Cercetări Agronomice în Moldova
Vol. XLI , No. 3 (135) / 2008

IMPROVING THE VINE CROP TECHNOLOGIES BY USING GLYCOSIDE SUBSTANCES, UNDER CONDITIONS OF ECONOMIC EFFICIENCY AND ENVIRONMENTAL PROTECTION

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Received March 3, 2008

ABSTRACT- Ecostim is a furostanol glycoside and represents a natural substance belonging to the class of saponines (found in *Lycopersicon esculentum* seeds). This product was obtained by alcoholic extraction from tomato seeds and represents a bioactive substance of vegetal origin, having a wide range of biological activities, especially antiviral and antifungal properties. The goal of this paper was to estimate the biological activity of the product. The influence of the vegetal compound with steroidal glycoside structure was studied on the vine plantation from the Iaşi vineyard. The treatments consisted in spraying the aqueous solution of Ecostim, at different doses and ways of using. The results pointed out the favourable effects of treatments on the plant growth and development, according to the phenological phase and used concentration.

Key words: bioactive compound, steroidal glycoside, vine plantation

REZUMAT - Optimizarea tehnologiilor de cultivare a viţei –de-vie, folosind biopreparate glicozid – steroidice, în condiţii de eficienţă economică şi protecţia mediului inconjurător. Ecostim este o glicozidă furostanolică, reprezentând o substanţă naturală ce aparţine clasei saponinelor (întâlnită în seminţele de *Lycopersicon esculentum*). Acest produs a fost obţinut prin extracţie alcoolică din seminţele de tomate şi este o substanţă bioactivă de origine vegetală, având multe activităţi biologice, în special proprietăţi antivirale, antifungice etc. Scopul acestei lucrări îl reprezintă activitatea biologică a produsului. S-a studiat influenţa compusului vegetal cu structura unei glicozide steroidice asupra plantaţiei de viţă-de-vie din

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podgoria Iaşi. Tratamentele au constat în pulverizarea cu soluție apoasă de Ecostim, în diferite doze şi moduri de folosire. Rezultatele au subliniat efectele favorabile ale tratamentelor asupra creşterii şi dezvoltării plantelor, în funcție de fenofază şi de concentrația folosită.

Cuvinte cheie: compus bioactiv, glicozidă steroidică, plantație de viță-de-vie

INTRODUCTION

The use of biologically active substances (BAS) for the quantitative and qualitative crop increase has a tradition for over 50 years (Croitoru et al., 1988). These substances are also used in genetics and breeding works, in the modification of flower sexual determinism and in the capitalization process of heterosis. Most of the substances we use today are of exogenous origin, obtained by the chemical synthesis, due to relatively cheap and simple proceedings (Tschesche and Wulff, 1972). The opportunity of promoting a less chemical agriculture, because of the polluting effect of synthesis chemical substances used in agriculture, made that the importance of BAS for the farming production diminished. At the same time, the "returning to nature" policy suggested the use of BAS of endogenous origin from plant cells, tissues or organs. The extraction of these substances for their use in farming practices has a tradition of over 10 years, but their efficiency is not always satisfactory, as compared to the synthetic ones (Kofler, 1972; Бобейко, Кинтя, 1991;Sato, Sakamura, 1973; Tschesche, 1971).

In this sense, more investigations were carried out, following the introduction of these substances in the growing technologies of some horticultural plants.

MATERIALS AND METHODS

Investigations were carried out in the experimental field of the Faculty of Horticulture from Iaşi on vine (*Vitis vinifera*), Fetească albă Variety, grafted on Kober 5 BB rootstock. The plantation was set up in 1985, having planting distances of 2.2 x 1.2 m. Vine stocks were trained under the shape of semi-high bilateral cordons (0.8 m height). The fructification pruning was done in fruit-bearing chains, made of 4-6 eye fruiting shoots and 1-2 eye renewal spurs, on each vine stock being about 50 eyes. The training technology was specific to the Iaşi Vineyard.

For testing the Ecostim product, before flowering (June 6, 2006), 28 vine stocks were treated by leaf spraying, the following variants being established: V_1 – Ecostim 0.0001%; V_2 – Ecostim 0.001% and V_3 – Ecostim 0.005%. The experimental variants were compared to the untreated control.

During the vegetation period, the observations and determinations carried out were: content of leaf pigments, vine stock productivity, grape yield and its quality.

RESULTS AND DISCUSSION

The leaf application of the Ecostim product has an important role as concerns the plant growth and development, having direct consequences on the metabolism of grape yield and its quality.

Tables 1-3 present the results of the investigations concerning the influence of some steroidal glycoside biopreparations on the photosynthesis efficiency of vine leaves in dynamics, during the vegetation period (July, August and September 2007). In July, the lowest values of the content of assimilating pigments per 1 g fresh matter were found in the control (3.04 mg/g fresh matter). In V_3 , the photosynthesis efficiency has increased very significantly, both on each pigment and on total pigments (17.76% against the control). V_2 has influenced positively the photosynthesis efficiency, resulting in an increase of 15.79% in the total content of pigments (distinctively significant increase against the control). In V_1 , photosynthesis was influenced positively , resulting in a significant increase of 10.20%, against the control (*Table 1*).

Table 1 – Influence of the application of Ecostim on the photosynthesis efficiency in vine (Fetească albă Variety), July 2007

Variants	Chlorophyll *a* mg/g fresh matter	Chlorophyll *b* mg/g fresh matter	Carotene mg/g fresh matter	Total pigments			
				mg/g fresh matter	Dif. against the control	%	Signif.
Ecostim 0.0001%	1.74	0.76	0.85	3.35	0.31	110.20	x
Ecostim 0.001%	1.78	0.85	0.89	3.52	0.48	115.79	xx
Ecostim 0.005%	1.83	0.84	0.91	3.58	0.54	117.76	xxx
Control	1.63	0.66	0.75	3.04	-	100	-

LSD 5% = 0.23 mg/g; LSD 1% = 0.35 mg/g; LSD 0.1% = 0.52 mg/g

In August, the highest values of the content of assimilating pigments were found in V_3 (4.42 mg/g fresh matter), with very significant positive differences against the control. In V_2 , the photosynthesis efficiency has increased very significantly, both on each pigment and on total pigments, at values close to V_3 (4.30 mg/g fresh matter). V_1 had also a positive influence on photosynthesis, showing a distinctively significant increase against the control (10.12%). The lowest values of the content of assimilating pigments were found in the control, 3.46 mg/g fresh matter (*Table 2*).

Table 2 - Influence of the application of Ecostim on the photosynthesis efficiency in vine (Fetească albă Variety), August 2007

Variants	Chlorophyll *a* mg/g fresh matter	Chlorophyll *b* mg/g fresh matter	Carotene mg/g fresh matter	Total pigments			
				mg/g fresh matter	Dif. against the control	%	Signif.
Ecostim 0.0001%	1.95	0.89	0.97	3.81	0.35	110.12	xx
Ecostim 0.001%	2.18	0.96	1.16	4.30	0.41	124.28	xxx
Ecostim 0.005%	2.20	0.99	1.23	4.42	0.52	127.75	xxx
Control	1.75	0.79	0.92	3.46	-	100	-

LSD 5% = 0.15 mg/g; LSD 1% = 0.25 mg/g; LSD 0.1% = 0.39 mg/g

In September, the lowest values of the content of assimilating pigments were found at the control (2.99 mg/g fresh matter). Values close to the control, with insignificant differences, were obtained in V_1 (3.11 mg/g fresh matter). In V_3 and V_2, the photosynthesis efficiency has increased very significantly, both on each pigment and on total pigments (11.37% and 10.37%, respectively, against the control) (*Table 3*).

Table 3 - Influence of the application of Ecostim on the photosynthesis efficiency in vine (Fetească albă Variety), September 2007

Variants	Chlorophyll *a* mg/g fresh matter	Chlorophyll *b* mg/g fresh matter	Carotene mg/g fresh matter	Total pigments			
				mg/g fresh matter	Dif. against the control	%	Signif.
Ecostim 0.0001%	1.71	0.65	0.75	3.11	0.12	104.01	-
Ecostim 0.001%	1.78	0.73	0.79	3.30	0.31	110.37	xxx
Ecostim 0.005%	1.81	0.71	0.81	3.33	0.34	111.37	xxx
Control	1.62	0.63	0.74	2.99	-	100	-

LSD 5% = 0.14 mg/g; LSD 1% = 0.22 mg/g; LSD 0.1% = 0.27 mg/g

The productivity of vine stocks was greatly influenced by Ecostim. The number of grapes formed on the vine stock has significantly increased against the control in all the experimental variants. The highest values were found in V_3 (33.5) and V_2 (35.5), but values with significantly positive differences against the control were also found in V_1 (31.7). The lowest number of grapes formed on the vine stock was found at the control (29.3).

The mean grape weight has increased in variants V_3 and V_2, treated with Ecostim, against the control (80.2 g), with distinctively significant positive differences in V_3 (90.3 g) and significant differences in V_2 (85.6 g). In V_1 , the lowest value of the mean weight of a grape (79.3 g) was found, but with insignificant differences against the control.

Ecostim has also influenced the berry weight and diameter. The 100-berry weight has significantly increased only in V_3 (160g). In V_1 and V_2, the 100-berry weight has registered close values to the control, with insignificant differences. The berry diameter has slightly increased in the experimental variants, by 0.2 mm in V_1, 0.8 mm in V_2 and by 1.2 mm in V_3 (*Table 4*).

Table 4 - Productivity of Fetească albă Variety, treated with Ecostim, Iaşi Vineyard, year 2007

Variant	Mean no. of grapes/vine stock				Mean weight of a grape				100-berry weight (g)	Mean diameter of a berry (mm)
	No.	Dif.	%	Signif.	g	Dif.	%	Signif.		
Ecostim 0.0001%	31.7	2.4	108.2	x	79.3	-0.9	98.9	-	128	9.9
Ecostim 0.001%	33.5	4.2	114.3	xx	85.6	5.4	106.7	x	132	10.5
Ecostim 0.005%	35.5	6.2	121.2	xxx	90.3	10.1	112.6	xx	160	10.9
Control	29.3	-	100.0	-	80.2	-	100.0	-	131	9.7
	LSD 5% = 2.1 grapes LSD 1% = 3.3 grapes LSD 0.1% = 4.7 grapes				LSD 5% = 4.1 g LSD 1% = 7.8 g LSD 0.1% = 10.7 g					

Both on vine stock and per ha, the grape yields were greater against the control in V_2 and V_3 . The highest grape yield, with very significantly positive differences was obtained in V_3 (3.3 kg/vine stock and 11.5 t/ha, respectively). In V_2 , the grape yield has registered lower values against V_3, but with significantly positive differences against the control (2.7 kg/ vine stock and 9.4 t/ha, respectively). In V_1 , the grape yield was practically equal to that obtained by the control (2.5 kg/ vine stock and 8.7 t/ha, respectively) (*Table 4*).

The sugar content was slightly influenced by Ecostim, with insignificant differences against the control. The highest sugar concentrations were found in V_1 (218 g) and at the control (213 g). A more reduced content, correlated negatively to the grape yield was obtained in V_2 and V_3, with 212 g/l and 207 g/l, respectively.

Acidity has shown close values at all the variants and it was slightly influenced by the level of grape yield; insignificantly higher values than the control were found in V_3 (5.20 g/l H_2SO_4).

In all the experimental variants, inclusively at the control, at full ripeness, grapes had a green-yellowish colour and a juicy pulp, specific to a wine grape variety (*Table 5*).

Table 5 – Grape yield and its quality in Fetească albă Variety treated with Ecostim, Iaşi Vineyard, year 2007

Variant	Grape yield					Sugar content				Acidity g/l H_2SO4	Berry colour
	Kg/ Vine stock	t/ha	Dif.	%	Signif.	g/l	Dif.	%	Signif.		
Ecostim 0.0001%	2.5	8.7	0.0	100.0	-	218	5.0	102.3	-	4.83	Green-yellowish
Ecostim 0.001%	2.7	9.4	0.7	108.0	x	212	-1.0	99.5	-	4.70	Green-yellowish
Ecostim 0.005%	3.3	11.5	2.8	132.0	xxx	207	-6.0	97.2	-	5.20	Green-yellowish
Control	2.5	8.7	-	100.0	-	213	-	100.0	-	4.78	Green-yellowish
LSD 5% = 0.6 t/ha LSD 5% =1.5 t/ha LSD 5% =2.3 t/ha						LSD 5% =7.3 g LSD 5% =10.1 g LSD 5% =14.7 g					

CONCLUSIONS

Applied in vine, Ecostim has shown a positive influence on the photosynthesis efficiency, on grape yield and quality.

The content of leaf pigments has shown superior values at the control, both on elements (chlorophyll *a*, chlorophyll *b* and carotene) and entirely, the highest pigment content being noticed in the first decade of August at the variants treated with Ecostim 0.001% and 0.005%. The increase in the content of leaf pigments has also resulted in increasing the photosynthetic efficiency.

Productivity and grape yield have significantly increased in the variants treated with Ecostim 0.001% and 0.005%, with values superior to the control, as concerns number of grapes formed on the vine stock, mean weight of a grape, 100- berry weight, berry diameter and grape yield per vine stock. At the variant treated with Ecostim 0.001%, the values of productivity and grape yield were close to the control, without significant differences.

The quality of grape yield (sugar content and acidity) was similar to the control in all the variants, the low differences being mainly determined by the dimension of the grape yield.

The influence of Ecostim was positively correlated to the concentration of the solution used for treatment, the best results being obtained in V_2 (Ecostim 0.001%) and V_3 (Ecostim 0.005%).

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