of treatments was not observed during examined period neither at ‘Gönci magyar kajszi’ nor ‘Mandulakajszi’.

Table 4.

Results of leaf K

	K (% dry matter)					
	Gönci magyar kajszi			Mandulakajszi		
	25 April	14 May	30 June	25 April	14 May	30 June
C	2.02	2.23	2.25	2.01	1.66	1.62
BPL	2.04	2.01	2.15	1.99	1.84	1.8
NC	2.08	2.18	2.29	1.69	1.65	1.64
BPL+NC	2.01	1.91	2.19	1.89	1.87	1.82
Average	*2.04*	*2.08*	*2.22*	*1.90*	*1.76*	*1.72*
$SzD_{5\%}$	*0.03*	*0.15*	*0.06*	*0.14*	*0.11*	*0.10*

Leaf Ca continuously increased during examined period in all treatments till ripening stage according to the reference curves. Moreover, treatments had an increasing effect on leaf Ca from April to June. All applied treatments increased leaf Ca significantly at all sampling time at ‘Gönci magyar kajszi’. Similar consequent effect was not observed at ‘Mandulakajszi’.
In April, only BPL treatment increased leaf Ca significantly compared to the control at ‘Mandulakajszi’. Later, the effect of all treatments became significant. Differences were not found between cultivars regarding the absolute Ca values of leaves (*Figure 2*).

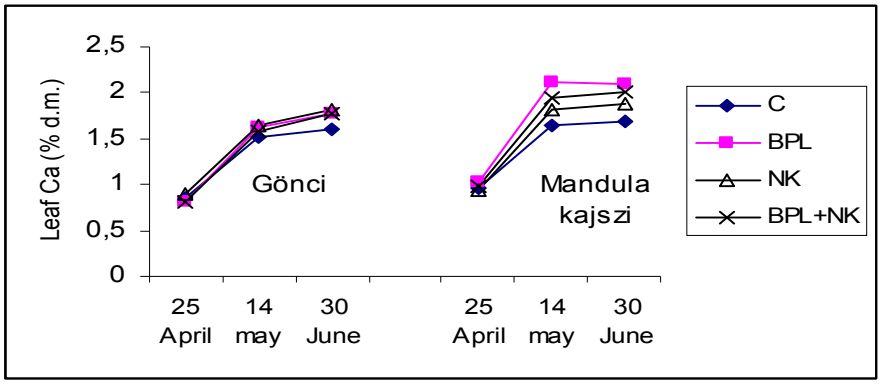

Figure 2. Seasonal pattern of leaf Ca

Similarly to leaf Ca, leaf Mg was increased continuously from April to June. BPL and combined treatment increased leaf Mg significantly at ‘Gönci magyar kajszi’ at every sampling time. At ‘Mandulakajszi’, all treatments increased leaf Mg significantly but only from May. Moreover, at the ripening stage significantly higher Mg was measured at ‘Mandulakajszi’

than at 'Gönci magyar kajszi' in treated samples (*Figure 3*). It suggests that used fertilizers differently affected leaf Mg at different examined cultivars. Naturally, further investigations needed to find out differences among cultivars.

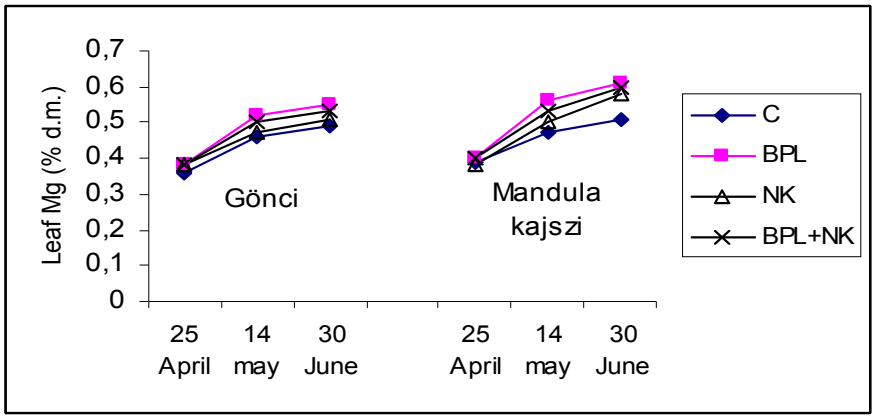

Figure 3. Seasonal pattern of leaf Mg

Acknowledgements

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