PHYZIOLOGICAL ASPECTS OF THE *VITIS VINIFERA* L. FOLIAR TREATMENT BY THE COMPLEX OF TRACE ELEMENTS

ASPECTE FIZIOLOGICE PRIVIND TRATAREA FOLIARA A PLANTELOR DE *VITIS VINIFERA* L. CU COMPLEX DE MICROELEMENTE

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Abstract. *The first local complex compound of trace elements Microcom has been elaborated, brevetted, registered and tested for applicability. The efficacy of foliar treatment of vine with a specific complex of trace elements Microcom under the low negative temperatures was physiologically based on the results that was obtained in the 3- year experiments: modification of microelements content in the tissue, intensification of phosphor components and carbohydrates metabolism, optimization of shoots growth and maturation, fuller realization of genetical potential of frost and winter resistance.*

Rezumat. *A fost elaborată, brevetată, înregistrată şi verificată aplicabilitatea primului preparat complex de microelemente autohton Microcom. În baza rezultatelor obţinute în decurs de 3 ani, ce ţin de modificarea conţinutului de microelemente în ţesuturi, intensificarea metabolismului compuşilor fosforici şi carbohidraţilor, optimizarea proceselor de creştere şi maturizarea lăstarilor anuali, realizarea mai deplină a potenţialului genetic de rezistenţă la ger şi iernare, s-a argumentat fiziologic eficacitatea utilizării procedeului de tratare extraradiculară a plantelor de viţă-de-vie cu preparatul complex Microcom, în condiţii de accidente climatice (temperaturi negative joase în perioada de iarnă a anului).*

Vine is cultivated, in generally, on the soils with low fertility due to the morphophiziological particularities, high level of plasticity and high adaptive potential. In the future this tendency will grow. But such soils require permanent amelioration of the nutritive regime.

Provision of grape plants by macro- and microelements, prevention and attenuation of currency and subcurency of nutritive elements on the period of vegetation, increase of the quantity and quality of grape is possible through the foliar treatment of plants. The problem of fertilization is especially important for Moldova, because of high degree of soil degradation, slopes, and semi-arid conditions (1, 2).

Foliar fertilization is an important factor as supplementary and compensatory fertilization due to the high degree of uptake and utilization of the applied nutrients. Elaboration and utilization of the complex compounds for fertilization predominate actually in the world. Taking into account the insufficient supply of soils in mobile forms of microelements Fe, B, Mn etc. in

our region, and also their high necessity for perennial plants, a special complex of microelements *Microcom-V* was created in the Institute of Genetics and Plant Physiology Academy of Sciences of Moldova. The main objective of this article is elucidation of the some phyziological aspects of the influence of specific complex of trace elements Microcom-V on the grape metabolism.

MATERIAL AND METHODS

The experiments were carried out during the period 2004-2006 in the green house and in the experimental plots in different parts of Moldova. Next cultivars of grape were used: Aligote, Shardone and Alb de Surucheni. The foliar treatment with solution of Microcom was conducted twice – three times: a week before flowering, and a week after flowering then 10 days later. The optimal concentration of compound was established on the base of previous experiments in green house.

The samples of the plants were gathered in 3 and 6 days after treatment. The following laboratory methods were used: content of phosphoric compounds – according to Ocanenco A.S. et al. (1969) and Levit T.E. (1981); sugar content – according to Bertrane; content of trace element – by atomic absorption spectrometer after dry ashing at the t=480 °C; grown and ripening of shoots - according to Lazarevskii M.A. (1963), Iova Gh, Dobrei A. (1996); frost-resistance - according to Cernomoreț M.V. (1985), Cernomoreț M.V. et al. (2000).

RESULTS AND DISCUSSIONS

The content of trace elements in the grape leaves is one of the indices that testify about the conditions of plants mineral nutrition and stipulate the realization of potential of plants productivity and ecological resistance. Under the control conditions (in the green house) the content of the trace elements in the grape leaves after two foliar treatments was determinate. It was showed that foliar treatment influenced first of all the concentration of introduced element in leaf blades of treated plants - Fe, Mn and Zn (Tab.1).

Table 1

Content of trace elements in grape leaves, v. Alb de Suruceni, green house (mg/kg d.w.)

Variant	% of ash	Fe	Mn	Zn	Cu
Control	10,05	28,1	12,84	1,35	1,73
Microcom – 2 treat.	9,16	41,5	13,74	1,45	1,01
Microcom - 3 treat.	10,61	108,7	13,45	3,66	0,23

The content of Cu decreased in comparison with the control plants. It is well manifested the antagonism between Fe and Cu, that was mentioned in our previous investigations too. It is necessary to take in into consideration in the elaboration of the technology of Microcom application on the vineyard.

Importance of phosphorus for the synthesis processes activation, transport in plants, role of this element for the formation and manifestation of the level of frost resistance and wintering of perennial plants, stipulated the idea to study the influence of foliar treatment by Microcom on the content of phosphoric compounds in grape leaves. The samples were gathered after two and three

treatments at SRL „FOSIGAMIV„ (d. Criuleni), v. Aligote. The significant modifications in the content of acid-soluble phosphorus (F. a.-s.) and its components were observed: phosphorus inorganic (F. neorg.) and organic (F.org.). The quantitative increase of those components depends on the quantity of treatments. More significant values takes place after 3 treatments (Fig.1).

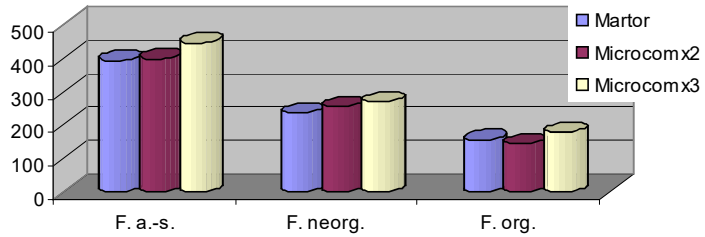

Figure 1 - Influence of Microcom on the content of phosphoric components in leaves.

Essential increase of the phosphoric lipids (F.lipid) and nucleotides content was revealed under the influence of Microcom (Fig. 2 and 3). Simultaneously foliar treatment led to the decrease of other fraction of phosphorus organic in grape - phosphoglucides (Fig. 2) as a result of the metabolism intensification.

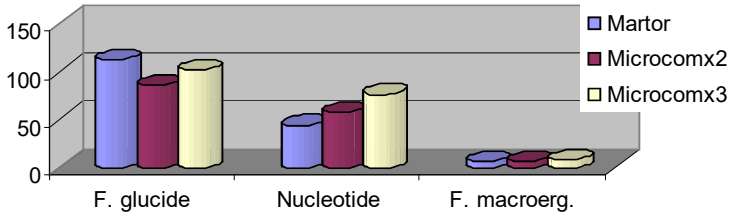

Figure 2. - Content of the organic phosphoric compounds under the influence of Microcom

Foliar treatment by trace element complex has a favourable effect on the content of nucleic acids (Fig.3) that finally enter into the formation of genetical cod that determines the potential of productivity and resistance of the grape plants.

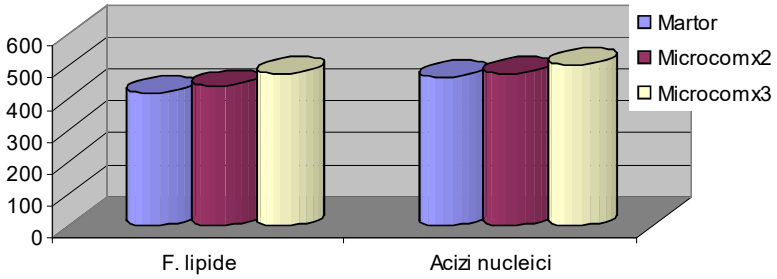

Figure 3 - Effect of Microcom on the metabolization of phosphoric compounds.

Treatment of grape by trace element containing compound changed the intensity and direction of synthesis and hydrolysis of carbohydrates in plants. The

content of monosaccharide and the sum of saccharide in leaves and shoots, and starch in shoots of vine was increased (tab.2).

Table 2

Effect of Microcom-V on the content of carbohydrates in the organs of vine plants, v. Alb de Suruceni, experiment in green house, %

Variant	leaves			shoots			
	Mono-saccha-rides	Di-saccha-rides	Sum of saccha-rides	Mono-saccha-rides	Di saccha-rides	Sum of saccha-ride	starch
Control	2,66	0,51	3,22	0,22	0,08	0,30	1,89
Microcom - 2	7,17	1,64	8,39	2,03	0,33	2,38	1,95
Microcom - 3	5,98	1,37	7,97	2,27	0,77	3,08	2,65

The critical low temperature during the winter is the main factor in the destabilization of viticulture in Moldova. Increase the frequency of winters with critical conditions for the vine wintering, when temperature brings down to -25^0 -27^0 C and sometimes to -33^0 C are marked. For majority of cultivated in Moldova grape varieties the critical temperature during the winter achievs -20^0 - 22^0 C. Plants damaged not only under so low temperature, if they enterd in wintering without corresponding preparation. The confirmation of about mentioned was winter 2005/2006, when temperature descended before -25-30^{o}C.

Increase of plant resistance in such conditions is one of the preponderant links in resolution of the general problem to obtain stabile high and qualitative crops. The data obtained in controlled conditions testify that foliar treatment of plants during the vegetation by Microcom led to the increase of average length of annual vine shoots on 18,86 – 25,94 % in comparison with the control plants (tab.3). Annual shoot maturation of treated plants in august was a bit more that of control plants (34,59 and 38,89 % comparatively to 33,02 % - control).

Table 3

Effect of trace element complex on growth and maturation of shoots in controlled conditions.

Variant	18 August 2004			22 October 2004		
	Average length, M±m (cm)	Ripe part, M±m (cm)	Maturation degree, (%)	Average length, M±m (cm)	Ripe part, M±m (cm)	Maturation degree (%)
Control	21,2±1,3	7,0±0,9	33,02	21,2±1,3	14,29±1,2	67,42
Microcom x 2	26,6±0,8	9,2±0,7	34,59	26,7±0,8	19,90±1,0	74,53
Microcom x 3	25,2±1,1	9,8±0,5	38,89	25,2±1,1	19,80±1,4	78,57
DL, 5 %	-	-	3,04	-	-	5,65

Effect of foliar treatment was more pronounced on the end of vegetation (october). Extent of maturation of annual shoots of treated plants reached to 74,53 and 78,57 %, on the controlled plants - 67,42 % (tab.3). Significant increase of annual shoots maturation degree is likely to be associated with more intensive accumulation

of reserve substances, especially those protective, under the influence of trace element complex Microcom.

Investigations that were made in conditions of production in Sarata Meresheni, Hincheshti confirm those from greenhouse. Foliar treatment influenced growth of annual shoots of two cultivars of grape. Average length of shoots v. Shardone increased to 6-8 cm and v. Alb de Suruceni – to 12-21 cm comparatively to control plants. Degree of maturation of annual shoots enlarged correspondingly by 5,9% and 10,9% (tab.4). It is likely that effect of Microcom is more expressed on the technical cultivars that on the table ones.

Table 4

Effect of trace element complex on growth and maturation of shoots in conditions of production, Sarata Mereşeni, Hînceşti, 2005

Variant	Şardone			Alb de Suruceni		
	Average lendth, cm	Ripe part, cm	Maturation degree, %	Average lendth, cm	Ripe part cm	Maturation degree, %
Control	104	70	67,3	91	44	48,0
Microcom x 2	110	69	63,0	103	53	51,5
Microcom x 3	112	82	73,2	112	66	58,9

The same results were obtained in 2006 in other climatic conditions in Zaicani, Criuleni (Tab.5), v. Aligote. Thrice - repeated foliar treatment of grape by complex of trace elements influenced the proceses of growth and development of plants, shoots maturation increased to 6,9-7,3% relatively to control plants.

Table 5

Growth and maturation of annual shoots depending on foliar treatment by Microcom-V, c. Aligote, Zaicani, Criuleni, 2006.

Varianta	Average lendth, cm	Ripe part, cm	Degree of maturation, %	Relatively to control,%
Control	173 ± 3,8	143 ± 2,4	82,7	
Microcom x 2	201 ± 4,3	181± 3,5	90,0	+7,3
Microcom x 3	221 ± 8,1	198 ± 4,9	89.6	+6,9

The plants grown in pots in green house and treated during vegetation 2004 by Microcom, were exposed to the temperature -18 ^{o}C 10 January 2005. Increase of plant resistance to the frost till 3,6% in optimal variant of treatment was mentioned (tab. 6). The quantity of alive buds grows, but quantity of damaged and perished buds decreased in the treated plants under the influence of foliar treatment (84,8, 8,2, 7,0% – after 3 treatments and 81,2, 10,4, 8,4% - in controlled plants).

Table 6

Frost-resistance of vine under the influence of Microcom, c. Alb de Suruceni

Variant	18 August 2004	22 October 2004	10 January 2005, t -18°C		
	Degree of maturation, %	Degree of maturation, %	Buds alive, %	Buds damaged, %	Buds perished, %
Control	33,02	67,42	81,2	10,4	8,4
Microcom x 2	34,59	74,53	82,3	11,7	6,0
Microcom x 3	38,89	78,57	84,8	8,2	7,0
DL, 5 %	3,04	5,65			

Determination of the resistance to the wintering in conditions of production shown that it increased after the foliar treatment by 5,1% for cultivar Şardone and by 2,5 for cultivar Alb de Suruceni (Tab. 7).

Table 7

Effect of Microcom on the vine resistance to the wintering

Variant	Resistance degree to the wintering (%)	
	Şardone, M±m	Alb de Suruceni, M±m
Control	78.7±0.7	89.4±0.6
Microcom x 2	78.5±0.9	88.7±0.8
Microcom x 3	83.8±1.2	91.9±1.4

COCLUSIONS

The efficiency of the specific complex of trace elements Microcom was studied. Foliar treatment of vine by Microcom during the period of vegetation changed some physiological indices: microelements content in the tissue, intensification of phosphor components and carbohydrates metabolism, shoots growth and maturation. Modifications which were revealed in 3-year experiments led to the intensification of processes of growth and development of plants, formation and fuller manifestation of genetically based potential of frost and winter resistance. Physiologically the efficiency of trace elements complex in conditions of accident climatic – low temperature during the wintering was established.

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