THE EFFECT OF FE AND NI ON THE RESISTANCE AND PRODUCTIVITY OF VINE

EFECTUL MICROELEMENTELOR ASUPRA REZISTENȚEI ŞI PRODUCTIVITĂȚII VIȚEI DE VIE

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Abstract: *The efficacy of foliar treatment with trace element containing compounds - $FeSO_4$, Dissolvin, $NiSO_4$ and a complex of trace elements Microcom, that has been elaborated and tested for applicability in Moldova, on the vine resistance to low temperature and productivity, was studied in greenhouse and under the field condition. Foliar treatment of vine during the vegetation led to the accumulation of newly acquired solutes (prolin, glutamic acid, glutamin, monosaccharides), that might protect the plants as osmotic – balancing solutes or against free radicals generated in response to stress. Modifications that were revealed 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.*

Rezumat: *Rezistenta plantelor multianuale asupra conditilor nefavorabile este strins legata de statusul mineral al plantelor. Deseori factorul limitativ este continutul de microelemente, care joc un rol important in procesele metabolice al plantelor. De regula solurile si plantele sunt slab asigurate cu forme accesibile de Fe, Mn, Zn, B. Eficacitatea tratamentului foliar a vitei de vie cu complex de microelemente Microcom, care a fost elaborat in Moldova, s-a studiat in conditii de producere si in casa de vegetatie. Tratarea plantelor in perioada de vegetatie a adus la acumularea solutiilor,care pot proteja plantele ca solutii usor compatibile (prolina, acidul glutamic, glutamina, monosaharide). Modificarile relevate tin de intensificarea proceselor de cresterea si maturizarea plantelor, manifestarea mai deplina a potentialului genetic de pezistenta la iernare.*

INTRODUCTION

The resistance of perennial plants to the unfavorable conditions of growth is closely connected to mineral status of plants. More over the basic limitative factor is content of trace elements, which play a very important role in many metabolic processes of plants. Horticultural crops need to receive more micronutrients than field crops owing to their greater susceptibilities to deficiencies and the relatively high value of their produce (1). As a rule, the soil under the vine is insufficiently ensuring with mobile form of Fe, Mn, Zn, B (2). Healthy plants with no trace elements deficiency stresses are better able to resist unfavorable conditions of grows (drought, low temperature, diseases and infections). Most effective way to ensure the plants with micronutrients is foliar treatment.

Taking into account the insufficient supply of soils in mobile forms of microelements 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. It was studied in greenhouse and under the field condition parallel with $FeSO_4$, Dissolvin, $NiSO_4$.

It's well known, that one of the plant resistance mechanism to the unfavorable conditions of growth is the accumulation of compatible osmolits in the cells of organic compounds with little molecular weight. Glucides and free amino-acids with stress – protective action refers to those components. Earlier we emphasized that Fe had a positive effect in the decrease of manifestation grade of edafic chlorosis of vine by modification of some metabolic processes inclusively quantitative and qualitative component of free amino-acids and glucides in vine leafs (3, 4). In 2005-2006, we established that Fe in Dissolvin - form had a passive role in glucide metabolism to vine adaptation to low temperatures.

The main objective of this article is elucidation of the influence of Fe in different compounds and Ni as $NiSO_4$ on the accumulation of carbohydrates and free amino acids, resistance to low temperature and productivity of vine.

MATERIAL AND METHODS

The experiments were carried out during the period 2006-2007 in the greenhouse and in the conditions of production in different parts of Moldova. Next cultivars of grape were used: Aligote, Alb de Surucheni and Codrinski. The foliar treatment with solution of trace elements was conducted twice – three times: a week before flowering, and a week after flowering then 10 days later. The optimal concentration of compounds 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 free amino acids – with the aim of the amino acid analyzer; photosynthetic pigments - after extraction from leaf discs with acetone 80 %; sugar content – according to Bertrane; content of phosphoric compounds – according to Ocanenco A.S. et al. (1969) and Levit T.E. (1981); 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, DobreiA. (1996); frost-resistance - according to Cernomoreț M.V. (1985), Cernomoreț M.V. etal. (2000).

RESULTS AND DISCUSSIONS

The free amino-acids and carbohydrates (mono- and disaccharides) supply to apoplast from the photosynthetic cells as a rule depends on the intensity of photosynthesis process in the plant, so we determined the content of photosynthetic pigments in dynamic in vine leafs during vegetation.

After the first treatment all components, which contains Fe, increased the *a* chlorophyll content, but most effectively influenced Ni. The chlorophyll sum in this phase increased more significantly with Ni. It was not remarked considerable changes of carotinoid content (tab.1). In a month, after the 3rd treatment, the chlorophyll and carotinoid content decreased related to the control plants. Fe in Dissolvin form and Ni maintain the pigment content at a higher level. It is necessary to be mentioned that in 2007 in conditions of long drought, it was

noticed for the first time, that Ni effect on the content of photosynthetic pigments is stronger than Fe effect.

Table. 1

The content of photosynthetic pigments in vine leafs after treatment with Fe - containing compounds, s. Codrinschi, % f. w.(5.06.2007).

Variant	Chlor."a" M±m	Chlor."b" M±m	Sum a+b M±m	Carotinoid M±m
Control	0,516 ± 0,009	0,202 ± 0,005	0,718±0,009	0,302±0,004
$FeSO_4$	0,530 ±0,008	0,202 ±0,005	0,736±0,008	0,317±0,004
Dissolvin	0,583 ±0,005	0,213 ±0,005	0,796 ±0,011	0,346±0,005
Microcom	0,568 ±0,033	0,209 ±0,005	0,777 ±0,035	0,335±0,010
$NiSO_4$	0,614±0,016	0,301±0,006	0,916±0,021	0,339±0,005

The carbohydrates content in vine leafs increased for 3-4 fold in summer period (June – July). The most stable and strong positive effect on the sum of soluble saccharides was in variant with microelements complex (Microcom). It was enhanced the content on monosaccharides. The insignificantly increase of starch confesses indirectly about the increase of processes of synthesis.

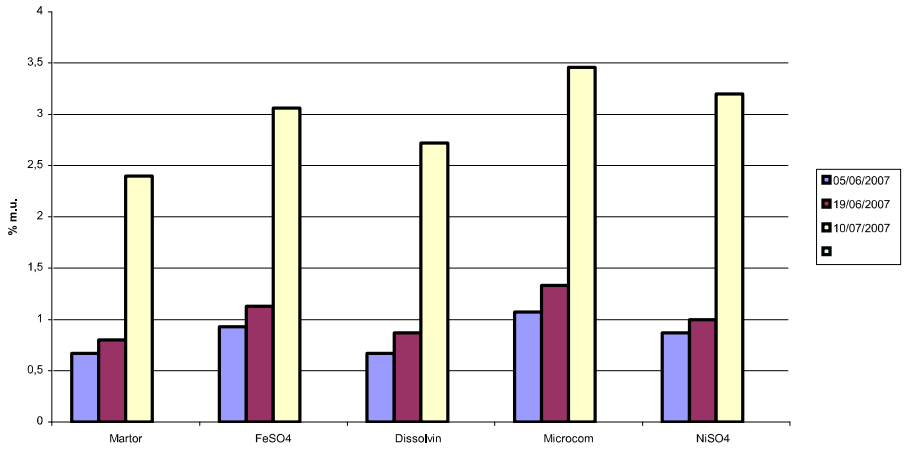

Fig.1. The carbohydrates content in vine leafs after the treatment with microelements, s. Codrinschi

The free amino-acids (AA) content in vine leafs has been determined for three times. To be mentioned, that treatment with microelements during vegetation maintains the summary of AA at significantly higher level. The quantitative and qualitative changes are stronger after the 3rd treatment. The sum of AA in this period obviously increased after treatment with Fe-containing compounds, special – with Microcom and Dissolvin. Qualitative content analysis of AA shows, that in the variants with microelements increases the content of praline, valine, tyrosine, phenylalanine. After the 3rd treatment the content of glutaminic acid + glutamine increased. The content of γ – aminobuteric acid also was more than in control plants. In variant with Ni the sum of AA after the first two treatments is enhanced related to the control plants, but at the beginning of ripening - decreases. The Fe-effect depends on the compound used as a source of

elements and on the supply of nutritive elements. It's better to use Fe in chelat-form (Dissolvin) and in complex with other elements (Microcom).

We suppose, it's taking place a stimulation of AA synthesis process after the treatment with Fe and Ni, special after three treatments, at the beginning of ripening. The difference between variants is better seen at the 3rd determination. This could be bound up with the accumulation of microelements effect or with worsening of drought, which took place in 2007.

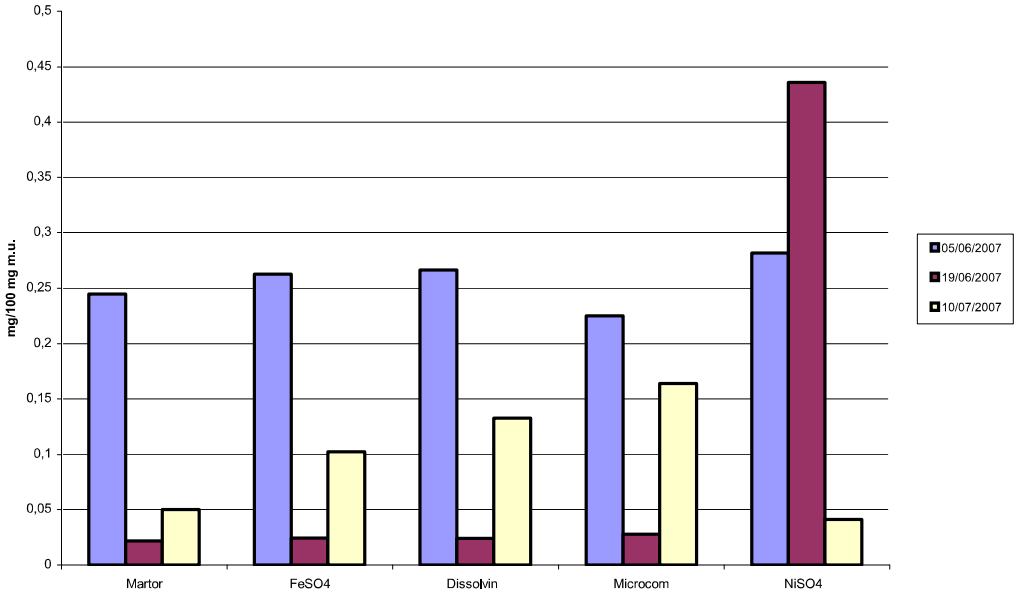

Fig.2. The content of AA in vine leafs after the treatment with microelements s. Codrinschi

Foliar treatment by complex of trace elements Microcom influenced growth of annual shoots of grape. Average length of shoots v. Chardonnay 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%. It is likely that effect of Microcom is more expressed on the technical cultivars that on the table ones. The same results were obtained in 2006 in other climatic conditions, v. Aligote. Three times repeated foliar treatment of grape by complex of trace elements influenced the processes of growth and development of plants, shoots maturation increased to 6,9-7,3% relatively to control plants.

It is known the 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. The study of the influence of foliar treatment by Microcom on the content of phosphoric compounds in grape leafs show significant modifications in the content of acid-soluble phosphorus and its components: phosphorus inorganic and organic. The quantitative increase of those components depends on the quantity of treatments. More significant values take place after 3 treatments.

The foliar treatment led to the crop increase in comparison with control plants. The positive influence of foliar treatment on the weight and quantity of bunches was marked. Some increase of bunches number took place as foliar treatment before flowering influenced the additional development of buds because of better mineral status of plants and improvement of leaf photosynthetic activity (table 2).

Table 2

The influence of foliar treatment with microelements on the productivity of vine s.Codrinschi

Variant	Grapes/bunch		Medium weight for 1 grape		Crop /bunch		% to control
	x	Sx	x	Sx	x	Sx	
Control	48,86	3,22	144,44	7,50	7,05	0,46	100
$FeSO_4$	42,33	2,38	181,61	11,44	7,68	0,43	108,9
Disolvin	41,80	2,57	164,76	9,74	6,88	0,42	97,6
Microcom	56,40	3,63	156,33	7,64	8,81	0,59	125,0
$NiSO_4$	59,80	2,75	190,65	8,99	11,39	0,23	161,6

It's meaningful that the content of AA, especially those indispensable ones, increased in grapes, in variants with Dissolvin and with the complex of microelements. It means, that quality of grapes became better. The content of sugar in grapes increased related to control only in variants with the complex of microelements Microcom and with Ni (table 3).

Table 3.

The influence of the treatment of vine with microelements on sugar content, %

Variant	x	Sx	% to control
Control	18,77	0,16	100
$FeSO_4$	17,77	0,12	94,7
Disolvin	18,23	0,22	97,2
Microcom	19,67	0,17	104,8
$NiSO_4$	19,71	0,16	105,0

CONCLUSIONS

The foliar treatment of the vine during the period of vegetation influences positive the content of carbohydrates, photosynthetic pigments and free amino-acids in leafs, especially in conditions of drought which took place in 2007.

The effect of Fe on the accumulation of compatible osmolits (glucides and free amino-acids), that have stress – protective action, was stronger than in previous years. We presume it is taking place a stimulation of AA synthesis process after the treatment with Fe and Ni, special after three treatments at the

beginning of ripening. The difference between variants is better seen at the 3rd determination. This could be bound up with the accumulation of microelements effect or with worsening of drought. The better effect was after the treatment with Fe in chelat-form and Microcom.

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