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IMPACT OF FOLIAR FERTILIZER ON PHYSIOLOGICAL COMPOUNDS IN DIFFERENT APRICOT VARIETIES

Cristina PETRIȘOR[1], Adrian ASĂNICĂ[2], Gheorghe CÂMPEANU[2], Adela BĂRBULESCU[1]

[1]Research Station For fruit Tree Growing Baneasa, 4 Ion Ionescu de la Brad, District 1, Bucharest, Romania
[2]University of Agronomic Sciences and Veterinary Medicine of Bucharest, 59 Marasti, District 1, Bucharest, Romania

Corresponding author email: crisstop@yahoo.com

Abstract

In the last decade applying of nutritive elements by foliar spraying became a usual practice for many crops, with benefit part in balancing of plant nutrition. Also, foliar fertilization have a practical and economical importance and have a low risk for environmental pollution. Implication in physiological processes, and in general in the plant metabolism of nutritive substances adsorbed by the leaves have an important role in increasing the adaptative capacity of trees to the stress conditions and therefore for growth production. The influence of foliar fertilizer on physiological and biochemical parameters of different apricot varieties was studied during two seasons at experimental orchard of Research Station Baneasa. Results indicated the increase of photosynthetic pigments content proved by a better function of photosynthetic apparatus. It also was found that polyphenolic compounds increased, which denotes the activation of tree defence mechanism for a better stress resistance.

Key words: *assimilation pigments, polyphenolic compounds, apricot leaves, enzymes*

INTRODUCTION

In the last decade, biological agriculture has the goal to use natural products with benefit part in balancing of horticultural crop nutrition for a better adaptation at different environmental conditions with increasing of economical efficiency by obtaining a significant increase of the crops quality.
From all this products, foliar fertilizers have a low risk for medium pollution and have a distinguished action in adjustment of the nutrient circuit among the agro ecosystem components.
In the world, foliar fertilization is an usually practice used in fruit growing for obtaining fruits of superior quality, high quantitative effects over fruits production and for providing a high resistance of trees to pest and diseases (Chamel, 1990; Bertschinger et al., 1999).
In Romania, it were tested a large range of foliar fertilizers for cultivated plants and among fruit trees species only for apple, plum, sour cherry (Borlan, 1995; Platon and Soare, 2002; Rusu et al., 2002; Dinu et al., 2009; Bochis and Ropan, 2011) with special regarding on tree growing and increasing of fruit yield.
Concerning a distinct interest for using foliar fertilization at fruit trees, our study was conducted to determine physiological and biochemical parameters at different apricot cultivars with Cropmax treatment, an ecological product.

MATERIALS AND METHODS

We take in study 33 apricot hybrids and three standard cultivars ('Dacia', 'Excelsior', 'Litoral') with the different ripening period. We determined in the leaves assimilating pigments, polyphenolic compounds, proteins and peroxidase. Also for the same hybrids it was evaluated the fruits quality through analyses of soluble solids content and titratable acidity and ratio among these parameters. In that sense it had been used specific methods for each parameters. To extract pigments, leaves of hybrids studied were ground with a mortar and pestle in acetone, with calcium carbonate added to prevent pheophytinization. Homogenates were centrifugate for 3-4 minutes at 3000 g.

The resulting extracts were immediately assayed. Absorbance of the clear extract at 645nm, 663nm and at 450nm were recorded and concentration of chlorophylls 'a' and 'b', carotenoids, chlorophyll a/b ratio and chlorophylls a+b/carotene+xantophylls ratio were computed after Arnon (1949) equations.

Quantification of total polyphenols was realized using the Folin Ciocalteu colorimetric method (Singleton and Rossi, 1965) and the results were expressed in mg/g fresh weight.

Determination of total dry matter was conducted by drying at 105°C until constant mass.

Assessment of proteins was realized by Bradford's method using bovine serum albumin as standard.

Peroxidase activity was determined by Bergmeyer's method based on the quantification of tetraguaiacol formation, spectrophotometrically at 436 nm and at 25°C.

To derive the chemical components, fruits were cleaned from their skin and core, sliced and homogenized; the obtained mixture was centrifuged and the supernatant used for analyzes.

For the soluble solid content it was used Abbe refractometer with temperature correction derive. Total acidity was determined by titrating each sample with solution 0.1 N NaOH until pH 8.1. The ratio between the soluble solids and the total acidity reflects the fruit taste feature.

RESULTS AND DISSCUSION

Determination of physiological and biochemical compounds indicated a differences between the leaves of treated hybrids with foliar fertilizer and samples untreated. For all studied hybrids we can observe a little increase of dry matter content in leaves for treated hybrids .

Also, for polyphenolic compounds it was observed a significative increase of their amount in the leaves of fertilized trees, which means a better resistance at pathogens because of their antioxidative character.

Protein content is substantial rising at hybrids fertilized with Cropmax. Among selection with early maturation it was relevant 77.23.39 BIV (952 mg/g dry weight) and 77.4.73 BV (948mg/g d.w), for selection with medium maturation can be noticed 82.28.62 BIV (888mg/g d.w), 82.32.29 BIII (950 mg/g d.w), 85.1.96BIII (809 mg/g d.w.) and for hybrids with tardive maturation distinguish 82.4.41 BIV (811 mg /g d.w.) and 82.15.10 BIV (613 mg/g d.w.).

Table 1. Variation of physiological and biochemical parameters at apricot variants without foliar fertilizer

Sample	Dry matter g%	Chlorophyll a/b	Chlorophyll a+b / carotene+ xantophyll	Polyphenols mg/g f.w.	Proteins mg/g d. w.	Peroxidase µmol/mg proteins
DACIA(control)	40.14	4.34	4.37	1.89	359.97	10.18×10^{-3}
77.23.39 BIV	36.53	3.01	6.48	2.54	736.38	6.32×10^{-3}
77.3.60 BIV	44.14	3.17	5.65	2.01	583.37	6.98×10^{-3}
77.4.73 BV	43.78	4.8	5.01	2.28	211.76	12.07×10^{-3}
82.6.62 BIV	45.85	5.26	3.97	2.21	460.06	0.67×10^{-3}
85.4.104 BIII	38.11	3.24	7.29	2.88	530.2	1.08×10^{-3}
EXCELSIOR (control)	45.11	3.9	6.94	2.55	582.57	0.45×10^{-3}
82.12.91 BIV	34.56	5.78	3.91	2.38	281.88	0.41×10^{-3}
85.5.100 BIII	39.08	3.18	4.13	2.11	108.67	1.88×10^{-3}
82.28.62 BIV	35.57	3.09	3.02	2.35	770.94	1.89×10^{-3}
85.18.5 BIII	36.59	5.19	4.60	2.6	552.22	0.198×10^{-3}
85.11.85 BIII	33.35	2.51	10.66	2.46	834.63	2.41×10^{-3}
85.11.95 BIII	37.58	2.44	8.66	2.67	589.78	0.40×10^{-3}
85.1.96 BIII	38.21	3.07	7.86	2.50	294.46	0.60×10^{-3}
82.32.29 BIII	41.43	4.02	5.54	1.70	517.55	0.68×10^{-3}
82.8.26 BIV	36.08	3.77	4.77	3.64	362.8	0.3×10^{-3}
85.4.95 BIII	44.09	5.02	5.26	2.09	408.09	2.7×10^{-3}
LITORAL (control)	45.01	4.16	5.42	1.56	174.11	2.42×10^{-3}
82.15.10 BIV	42.64	4.51	4.08	2.27	352.97	2.19×10^{-3}
82.12.7 BIV	37.93	4.20	5.32	2.20	264.55	3.86×10^{-3}
82.19.3 BIV	41.67	3.86	5.42	2.76	278.3	0.6×10^{-3}
82.15.48 BIV	47.77	3.32	6.41	2.89	238.45	1.58×10^{-3}
82.4.41 BIV	38.04	3.9	6.09	3.04	271.00	1.45×10^{-3}

The increasing of proteins quantity could be explained by the free amino acids content of foliar fertilizer which had a positive influence for protein synthesis at all apricot cultivars studied.

In the case of chlorophyll pigments we can observe at all hybrids analyzed a little decrease of chlorophyll content, this can be observed from ratio chlorophyll a/b. But clf. a+b/carotina+xantophyll ratio vary randomly at all hybrids.

We can concluded that in both cases (chlorophylls and carotenoids) the foliar fertilizer determine a different response reaction at almost all apricot hybrids studied but it was registered an exception in the positive sense: from early maturation selections were remarked 77.23.39BIV with a ratio of 3.09 and 85.4.104 with the ratio of 3.9; from the elites with medium maturation 82.28.62 BIV with the ratio clfa/clf b 3.31, 85.11.85 BIII (3.17) and 85.11.85 BIII (3.17) and 85.11.95BIII (3.15) are distinguished. Among hybrids with tardive maturation were remarked 82.15.10 BIV with ratio 4.83 and 82.15.48 BIV with ratio 3.43.

Peroxidase activity is, in general, higher at foliar fertilized hybrids with early and medium maturation, which means a better resistance of them at exogenous factors.

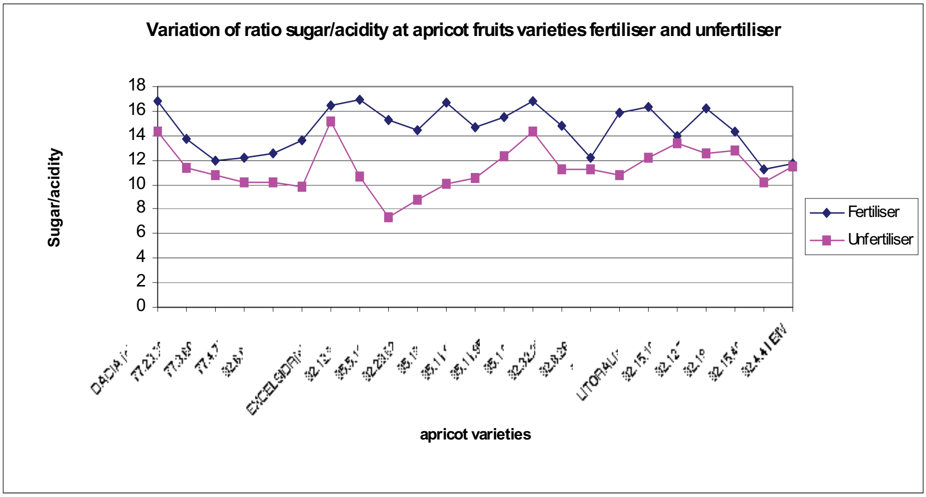
For fruit quality all hybrids have a positive response at foliar treatment by increase of soluble solids content and a little decrease of total acidity.

Table 2. Variation of physiological and biochemical parameters at apricot variants with foliar fertilizer

Sample	Dry matter g%	Chlorophyll a/b	Chlorophyll a+b / carotene+ xantophyll	Polyphenols mg/g f.w.	Proteins mg/g d. w.	Peroxidase μmol/mg proteins
DACIA(control)	43.48	2.29	4.71	3.44	929	$9.67 x10^{-3}$
77.23.39 BIV	44.01	3.09	5.12	4.6	952	$0.13 x10^{-3}$
77.3.60 BIV	41.23	2.47	5.54	2.83	770	$0.16 x10^{-3}$
77.4.73 BV	42.87	2.30	4.13	3.52	948	$0.27 x10^{-3}$
82.6.62 BIV	48.01	2.83	6.17	3.9	894	$2.43 x10^{-3}$
85.4.104 BIII	38	3.90	4.77	3.71	756	$6.06 x10^{-3}$
EXCELSIOR (control)	44.86	3.61	5.39	3.65	802	$2.24 x10^{-3}$
82.12.91 BIV	32.47	2.35	6.39	2.65	410	$15.9 x10^{-3}$
85.5.100 BIII	37.1	2.61	3.98	3.89	305	$0.33 x10^{-3}$
82.28.62 BIV	46.18	3.31	4.67	3.23	888	$0.15 x10^{-3}$
85.18.5 BIII	37.48	2.99	6.88	3.72	630	$4.96 x10^{-3}$
85.11.85 BIII	43.25	3.17	6.22	3.67	840	$9.29 x10^{-3}$
85.11.95 BIII	46.36	3.15	5.57	3.83	726	$2.86 x10^{-3}$
85.1.96 BIII	39.4	3.09	5.99	3.31	809	$5.39 x10^{-3}$
82.32.29 BIII	42.98	2.39	7.46	2.67	950	$1.2 x10^{-3}$
82.8.26 BIV	47.13	2.36	4.4	4.03	781	$0.62 x10^{-3}$
85.4.95 BIII	44.15	2.21	5.03	2.89	402	$10.56 x10^{-3}$
LITORAL (control)	47.2	2.61	7.40	2.71	856	$3.45 x10^{-3}$
82.15.10 BIV	46.88	4.83	7.44	2.63	613	$9.99 x10^{-3}$
82.12.7 BIV	47.3	3.74	7.61	3.47	500	$0.06 x10^{-3}$
82.19.3 BIV	37.4	3.94	4.09	3.58	453	$0.99 x10^{-3}$
82.15.48 BIV	46.75	3.43	5.97	3.71	581	$2.32 x10^{-3}$
82.4.41 BIV	49.6	2.86	10.56	3.9	811	$2.27 x10^{-3}$

The ratio soluble solids/acidity indicated the ripening level of fruits. A value of this equal or higher than 8 for apricot fruit reflect the optimum maturity time.

From results obtaining at treated hybrids we can observe that ratio soluble solids/acidity varied between 11.25 at hybrid 82.15.48 BIV and 16.97 at 82.12.91 BIII which demand an equilibrate taste of them. As exception is the case of 82.12.4 BIV (16.22), 85.4.95 BIII (15.89), 85.11.95BIII (15.52), 85.18.5 BIII (16.73) and 82.12.91 that have a very sweet taste.



CONCLUSIONS

The foliar fertilizer tested have a significant effects in the mean of reaction response of apricot variants by studied parameters.

We can observe that all apricot hybrids studied had a positive response at foliar treatment with Cropmax from pathogen agents resistance point of view by increasing of polyphenolic compounds content and peroxidase activity from leaves.

Both polyphenolic compounds and peroxidase enzyme have an important role as part of defence mechanism of plant after microbial attack.

Foliar treatment determine a different reaction of apricot hybrids concerning chlorophyll and carotenoid pigments with a low decrease of them which is reflected by the ratio chlorophyll a /chlorophyll b.

Foliar fertiliser have a positive effects concerning apricot fruit quality emphasized by an increased ratio soluble solids/titratable acidity and a fresh fruit well-balanced taste.

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